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ILLINOIS STATE MUSEUM PRELIMINARY REPORTS No. 9

INVESTIGATIONS AT TAL-I-IBLIS

JOSEPH R. CALDWELL, EDITOR

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TO

SHEILA KELLY CALDWELL

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Visit of Governor (Farmandar) Ziai, right center, and Mr. Tajbaksh, Director of the Sugar Refinery. Next to Mr. Tajbaksh is Mr. Sarraf of the Archaeological Service of Iran. At the far right is the chief of the Gendarmerie at Mashiz. Behind him is Daniel Evett. David Chase is explaining.

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Prof. Elizabeth Ralph, University of Pennsylvania

Prof. Robert Stuckenrath, Jr., University of Pennsylvania

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And to the Staff of the Illinois State Museum:

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Mrs. Gloria Schroeder, Scientific and Technical Assistant

Mrs. Keith C. Schroeder, Secretary

Miss Ruth Ann Skeen, Secretary

Dr. Emily J. Blasingham, Associate Curator of Anthropology

And to our workmen from the villages of Dashgar, Najafarabad, Haidarabad, and Aliabad.

Field members of the 1966 project were:

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Mr. Daniel Evett, University of Chicago

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Prof. Cyril Stanley Smith, Massachusetts Institute of Technology

Mr. Habib Tiqua, Driver, Tehran

Dr. Gholam Hossein Vossouqzade, Iranian Ministry of Economy

Mr. Theodore A. Wertime, Smithsonian Institution

A Note on the Transliteration of Persian Place Names

In English literature on Iran many place names are rendered in a bewildering variety of forms. Even among the authors of this volume spellings followed a pattern of "every man for himself." Sheila K. Caldwell undertook the onerous task of regularizing these words. We also decided for this preliminary report to omit all diacritical marks. Aside from this, most of our spellings agree fairly well with Iran: Official Standard Names Approved by United States Board on Geographic Names, U.S. Office of Geography (Dept. of Interior), Gazetteer No. 19, U.S. Board of Geographic Names. Washington, 1956. What is probably an error of judgement by Joseph R. Caldwell has resulted in the spelling throughout this report of "Bardsir" as two words "Bard Sir," although it is better spelled as one. Correcting this in the pages typed for offset printing would have been expensive and therefore must await our final report.

Joseph R. Caldwell
Springfield, Illinois

II

FOREWORD

In the Bard Sir Valley of the Kerman Mountains, 1300 km east by southeast of Bagdad and the Tigris River, is Tal-i-Iblis. To the Iranian villagers of the valley this is "the evil mound," or "the devil's mound." One story is that someone very wicked once dwelt here. In Iran a tal is a mound or hill. A tal should be larger than a small mound or tepe but not so large as a mountain or kuh. The mound of Tal-i-Iblis is oval in plan, one hundred eighteen by one hundred meters, and it was once over eleven meters high.

Iblis is not a natural hill but an archaeological site, an accumulation of millenia of debris and mud from the decay of houses of sun-dried brick. In ancient times, as in many villages in southwest Asia today, old houses were simply leveled off and new ones built on the resulting elevations. Over the centuries whole towns reached skyward on slowly-rising platforms of old mud brick, trash, and wind-blown sand. The abandonment or destruction of a town meant that it would gradually take on the appearance of a hill; wind and weather would melt the remaining buildings and softly round the contours of the pile. There are hundreds of such ancient mounds in Iran.

Thirty-five years ago Iblis was visited and mapped by the archaeologist-explorer Sir Marc Aurel Stein. He published an excellent description of the mound and the valley.[1] It is his measurements noted above. On the plain around he saw pottery fragments for twelve hundred meters to the north and south and eight hundred meters east and west. The ancient town had been larger than the mound proper; the latter was simply the oldest and most intensively occupied part of the settlement. Because of unsettled times Stein was obliged to travel with a military escort. The officer in charge however, refused to allow him to dig. So far as I know, no other archaeologist saw Iblis during the years following Stein's expedition. The mound was believed to be untouched.

In April 1964 we came across southern Iran in an Iran-Jeep, the Persian version of the American Jeep, a car excellently suited to the roads and dry stoney desert we had to travel. Our party included my wife, Sheila K. Caldwell, Charles Carlson and Shapur Malek Shahmirzadi, students from the Universities of Oregon

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1 Sir Marc Aurel Stein, Archeological Reconnaissances in North-West India and South-Eastern Iran. London. 1937.

and Tehran respectively. We were to make a reconnaissance of some of the more accessible parts of Kerman province, a territory hardly known from an archaeological standpoint.

The region has had remarkably little attention from archaeologists. Sir Percy Sykes had investigated a Bronze Age site at Kinneman, west of Kerman.[1] Roman Ghirshman made important excavations at Tepe Sialk near Kashan 700 km northwest of Kerman.[2] Stein made two traverses of the area with test trenches at Tal-i-Iblis in the Bard Sir Valley, at other sites in the Halil Valley, and at Bampur he disclosed traces of a brilliant cultural development.[3] Huckriede discovered a late Mesolithic site near Ravar.[4] In 1961 Theodore Wertime with the help of the Iranian Ministry of Mines made a metallurgical reconnaissance of archaeological sites in the northern part of the area.[5] In 1962 Wertime made a second trip accompanied by Cyril Smith. More recently Beatrice Di Cardi has begun further investigations at Bampur.[6]

Because so little was known, the region could not yet be treated as either one or as several prehistoric cultural provinces; one could hardly speak of connections between central Iran and Baluchistan except to suppose that they existed; we knew nothing of the culture-historical role of the southeast Iran in relation to the general developments in southwest Asia except to imagine it to have been considerable. With the exception of Tepe Sialk, which can be related with Tepe Hissar and other sites in the much better known northern part of Iran, the few known sites of the area were generally considered as part of the sparse and inchoate evidence from southeastern Iran and sometimes given cultural characterizations in terms of better known but inapplicable sequences in western Iran.

For later periods the archaeological situation was no better. The region was part of history in Achaemenian, Parthian and Sasanian times, but with no certainly identified sites of these periods. Instead there are occasional references to places and events in Greek, Pahlevi, or poetic sources, and local traditions crediting the founding of certain modern towns to the Sasanian Ardeshir Papakan. The abundant Islamic remains, were wholly unstudied on the ground. Sir Aurel Stein's main interest was in prehistoric sites. He mentions Islamic finds only occasionally and deals with them but briefly.

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1 Sir Percy Sykes, A History of Persia, Vol. 1, London, pp. 184-5, 1963.

2 Roman Ghirshman, "Fouilles de Sialk, pres de Kashan," Musee du Louvre Scrie Archeologique: Tome IV. Paul Geuther. Paris. 1938.

3 Stein, op cit.; also "An Archaeological Tour of Gedrosia," Memoirs of the Archaeological Survey of India, No. 43. Government of India, New Delhi. 1936.

4 Reinhold von Huckriede, "Jung-Quartar und End-Mesolithicum in der Provinz Kerman (Iran)," Eiszietalter und Gegenwart, 12:25-42, 1962.

5 Theodore A. Wertime, "Man's First Encounters with Metallurgy," Science, Vol. 146, No. 3649. December, 1964.

6 Beatrice DiCardi, "The Bampur Sequence in the 3rd Millenium B. C.," Antiquity, Vol. 41, pp. 33-41, 1967.

The culture history of the region needed to be understood in its own terms, with reference to its own regional traditions. Such understandings would fill a gap in our present picture of the development of southwest Asia and would be of interest to scholars in the adjacent parts of Iran, Baluchistan and Afghanistan.

The Visit to Tal-i-Iblis

We had made our headquarters in the Hotel Sahra in Kerman and from there had set out, day after day, along the available roads. Later we moved to Bam for two days and hunted for archaeological sites along the highways there. Occasionally we descended from the jeep and walked some distance, but most of the sites we recorded were seen from the highway either as standing ruins of areas or scattered fragments of pottery. Our main objective was to find prehistoric sites, but this jeep-seat method of exploration yielded none at all. Instead we located 14 sites of historical Islamic times. Of these, Professor Geza Fehervari tells us in the present volume that nearly all were from the 12 to 13th centuries A. D. The most we can possibly infer from this is that the present network of roads may not have been established until that time. So much for this method of survey.

It was not until we reached the Bard Sir Valley that we found any prehistoric sites. We were led here by Stein's report of Tal-i-Iblis.

We arrived about noon at the town of Mashiz and through the kindness of Mr. Anuzgar of the Ministry of Education,who had come with us from Kerman that day, we were introduced to Mr. Ibrihimi, District Superintendent of Schools. Mr. Ibrihimi now took the wheel of the jeep and drove at a good clip out into the Mashiz Valley, dodging innumerable holes of the chain-wells (qanats) criss-crossing the plain, and in any one of which we might have lodged forever.

Considerable tracts of Bard Sir Valley are covered with low sand dunes. When Stein was here in 1932 he noted signs of increasing dessication. There was still a memory of the last canal while even the qanat were drying up, several villages were gradually being abandoned, and fields were being covered with sand. [1]

After passing a few poor villages we suddenly found ourselves at Iblis and at the scene of an archaeological tragedy. The entire center of this large mound had been dug out and destroyed. Even then a few men with shovels were hacking at remaining parts of the mound, piling the ancient earth into an old truck to enrich the fields of the valley. There was nothing we could do to stop them then, although later the Archaeological Service of Iran took steps to halt the destruction.

We walked about the ruined mound picking up hundreds of pieces of broken pottery, occasional fragments of small flint tools, grinding stones, occasional bits of alabaster vessels, and even part of an alabaster or calcite figurine of a seated woman. We could tell from these fragments that Iblis was quite old, pre-Islamic, that is, it was inhabited long before the Arab conquest of the Persian (Sasanian) Empire in 642 A. D. How great was the antiquity of Iblis we were presently to learn, for there was one bright spot in this picture. The digging

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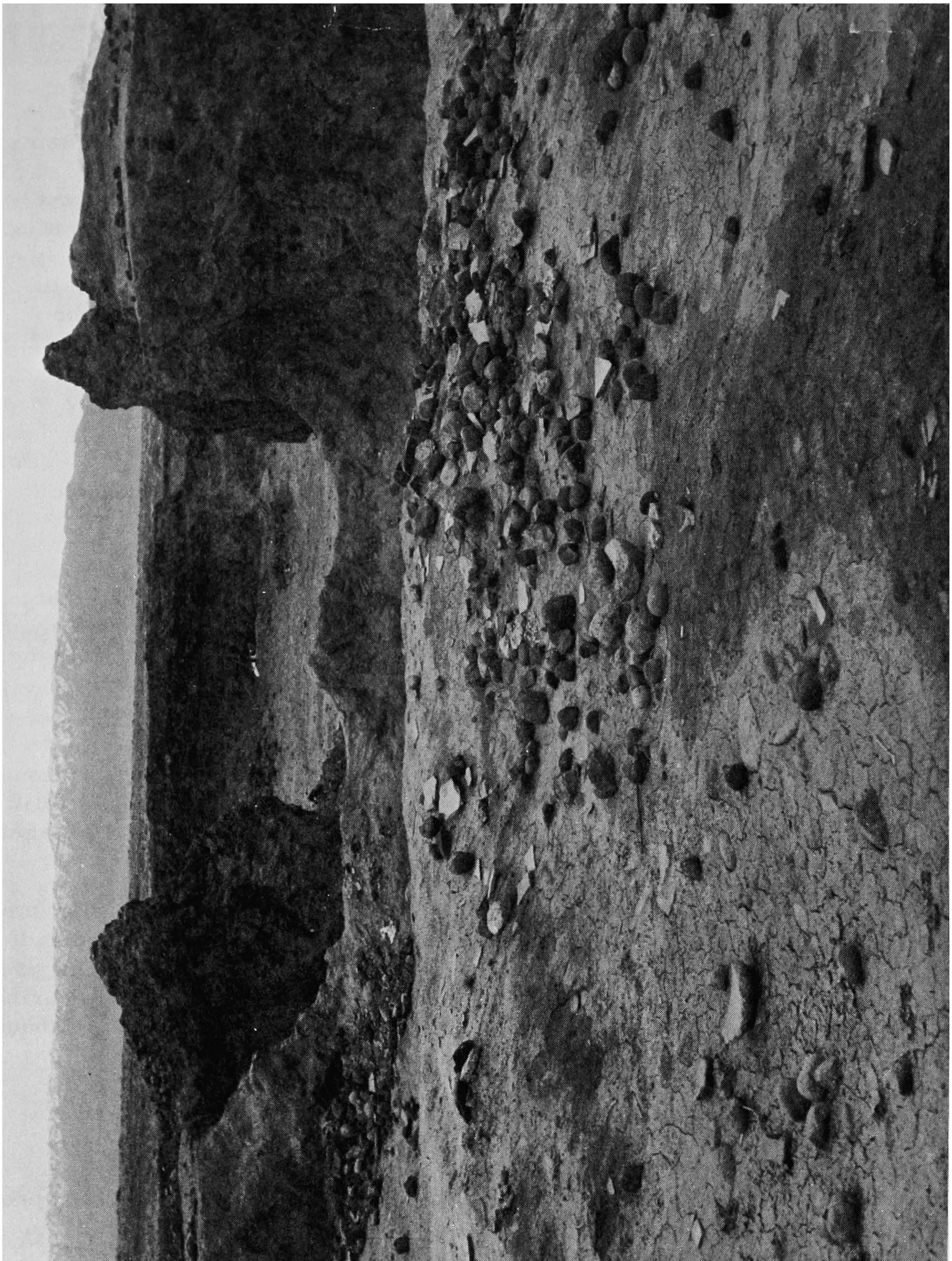
1 Stein, op cit. pp. 165-169.

PLATE 1 - IBLIS IN 1964



had left many vertical sides or faces in the earth and these showed a clear stratification of the ancient settlements which made up the mound. Six distinct levels showed as horizontal bands of debris one above the other. Each of these contained dark stained earth, bits of broken rock and pottery and more charcoal than we had ever seen at an archaeological site.

Two days were spent here taking radiocarbon samples and pottery fragments from these exposed levels. Some months later, through the kindness of Dr. Robert Dyson, Jr., Dr. Elizabeth K. Ralph and Dr. Robert Stuckenrath, Jr., of the University of Pennsylvania, Department of Physics, each of our periods could be assigned a radiocarbon date based on charcoal samples.[1]

As a result we now had six successive levels radiocarbon dated by the University of Pennsylvania. This was the beginning of a prehistoric chronology. A surprising discovery was that of "beveled rim bowls" of unmistakably Mesopotamian type, which could be assigned to an upper level dating 2869 ± 57 B. C. (P-929) and were a clear indication of some kind of connection with Protoliterate Mesopotamia far to the west. In earlier levels, dated 4091 ± 74 B. C. (P-925) and 4083 ± 75 B. C. (P-926A) respectively, were crucible fragments with indications of having been used in the smelting of copper. Still more ancient was a premound level distinguished by coarse, straw-tempered pottery, flint sickle blades, unidentified animal bones and traces apparently of emmer wheat - the first substantial evidence of an early farming community in all of southeastern Iran. One of the crucible fragments was studied by Ralph C. Dougherty, then of Argonne National Laboratory. His report is reproduced in the paper following through the kindness of the editors of *Science.*

The Iblis indications of Mesopotamian connection at about 2800 B. C. may be added to the evidence at Tepe Sialk of Mesopotamian contact at about 3000 B. C.[2] There is no reason to deny the possibility of earlier connections. Indeed, claims have been made from Sialk of priority in the development of some decisive innovations characteristic of Mesopotamia.[3]

The importance of copper smelting at Iblis before 4000 B. C. may indicate, together with hints from Sialk, that some technologies being practiced in the Kerman Range in those times were at least equal to what was being done in Mesopotamia and western Iran before and during the flowering of Protoliterate civilization. It is already a reasonable question to ask how much in the way of

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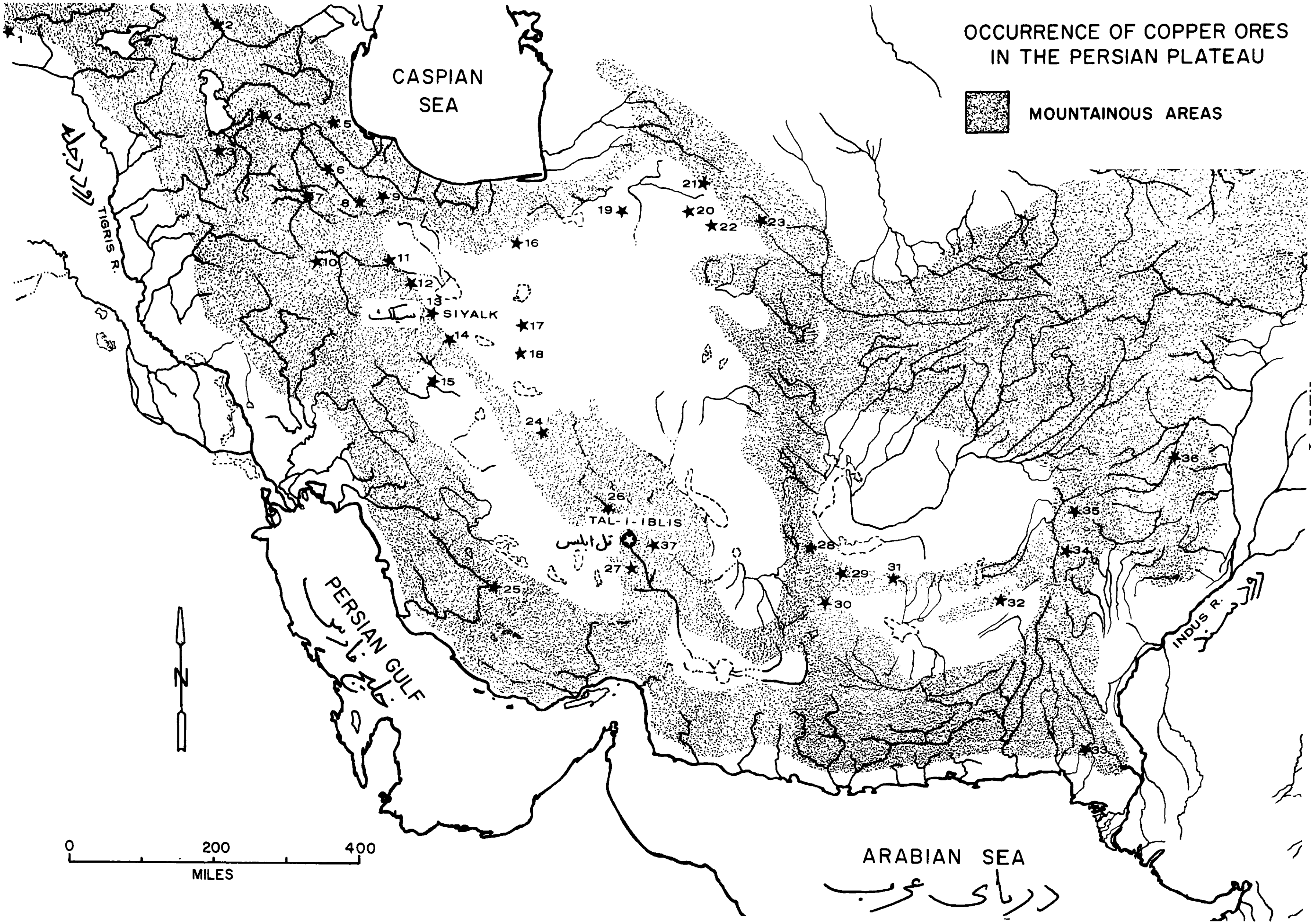
1 All radiocarbon determinations used in this volume are according to the new half-life of 5730 ± 40 years.

2 Two spouted vessels from Sialk III, 6, are of a form occurring at Warka VIII and VI in Mesopotamia. There is now a date of 3000 B. C. for materials at Nemazga Tepe in Turkmenistan said to be equivalent to Sialk III, 6, 7.

3 Donald E. McCown, "The Comparative Stratigraphy of Early Iran," *Studies in Ancient Oriental Civilization,* No. 23, Chicago, University of Chicago Press, 1942.


OCCURRENCE OF COPPER ORES
IN THE PERSIAN PLATEAU
MOUNTAINOUS AREAS
CASPIAN
SEA
TIGRIS R.
رود دجله
SIYALK
سیلک
TAL-i-IBLIS
تل ابلیس
PERSIAN GULF
خلیج فارس
INDUS R.
رود سند
ARABIAN SEA
دریای عرب
N
0
200
400
MILES

MAP I

Map 1. -The Occurrence of Copper Ores on the Persian Plateau, is preliminary and incomplete. It does not include the recent results of metallurgists associated with the Iblis Project.

Number on Map	Mine and Reference	Number on Map	Mine and Reference
1. Ergani	(3)	20. Sabzevar	Dahaneh Siah Mine(1)(6)
2. Abbas Abad	Mine (5)	21. Jovain	Mine (5)
3. Savojbalagh	Kuhmesgaran Mine (5)	22. Miandasht	Mines in Shurab Valley(5)
4. Kuh-i-Sahand	Mine (5)	23. Near Meshad	Mine (6)
5. Khalkhal	Mine (5)	24. Yazd	Mine (6)
6. Zahjan	Bayjeh and Kalacheh Mines (1) (6)	25. Fasa	Mine (5)
7. Khamse	Amirabad, Aliabad, Virachine Mines (5)	26. Rafsanjan (Formerly Bahromabad)	Mine (5)
8. Meshkin	Mine (5)	27. Baft	Traditional Metal Working Center (4) (6)
9. Qazvin	Zarrin Khaneh Mine(1) Lominezard, Tudaran, Hissar, Parvan, Homayonak-i-Afshari Mines	28. Garandi Spring	(2)
10. Hamedan	Ashegloo Mine (1)	29. Saindak	(2)
11. Saveh	Ziaran Mine (1)	30. Kuh-i-Taftan	Ore noted (2)
12. Qom	Mine (5)	31. Patkok Area -	(2)
13. Kashan	Niaz Morgh Mine (1)	32. Ras Koh Area -	Numerous small veins(2)
14. Natanz	Ores Noted	33. Shah Bellawal -	(2)
15. Isfahan	Pinavand, Sarnegoon, Mirabad Mines (1)	34. Between Ziarat and Johan -	(2)
16. Semnan	Mine (6)	35. Quetta-Pishin -	Poor ores (2)
17. Between Anarak and Semnan	Mine (6)	36. Ft. Sandeman -	Numerous small deposits (2)
18. Anarak	Chah Palang Mine(1)(6)	37. Bahr-Aseman-Mine (5)	
19. Maiamei	Mine (5)		

(1) Conference on Minerals held in Ankara, Turkey, December, 1959. N. Khadem. Mining Geology and the Base Metals. Central Treaty Organization. 1961.
(2) Records of the Geological Survey of Pakistan, Vol. 1, pt. 1, and Plate 1; Vol. 7, pt. 2, 1955. (3) Theodore A. Wertime, "Man's First Encounters with Metallurgy." Science, Vol. 146, No. 3649, pp. 1257-1267, December, 1964. (4) Wertime communication. (5) Major Masoon Khaan Kaihan, Geography of Iran, Vol. III, pp. 261 ff., Tehran (In Persian). (6) Economic map of Iran, Sahag Geographical and Drafting Institute, Tehran, Iran (In Persian).

innovation southern Mesopotamia might owe to outlying areas such as the Kerman Range. There has been some tendency in the past to regard southern Mesopotamia as having largely developed in vacuo.[1] More attention to outlying areas would at the very least give a more contextual picture of the general conditions out of which southern Mesopotamia advanced so rapidly and so well. The more certain and later connection with Mesopotamia indicated by the Iblis beveled rim bowls, together with the indications that smelting may have continued there, have impelled us to wonder about the extent to which the Kerman Range may have been supplying copper to Mesopotamia. We therefore prepared a map showing all reported occurrences of copper ores in Iran (Map 1). This had the interesting and surprising result of showing more ore occurrences in the Kerman Range than in western Iran bordering Mesopotamia. This was an indication that we might be on the right track, although Anatolia is expectably another major source of supply. What we needed now was the help of metallurgists in seeing to what degree the composition of Mesopotamian copper artifacts might be traced to sources in the Kerman Range. We also needed the help of metallurgists in telling us something of metal-working connections with the regions eastward and of exchanges, if any, with Indus Valley civilization.

As a result of these discoveries we were able in the fall of 1966 to bring an international expedition to Tal-i-Iblis, organized by the Illinois State Museum and supported by the National Science Foundation. While the archaeological work was in progress a coordinate metallurgical team traveled widely in eastern and southern Iran to visit ancient mines, smelters, and slag heaps, and to interview modern Iranian metal workers.

The present volume comprises a series of preliminary reports by members of both projects. We are working in an area which is largely unknown geologically, geographically, historically, archaeologically, and also from the standpoint of early metallurgy. We expect to change some of our views as the work progresses.

At this writing, one year from the inception of the National Science Foundation project, a number of the special metallurgical and archaeological studies are still incomplete.

Joseph R. Caldwell
Springfield, Illinois, 1967

1 Pinhas Delougaz, "Pottery from the Diyala Region," University of Chicago Oriental Institute Publications, Volume LXIII. University of Chicago Press, p. 132, 1952.

III

CONTENTS

IV

EVIDENCE OF EARLY PYROMETALLURGY IN THE KERMAN RANGE IN IRAN

Ralph C. Dougherty and Joseph R. Caldwell

Abstract

Physical and chemical analysis of pottery fragments, including a crucible shard and ore samples from Tal-i-Iblis, Iran, suggests that copper smelting may have been well advanced late in the fifth millennium B. C.

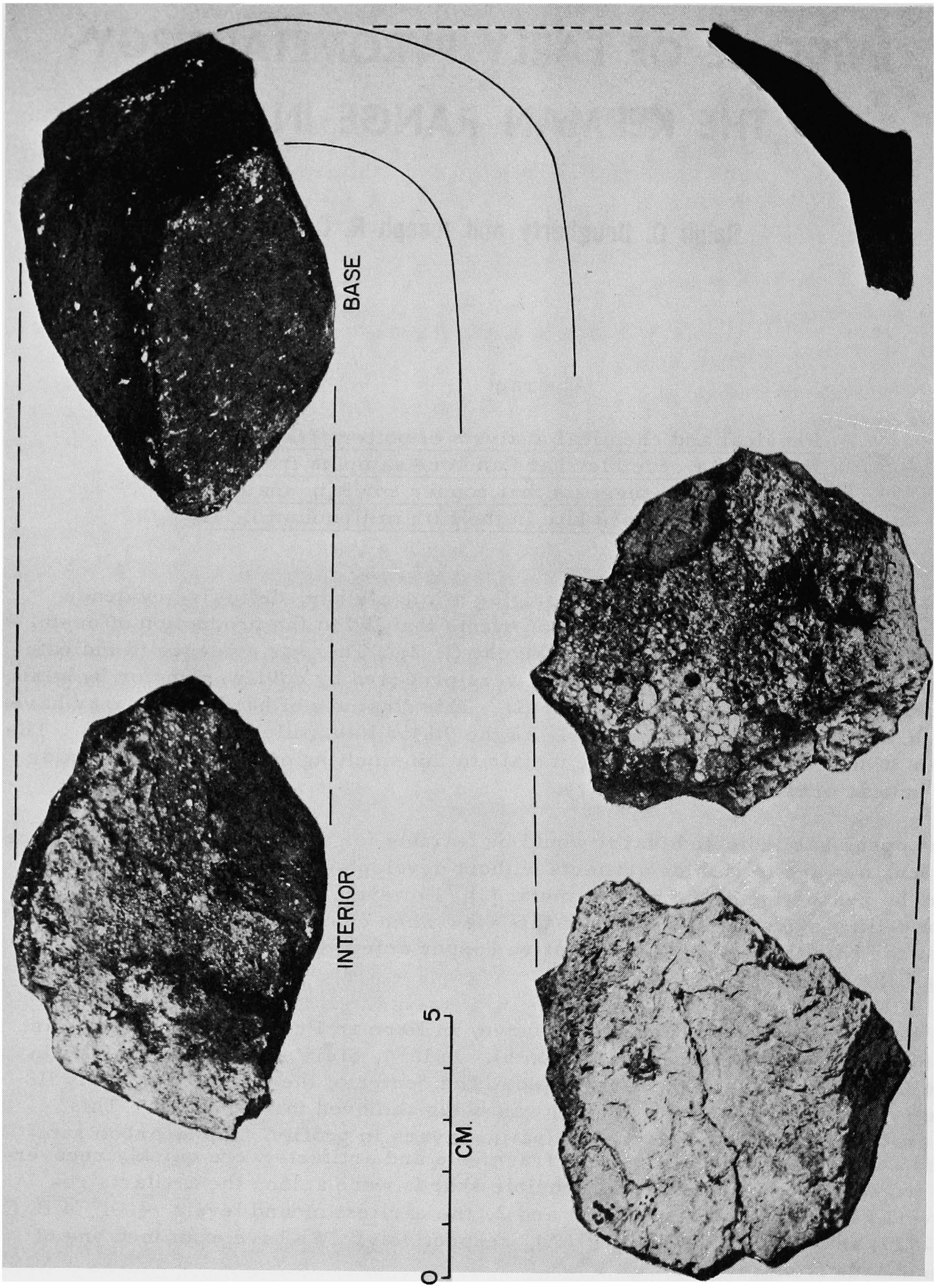
Despite the recent interest in the origins of metallurgy, definitive evidence relating to the locus and sequence of events that led to the production of useful metal objects from ores remains sketchy (1, 2). There is evidence to indicate that the first useful copper artifacts were produced by cold-working or by hammering and annealing native copper (1). This first use of hard metals may have occurred in the Near East as early as the 9th or 10th millennium B. C. (2). The transition from the use of native metals to the smelting of carbonate and oxide or sulfide ores was revolutionary.

Thompson has indicated that it would be feasible for a primitive smith to reduce copper ore and to fashion artifacts without developing the technology required for the production of the molten metal (3). However, there is at present no compelling evidence in support of this view when compared with the hypothesis that the smelting and casting of native copper antedated the discovery of smelting (1).

In the course of an archaeological survey in Kerman Province, southeast Iran, certain artifacts were recovered (4, 5). In 1964, Stein's site of Tal-i-Iblis in the Lalehzar Valley (6) was revisited. The center of the mound (originally 118 meters across and 11 meters high) was being removed for fertilizer. This operation exposed successive occupation layers in profile. Radiocarbon samples and a wide variety of pottery fragments and artifacts were quickly recovered from these levels. Several crucible shards were among the artifacts recovered from Tal-i-Iblis levels 1 and 2, the earliest mound levels /4091±74 B. C. (P-925) and 4083±75 B. C. (P-926A), respectively/. We have examined one of the shards from level 1.

* Reprinted through the courtesy of the editors of Science, Vol. 153, No. 3739, pages 984-985, August 26, 1966.

FIGURE 1



Crucible fragments from Tal-i-Iblis, Level 1. (These are from Iblis II in our revised terminology. Ed.)

The ceramic of the crucible shard was derived from a predominately kaolinite clay (7). It was poorly fired, as evidenced by its high porosity and spalling at the outer edges (see Fig. 1). The inner surface of the ceramic was covered with partially vitrified material that had the appearance of dross or slag which contained small pieces of slaked lime. Also noted were two prominent copper stains. Under microscopic examination of the inner surface a general pattern of copper stain was observed. The ceramic had a definite black core that extended to within 2 mm of the outer edge; the outer surface had a tan-salmon color. These data suggest that the crucible was intentionally fired in a reducing atmosphere, because even earlier pottery at this site was fired well enough to oxidize the organic materials that are normally present in all clays (8). The tan-salmon color of the outer surface, together with flaky composition of the ceramic, indicates that the maximum temperature obtained during the firing process was probably below 1000°C -- possibly from 700° to 800°C. These temperatures are sufficient for the reduction of copper ore (3), but they are well below the melting point of the metal (1083°C).

Spectrochemical analysis of the obvious copper stains on the shard's inner surface was consistent with the hypothesis that the copper metal that produced the stain originally came from a copper ore. In addition to copper, the stain contained significantly higher concentrations of cobalt, nickel, phosphorus, and tin, than the surrounding ceramic or the surface dross. If the source of the copper was an ore, these elements would be expected. They could not have been present in such amounts (0.1 to 1 percent) in a native copper sample.

Melting points for the ceramic were determined with an optical pyrometer (6, 9). The samples were melted on a tungsten filament in flowing nitrogen. The outer surface of the crucible melted at $990^\circ \pm 50^\circ$C. The melting point of the inner layers of ceramic was the same as that of the outer surface. All samples gave clear glasses. If the crucible had been used for melting native copper there should have been no difference in the three melting points because the metal-working process would not have appreciably altered the composition of the ceramic. The fact that the unaltered ceramic melted at about 1000°C makes it seem unlikely that the crucible was used for melting copper in any form. The temperature required to melt copper would probably have reduced the crucible to a glass.

One must consider the possibility that the low melting point of the ceramic may be due to superficial deposits of water-soluble alkali. This seems unlikely because the base-exchange capacity of the clay should be relatively small (10), and the interior of the ceramic shard had the same melting point as the outer surface. The possibility that the copper stain and dross resulted from experiments directed toward the production of a blue-green glaze may be discounted for the following reasons: (i) the number of samples and the time span for their production (shards of this type were recovered from the first two levels of the mound); and (ii) the high degree of ceramic technology exhibited in well-made and highly fired shards from the same level.

On the basis of this evidence, it is reasonable that the crucible was used for the reduction of a copper ore. This work might be considered as support for the hypothesis that smelting antedated the melting of copper metal, as the smith did not employ a highly refractory ceramic for this process. The only ore samples found at this site have proved to be chalcocite, a sulfide ore that would require roasting. If this was the ore that was used in the 5th millenium, pyrometallurgy was well advanced at that time.

If, as Pittioni has cautiously suggested (11), the first use of smelting occurred in Anatolia (Çatel Hüyük, level VI) not later than the 6th millenium, it would be reasonable to expect that the roasting and smelting of sulfide ores could have been accomplished by the end of the 5th millenium. Whereas more evidence concerning these events is necessary, the time scale for the development of metallurgy (1) will probably have to be extended.

References and Notes

1. T. A. Wertime, Science 146: 1257 (1964).

2. C. S. Smith, ibid. 148: 908 (1965).

3. F. C. Thompson, Man 58: 1 (1958).

4. Complete site description of Tal-i-Iblis and the archeological details of the artifacts are being prepared.

5. J. R. Caldwell, G. Fehérvári, S. M. Shahmirzadi, C. Carlson, S. K. Caldwell, in preparation.

6. A. Stein, Mem. Archeol. Survey India, No. 43 (Government of India, New Delhi, 1931); Archeological Reconnaissances in Northwest India and South-Eastern Iran (London, 1937).

7. Dr. L. Biels and Mr. D. White were responsible for this assignment, Mr. White also supplied all the melting point data contained in this report.

8. Straw-tempered pottery fragments recovered from the pre-mound level showed no traces of residual organic material in the pottery.

9. Melting points are uncorrected.

10. A. O. Shepard, Ceramics for the Archaeologist (Carnegie Institution of Washington, Washington, 1956), p. 15.

11. R. Pittioni, Archaeologia Austriaca 35: 98 (1964).

12. Under auspices of AEC, while R. C. D. was a resident research associate at Argonne National Laboratory, Argonne, Illinois.

Editor's Note: Mr. Dougherty's sample of chalcocite may have been a reject. Most of the ore fragments have turned out to be malachite, and to a lesser extent, azurite.

V

THE SETTING AND RESULTS OF THE KERMAN PROJECT

Joseph R. Caldwell

One does not pursue culture history in Iran without attention to topography. This will be a necessary background for many of the historical explanations we attempt in this volume. The Iranian plateau (occupied by the present nations of Iran, Afghanistan and the southwest part of Pakistan-Baluchistan) is entirely ringed by mountains. Drainage is inward, rivers and streams losing themselves in playas, saltwater lakes and marshes. On the west is the towering Zagros Range separating the Plateau from Mesopotamia. On the north the Elburz, Kopet Dagh, Jaghatai, Paropamisus, and Badakhshan Mountains divide it from the Caspian Sea and Turkmenistan. To the east the Sulaiman and Kirthar ranges mark the edge of the Plateau from the Punjab and the Indus Valley. To the south and southeast the mountains of Makran and the Zagros border the Gulf of Oman and the Persian Gulf.

The central part of the Plateau is occupied by two contiguous forbidding deserts: the Dasht-i-Kavir to the north and the Dasht-i-Lut to the south. Both lie within the borders of modern Iran but they effectively divide the Plateau into two parts, a western which includes most of the habitable parts of Iran (with the notable exception of the Caspian foreshore) and an eastern which comprises the habitable parts of Afghanistan and Baluchistan. One of the principal results of our recent work at Tal-i-Iblis was the realization of the importance of Mesopotamian (or Zagroan) influence in the western Plateau, an observation which is confirmed by Ghirshman's work at Tepe Sialk near Kashan.[1] Both sites lie near the margin of the central desert at the eastern extremity of the western Plateau. The evidence for these proposed Mesopotamia influences are minority objects occurring in what are essentially indigenous cultural assemblages. Nevertheless they are there, and in this respect the western Plateau differs from the eastern Plateau where we have no certain Mesopotamian connection until Early Dynastic times in Mesopotamia.[2]

It appears that Sialk was touched by these influences first. In Sialk I, Dyson[3] finds similarities in pottery painting to Hassuna, Samarra, and Halaf perhaps ultimately deriving from a "Zagroan oikoumenê" preceding the Ubaidian oikoumenê of Braidwood and

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1 Roman Ghirshman, "Fouilles de Sialk, Près de Kashan." Musée du Louvre, Serie Archéologique: Tome IV. Paul Geuthner. Paris. 1938.

2 George F. Dales, "A suggested chronology for Afghanistan, Baluchistan, and the Indus Valley." In Chronologies in Old World Archaeology, Robert W. Ehrich, Ed., Chicago, University of Chicago Press, pp. 267-274, 1965.

3 Robert H. Dyson, Jr. "Problems in the Relative Chronology of Iran, 6000-2000 B.C." In Chronologies in Old World Archaeology, Robert W. Ehrich, Ed. Chicago, University of Chicago Press, p. 236, 1965.

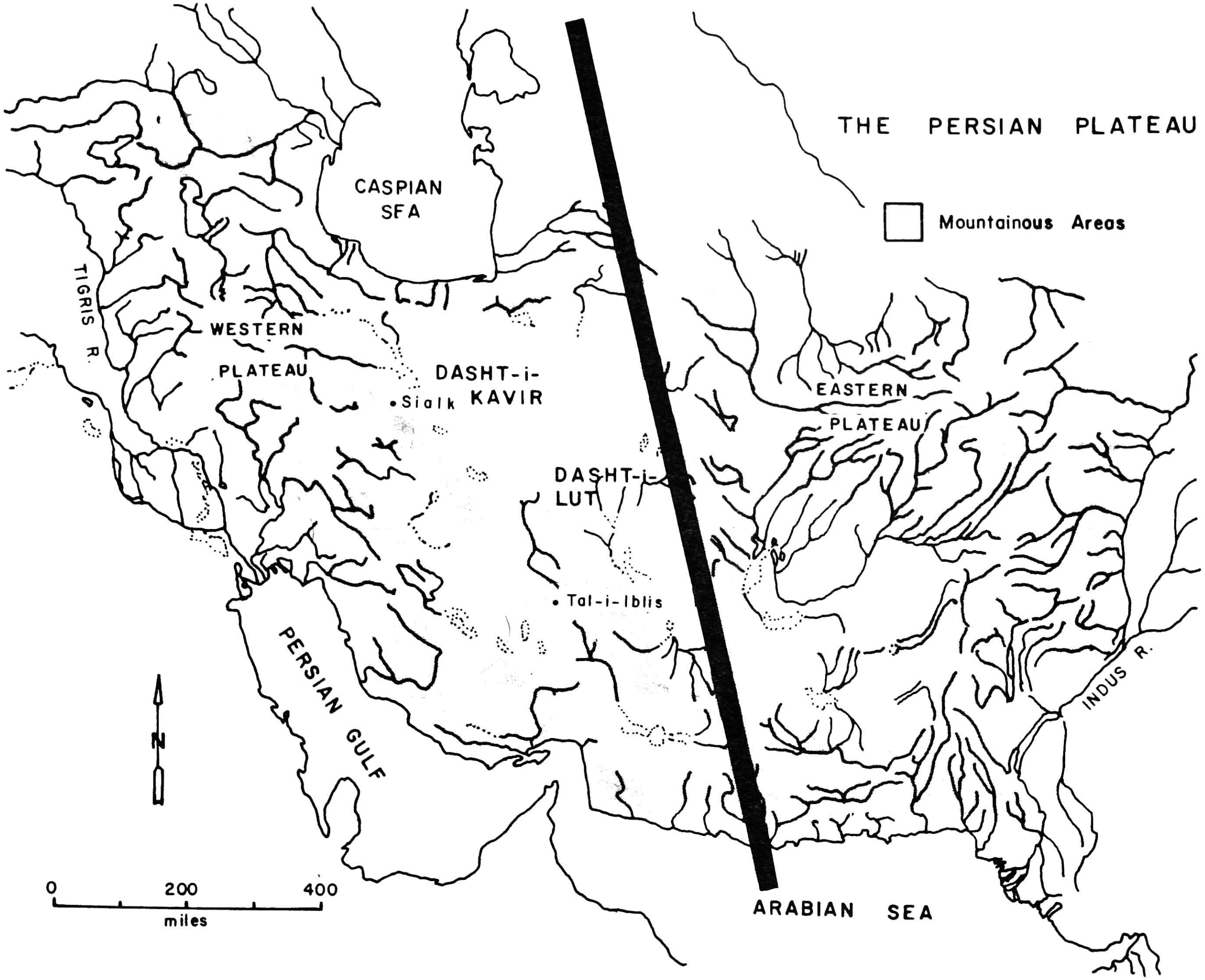
THE PERSIAN PLATEAU
Mountainous Areas
CASPIAN SEA
TIGRIS R.
WESTERN PLATEAU
DASHT-i-KAVIR
Sialk
DASHT-i-LUT
Tal-i-Iblis
EASTERN PLATEAU
PERSIAN GULF
INDUS R.
ARABIAN SEA
N
0
200
400
miles

FIGURE I

Howe,[1] although there is some possibility of cultural lag.[2] In Sialk II stylistic connections are to Halaf and Ubaid 3,[3] while in Sialk III the similarities are to Ubaid 4 and early Uruk (Warkan).[4] In Sialk III, 6, is a typical Warka VII spouted jar,[5] and Sialk IV shows many and specific resemblances to Jemdet Nasr.[6]

The sequence at Tal-i-Iblis, beginning possibly with our putative Iblis O, has in Iblis I a number of artifactual similarities to Sialk II. The overwhelming majority of pottery is a soft half-baked ware similar in manufacture, although not necessarily similar in form, to the soft ware of Bakun B 1. Fine painted buff ware appears at this time at Iblis in gradually increasing amounts throughout Iblis I.[7] Although still unstudied, our buff ware can perhaps be described as Ubaidian with some residual Halafian designs. It also seems to have some design similarities to Sialk II and to Tall-i-Gap in the Marv Dasht.[8] Two radiocarbon determinations from Bakun B 1 are very close to the acceptable determinations for Iblis I (Fig. 2), and it may be remarked that both sites mark the end of soft ware dominance in southern Iran and the appearance of Ubaidian inspired fine wares, probably Ubaid 3. The conformity of the Iblis and Bakun dates allows the suggestion that Braidwood and Howe's "Ubaidian oikoumenê" did not spread throughout southern Iran until shortly after 4400 B.C. These effects were less marked at Sialk. Sialk maintained important ceramic differences which in 1942 led McCown to regard Sialk, Hissar, and other northern sites as belonging to a distinct cultural province.[9] Other Mesopotamian-like objects appear in Iblis IV which has a beginning C^{14} determination of 3645 $\pm$ 59 B.C. (p. 928). Fragments of beveled rim bowls, shoulder spouts and wheelmade vessels are present, and there is also one variety of wheelmade vessel which Delougaz and Kantor found

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1 Robert J. Braidwood and Bruce Howe. Southwestern Asia Beyond the Lands of the Mediterranean Littoral. In "Courses Toward Urban Life." Robert J. Braidwood and Gordon R. Willey, Eds. Viking Fund Publications in Anthropology, No. 32, New York, p. 141, 1962.

2 A radiocarbon determination based on barley (Hordeum distichon L.) from Ghirshman's old sounding in the North Mound at Sialk at a level judged to be Sialk I, 2, was 3920 $\pm$ 90 B.C. (GX0949, 5730 half-life). This determination is surely too late. According to cross ties with our chronology at Iblis, Dyson's estimate of 4700 B.C. (Ibid., Fig. 1) for this level is much to be preferred.

3 Dyson, Ibid. p. 236. Also Donald E. McCown, "The Comparative Stratigraphy of Early Iran," Oriental Institute Studies in Ancient Oriental Civilization, No. 23, Chicago, University of Chicago Press, p. 33, 1942.

4 Dyson, Ibid. p. 237.

5 Ghirshman, Ibid. Pl. LXIX, p. 135.

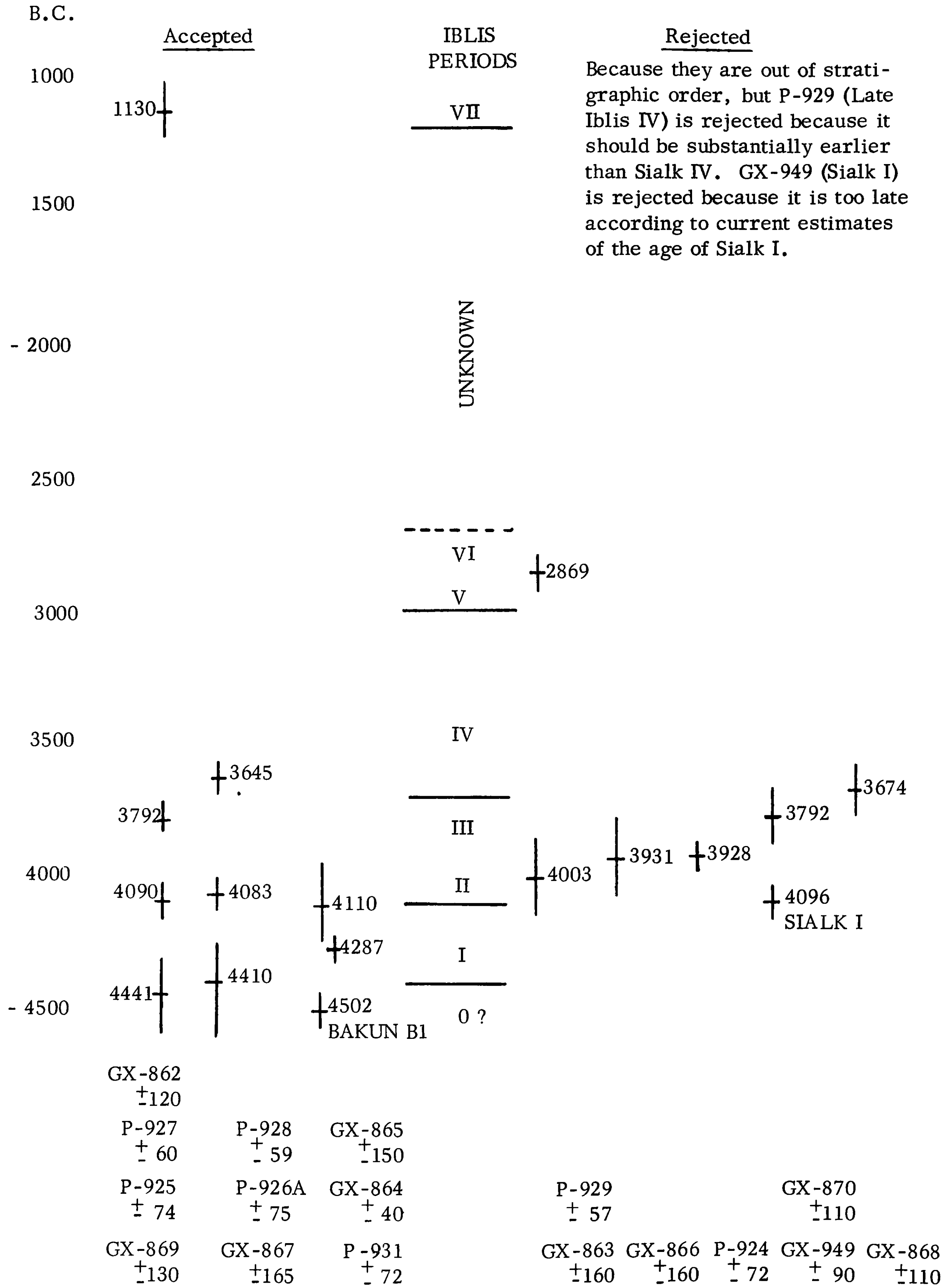
6 Ghirshman, Ibid. pp. 82-6.

7 See Paper X by Chase, Caldwell and Fehervari, this Volume.

8 Namio Egami and Toshohiko Sono. The Excavations at Tall-i-Gap Tokyo: Institute for Oriental Culture. University of Tokyo, 1959.

9 McCown, Ibid. pp. 12-13.

Figure 2.-C^{14} Determinations Obtained By The Iblis Project



All 5730 Half-Life

in early Protoliterate levels at Chogha Mish in southwest Iran.[1] Iblis VI has still more items which also occur in Mesopotamia. Although our samples are small, beveled rim bowl fragments are numerous and lip spouts and a lug of late Uruk or Jemdet Nasr type also occur. There are also examples of horizontal painted line pottery decoration, as in Sialk IV. At Iblis as at Sialk, Mesopotamian connections are more numerous than ever before.

That the western Plateau differs from the eastern Plateau in having some specific cultural items common in Mesopotamia before early Dynastic times, is not the end of the contrasts which can be drawn. Although there is a scattering of ancient sites from Paleolithic times on the Plateau and in the surrounding areas, the earliest settled farming communities are in the western intermontaine valleys of the Zagros and westward, and north of the Plateau in Turkmenistan. The earliest farming communities we know on the Plateau proper are: Cheshmeh Ali, near Tehran, Tepe Sialk near Kashan, and Tal-i-Iblis near Kerman, and Tal-i-Bakun B 1 in one of the intermontaine valleys of the southern Zagros. All of these except Bakun are on the eastern margin of the western Plateau. No doubt many more early farming sites remain to be discovered, but on present evidence none will be much earlier than 5000 B.C. Thus, with the exception of the western Zagros, early farming communities are not established on the Plateau until at least a thousand years later than they occur in Iraq, Turkmenistan, Anatolia, and Thessaly. Put in other terms, while these other areas have farming communities before they have pottery, all the farming communities we know on the Plateau so far have pottery from their beginnings, usually a half-baked coarse ware. On the eastern Plateau settled farming communities are later still. According to Dale's reevaluation of Fairservis' Quetta sequence[2] the KGM II period includes ten wheelmade pottery types. Far more work needs doing on the eastern Plateau, but granting that the western Plateau is more than 1000 years late in the achievement of settled farming communities, the eastern Plateau is more than 1000 years later than that. Or in other terms, while sites of the western Zagros to Thessally have villages before pottery, and sites of the western Plateau have a crude handmade pottery by the time they have settled villages, the sites of the eastern Plateau do not have villages until they have wheelmade pottery.

Turning now from the Plateau in general to the southeast part of the western Plateau where Tal-i-Iblis is located, the principal physiographic feature is a long chain of mountains usually called the central highlands of Iran. Some of these mountains reach six and seven thousand feet above the already respectable elevation of the Persian Plateau. On many maps these are assimilated to the Zagros Mountains of western Iran, but in actuality they are separated from the latter by the Isfahan-Sirjan Basin and can therefore be distinguished, following Bobek,[3] as a sub-central axis of mountainous elevations east of the Zagros. This I propose to call the Kerman Range. It begins far to the north of Kerman near the city of Qum in north central Iran and extends southeastward for some 1200 km to the border of Pakistan. It there joins the Central Makran and Siahan Ranges to turn northeastward toward Afghanistan.

1 Helene J. Kantor, Communication. One of ours is illustrated in Paper X, this Volume, Fig. 26, 13. The depression on the lower side of the vessel is also found in the examples at Chogha Mish.

2 Dales, Ibid. pp.260-261.

3 Hans Bobek, "Features and formation of the Great Kawir and Masileh," Arid Zone Research Centre, Publication No. 2, University of Tehran, p. 5, 1959.

Most of the province of Kerman is arid with hot summers and cold winters.[1] Annual rainfall seldom exceeds 20 cm and most of that falls in winter.[2] It is the Kerman Range which makes life possible over a large part of the area. The mountains are veritable sponges for trapping and conserving moisture. Winter snows remaining on the mountains during the Persian springtime persist on the highest mountains into summer, sending melt and ground waters into parched valleys and basins and also feeding a few perennial streams like the Halil, the Tahrud, the Chari, the Bampur, and the partly perennial Lalehzar.[3]

The Kerman range is definitely not well watered country, but if we compare it to the dreadful deserts on either side it is a more favorable zone, long and narrow, stretching from north-central Iran to Pakistan. To the east is a huge nightmare of salty desert called the Dasht-i-Lut, and to the west are the dry Gavkhane and Neriz basins containing some salt lakes which are of no use to anyone whatsoever. Thus the Kerman Range is a kind of corridor between these deserts. Sialk is near the northern end, Tal-i-Iblis is in the central portion, and the Bampur Valley is near the southern end, not far from the border of Baluchistan. We have already called attention to the connections between Iblis I and Sialk II, connections entirely separate from the fact that while Iblis I was adopting an Ubaidian kind of buff ware pottery, Sialk, in McCown's "separate province," was much less affected. It is therefore clear that there was some connection between Sialk II and Iblis I by way of the Kerman Range. In our subsequent period, Iblis II, there are still connections with Sialk, a few similar painted pottery designs, but more importantly perhaps, Iblis Painted pottery is no longer a buff ware but becomes red, both in paste and in slips. It is at this time also that we have our earliest reported settlement of the Bampur Valley. The lowest levels reached by Stein at Chah Husseini[4] show pottery with painted decoration essentially like that of Iblis II, and similar sherds were found by Stein along the Halil River. The Husseini materials are closer to Iblis than the Iblis materials are to those of Sialk. Thus, while we may claim that the Kerman Range was an important avenue of communication, we must probably also recognize that it linked at least two cultural provinces: McCown's province at the northern end of the Kerman range, extending northeastward to Cheshmeh Ali and Hissar, and an Iblis Province extending down the Kerman Range along the Halil River and over to Bampur.

In prehistoric times permanent settlement was evidently limited to the borders of perennial streams and occasional springs. This was first pointed out by Stein[5] and, indeed, has been our own experience so far. Yet it must be admitted that we still know little of the past climates of Kerman.[6] There are few trees today, and deforestation is

1 Phillip Beckett, "The City of Kerman, Iran." Erdkunde, Archiv fur wissenshaftliche Geographie, Band XX, Bonn, p. 120, 1966.

2 M. L. Dewan and J. Famouri, The Soils of Iran. Food and Agriculture Organization of the United Nations, Rome, 1964.

3 See Mirheydar, Paper VII this Volume.

4 Stein, Op.cit. 1937 pp.126-131, Pl.XIX, Nos.127,109,492,585.

5 Stein, Ibid. 1937.

6 Von Reinhold Huckriede, "Jung-Quartar und End-Mesolithikum in der Provinz Kerman (Iran). Eiszeitalter Und Gegenwart, Band 12, pp. 27-41, November 1962, has assembled convincing evidence for a pluvial period in Kerman at some time more than 25,000 years ago. His end-Mesolithic Kubanan Culture belongs to the present arid regime, however.

continuing.[1] There is every indication that formerly the area was more forested than at present, and thus rainfall is likely to have been greater.

Despite increasing aridity, since prehistoric times the areas available for agriculture and settlement have been greatly augmented by the use of chain-well systems (qanat). The dates of their invention and their introduction to Kerman are unknown.[2] Admitting a present difficulty in recognizing Parthian or Sassanian pottery in the Kerman region, it still appears to us that the most widespread settlements, and settlements most distant from perennial streams belong almost entirely to Islamic times.

Between the Kerman Range and the Zagros and within the Kerman Range is a series of long and "imperfect" southeastward intermontaine valleys. Within each of these the possibilities of habitation vary enormously depending on the availability of water. For example, the Isfahan-Sirjan Basin includes the dry and salty Gavkhane and Neriz Basins but at its northwestern end is a perennial stream nourishing Isfahan, one of the largest and most beautiful cities in Iran. Again, southeast and beyond Sirjan the Basin of Jiruft with the perennial Halil River is another very fertile district. We shall see such contrasts within long intermontaine valleys of the Kerman Range itself and it is clear enough that the culture-historical development within a particular segment of any single intermontaine valley will have to be examined in its own terms. In the present report, the few of the segments we have visited will be referred to as basins, valleys, or regions, but each is part of a larger valley. These include the Anar Valley, its southeastward continuation, the Bard Sir Valley; the Kerman Basin and its northward extension to the Hutg region; and the Rayin-Sarvestan Valley which is reached by moderate southeast passes where both intermontaine valleys converge. This last valley in turn connects with the Bam region and the Kerman desert.

The Anar Valley

A preferred route from Tehran to Kerman takes the traveler to the Oasis of Kashan at the northern end of the Kerman Range, where Ghirshman made important excavations.[3] From Kashan to Yazd one drives along the edge of the salt desert (Dasht-i-Kavir) to the East. Leaving Yazd the road enters a great intermontaine valley. We shall call the segment from Yazd to Rafsanjan the Anar Valley after the little town where we collected 14th to 17th Century Islamic sherds in the ruined citadel and which are described in Paper VI by Fehervari and Caldwell. All along the shingled road through this valley one sees barren mountains to the west but to the east at the end of a long barren slope is a ribbon of green agricultural lands dotted with villages. In season, water is carried there from the mountains by narrow man-made channels and throughout the year by chain-wells which emerge at elevations slightly lower than the water tables under the mountain slopes. This is a good example of the utilization of the marginal plains between the mountains and the salty lower-lying plains (kavir) and catchment basins noted by Bobek.[4] The present settlements depend chiefly on chain wells but archaeological survey might show prehistoric sites adjacent to springs which could also emerge in this zone.

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1 Some kind of wood, probably sissoo (D. sissoo) may have been brought from Kerman during the construction of Persepolis under Darius. See Hans E. Wulff, The Traditional Crafts of Persia, Cambridge, M.I.T. Press, p. 103, 1966. The historian Mustowfi tells that in early Islamic times there were extensive forests in Kerman (Guy LeStrange, "The Cities of Kerman in the Time of Hamd-Allah Mustawfi and Marco Polo," Journal of the Royal Asiatic Society, pp. 281-290, April, 1901). See also Paul Ward English City and Village in Iran, Madison, University of Wisconsin Press, pp. 13-14, 1966.

2 Many descriptions are available. See especially Wulff, Ibid. pp. 249-54. Also English Ibid. Appendix D.

3 Ghirshman, Op.cit.

There are several streams at the southeastern end of the Valley but I am not certain whether any except the Lalehzar are perennial. Below Rafsanjan the Valley forks and the road follows the northerly of these to Baghin in the Kerman Basin. At this end of the Anar Valley and its Baghin segment are a number of ruined settlements, including Tal Shaghai, Tal-i-Marai, and one Qaleh-i-Dukhtar (Maiden's Castle), the third site of that name we have encountered in the region. None of these sites were visited during our recent surveys.

The more southerly fork of the Valley is considerably wider and joins the Bard Sir Valley, to be described in detail by Professor Mirheydar in Paper VII of this Volume. There is no good road from Rafsanjan to Bard Sir. Instead we continue from Baghin into the Kerman Basin.

The Kerman Basin

This is much shorter and wider than the Anar Valley, and I think it is most properly considered as part of the next great intermontaine valley to the east. It is by far the best described of all the regions of Kerman Province.[1] Modern settlements tend to be scattered along the marginal plains of the mountains which nearly surround the basin. Teeming Kerman City with a present population of 82,000 derives nearly all its water from chain wells. But chain wells are expensive and this prompted Phillip Beckett to ask: "Why Kerman? Other centers are as well provided with soil and better provided with water. Why is Kerman a city if its development had required such a disproportionately high investment?" He finds his answer in the fact that Kerman City is at a maximum distance from tribal centers and former centers with independent dynasties, and in the fact it occupies a central position between two preferred routes of a major axis of international trade, both vulnerable to tribal interruptions at points remote from Kerman.[2]

If Beckett is right about this, then English, whose recent superb study of the Kerman Basin[3] deemphasizes the importance of international trade to Kerman City (on what I suspect to be a sound principle), may just happen to be wrong in this particular case. In addition to Beckett's arguments, one could note the quantities of imported glazed pottery and tiles mentioned by Fehérvári and Caldwell (Paper VI, this Volume) from the surface of Qaleh-i-Dukhtar in Kerman City. Time will tell if English was simply unlucky in selecting Kerman to illustrate this part of his thesis. On the other hand, English's contention that the villagers of the Kerman Basin are strongly urbanized is a point often overlooked and might make an interesting contrast to the inhabitants of other valleys and regions where I suspect they are less so. This is my impression of the inhabitants of some of the small villages in the Bard Sir Valley, despite the influence of the new sugar factory at Mashiz and the consequent increased planting of sugar beets as a cash crop.

Turning back to history, our reconnaissances in the Kerman Basin have so far yielded no

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1 See especially Ahmad Ali Khan-i-Vaziri, Tarikh-i-Kirman, (History of Kirman). Muhammad Ibrihim-i Bastaniyi-i-Parizi, Ed. Farman-Farmaian Memorial Library. Persian Book Company, 1961. Also, Beckett, Op.cit. Also, Anthony Smith, Blind White Fish of Persia, London, Allen and Unwin, Ltd., 1953. Also, English, Op.cit.

2 Beckett, Op.cit. p.121.

3 English, Ibid.

prehistoric sites, but there are many abandoned Islamic towns and villages. English's discussion of pre-Sassanian settlement in Kerman is based largely on Stein's visit to Tal-i-Iblis, which is not in the Kerman Basin. Not only for the sake of sweet pedantry, as Lynn White Jr. would say, but for the record, we do not know yet whether Iblis had either the walls or irrigation which English ascribes to it. The cultivated fields shown on Stein's plan (illustrated in this Volume in Paper VIII by Chase, Fehérvári, and Caldwell, Pl.5) are more likely to be recent than ancient. On the other hand our excavations at Iblis suggest that English may be right in supposing that Iblis was abandoned during the Indo-Iranian invasions. Aside from rare glazed sherds on the surface of the site, the latest object we have found so far is an iron dagger which has been identified as probably Achaemenian.[1] It also is likely that English is correct in following traditions which ascribe the founding of Kerman City to Ardeshir I, but confirmation of this would need major excavations at Qaleh-i-Dukhtar and Qaleh-i-Ardeshir. The earliest pottery we found on the surface of these sites dates from about the middle of the 10th Century A.D. when Kerman replaced Sirjan as the administrative center of the Province.

The Hutq and Kubanan Regions

Proceeding northeastward in the intermontaine valley where Kerman Basin is located we first pass another Qaleh-i-Dukhtar and reach the Hutq Region which contains a large number of stone cairns, probably Zoraostrian.[2]

Considerably farther on is the town of Zarand and beyond that the mining center of Kubanan (the Cobinam of Marco Polo) and also the region where Huckriede[3] found two sites with blade and microlithic assemblages, including sickle blades, geometric microliths, and "splendid pyramidal cores," very small and probably resembling the kind which occur at Moussian in southwest Iran. There were also perforators and thumbnail scrapers. Among the materials used was obsidian, of which the nearest known source is 200 km from Kubanan. Huckriede ascribes this Kubanan Culture to the end of the Mesolithic.

The Sarvestan and Bam Regions

Travelling from Kerman southeastward we come to the town of Mahan with its famous shrine to the religious leader of the Nematollahi sect and then by an easy pass come to the Rayin-Sarvestan Valley. This opens out at progressively lower elevations to the town of Bam with a perennial stream, the Tahrud, and its famous Arq or citadel, and thence to the Kerman Desert.

As already indicated, aside from the discoveries of Sikes at Kinneman[4] and Huckriede near Kubanan, very old sites have not been found in any of these areas, which is not to say that some would not be found in a more careful survey.

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1 Through the kindness of Miss Elizabeth Carter, Oriental Institute, University of Chicago.

2 Stein, 1937, p. 163. See Paper VI by Fehérvári and Caldwell, this Volume.

3 Huckriede, Ibid., pp. 36-40.

4 Sir Percy Sykes, A History of Persia, Vol. I, London, MacMillan, Ltd., pp. 184-5, 1963.

The Bard Sir Valley

This valley, which lies southwest of Kerman and is a natural continuation of the Anar Valley, is the only area where we found prehistoric sites, and above all, Tal-i-Iblis. A detailed description of the valley is given by Professor Dorreh Mirheydar in the accompanying Paper VI: Geography of the Bard Sir Valley. We expect her investigation to be a base line for future geographical studies. It will be increasingly useful as we continue to locate more settlements of each of the older periods: the geographical approach can be continued backward through time and significant culture-historical contrasts should result. It appears already that permanent settlement in the Bard Sir Valley is much older than in the Kerman Basin.

The next paper by Chase, Fehérvári, and Caldwell, No. VIII: Reconnaissances in the Bard Sir Valley describes the sites located in the 1964 and 1966 surveys. The time range is from possibly as early as Mousterian through recent Islamic. We do not have at this time sites of all periods. This is partly a result of insufficient survey and can be remedied in future work. Assuming the possibility that a fuller assemblage of Mousterian artifacts might be found, it is probably too much to expect to fill much of the gap between Mousterian and Iblis I times, but Gary W. Hume in Paper IX: Comments on the Geology and Archaeology of the Bard Sir Valley suggests that there is a great potential for Paleolithic sites in the Bard Sir area. He points out that the large number of solution cavities in the limestone deposits of the surrounding mountains indicate a good possibility of finding more caves and rock shelters than he and Mrs. Hume have located so far. Moreover what we do not find in the Valley proper may well turn up in adjacent areas. We have previously mentioned the "End-Mesolithic" sites reported by Huckriede near Kubanan. Also, as I understand it, in 1965 Ali Akhbar Safaroz of the Archaeological Service of Iran (communication) reached levels with microliths, but without pottery, at a site in Kerman Province.

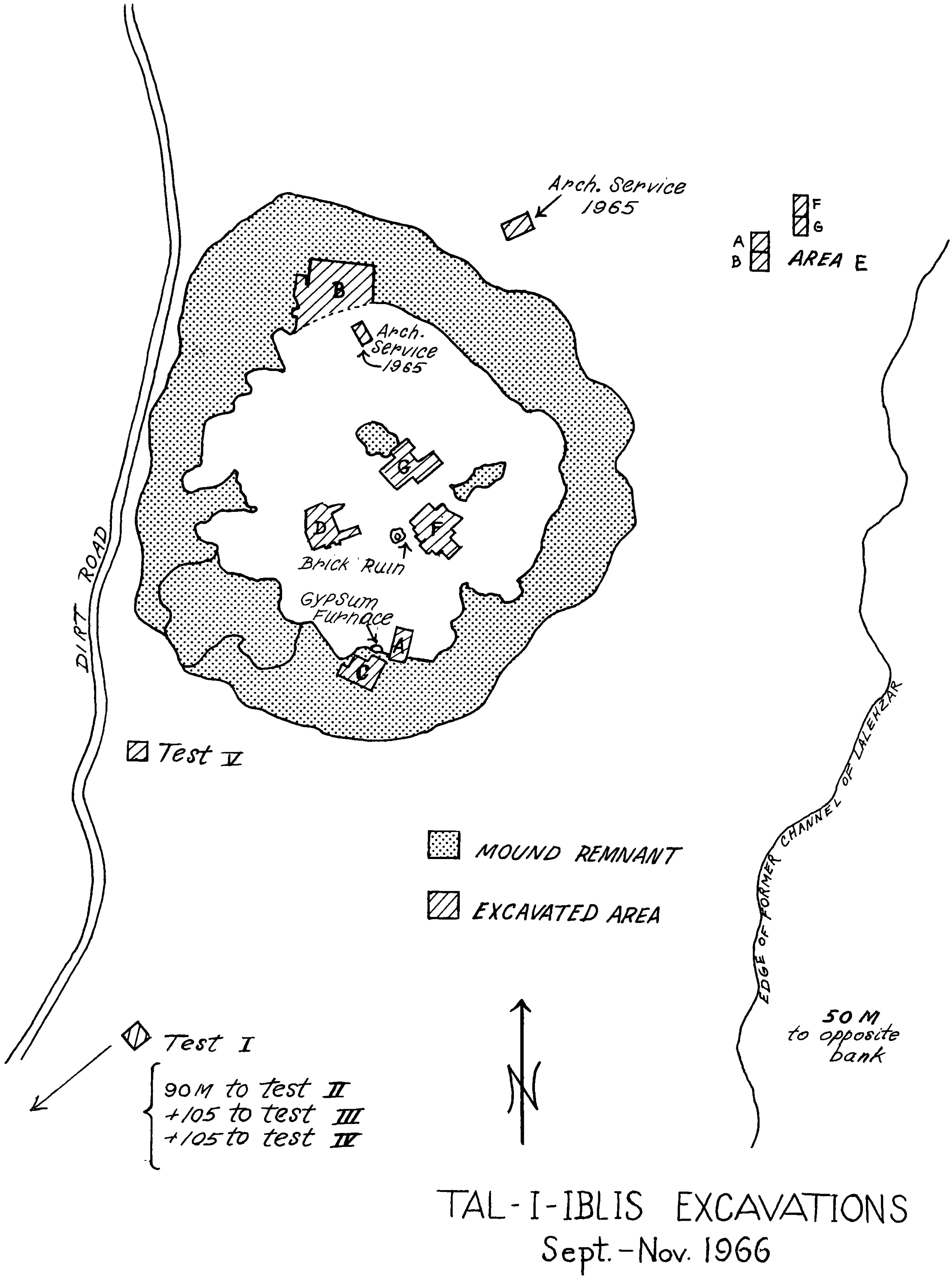
Probably our greatest lack at the moment is our inability to find, or at least to recognize, sites later than Iblis VI but earlier than Islamic times, i.e. the greater part of the historical period. Iblis did yield a well preserved pottery kiln of about 1100 B.C., but in the entire province of Kerman we cannot point to a single Achaemenian or Parthian site. Fehérvári has suggested, however, that some of the standing ruins in Kerman Province look to be Sassanian architecturally, and various members of the expedition have at one time or another identified certain blue glazed sherds to be Sassanian, but this writer, at least, is still doubtful of our ability to recognize Sassanian ceramics in this area.

It is this long gap in our sequence which suggests that we could learn much at the site of Ghubeyra at the junction of the Chari and Ghubeyra Rivers described in Paper VIII of this Volume by Chase, Fehérvári and Caldwell. Here is a site most felicitously situated with respect to a permanent water supply. In addition to having been a medieval Islamic city it also has prehistoric remains from at least two periods. Ghubeyra is perhaps the one place in the Valley which was occupied most continuously and where we have the best chance of finding some of our missing historical periods. In addition to this, is the importance of investigating medieval Ghubeyra itself, emphasized by Chase, Fehérvári, and Caldwell.

The stratigraphy of Iblis, so far as we understand it, is described by Chase, Caldwell, and Iren Fehérvári in Paper X: The Iblis Sequence and the Exploration of Excavation Areas A, C, and E. The reader will find that Area A, section C, is not the same as Area C, and next season we shall try to avoid this confusing terminology. We shall continue to use letters for excavation area designations, but numbers for the sections within them. The various excavation areas are shown in Figure 3.

Our sequence may start with Iblis O. Caldwell and Shahmirzadi originally used this term

FIGURE 3


Arch. Service
1965
F
G
A
B
AREA E
B
Arch.
Service
1965
G
D
F
Brick Ruin
Gypsum
Furnace
A
C
DIRT ROAD
Test V
EDGE OF FORMER CHANNEL OF LALEHZAR
MOUND REMNANT
EXCAVATED AREA
Test I
90M to test II
+105 to test III
+105 to test IV
N
50 M
to opposite
bank
TAL-I-IBLIS EXCAVATIONS
Sept.-Nov. 1966

for what they believed to be the lowest level in the mound.[1] All the sherds in their sample were Lalehzar Coarse, a half-baked soft ware. Chase's excavation in Area A, not far from where the original sample had been taken, showed that if it had been larger it would have included a few sherds of a fine buff ware, Bard Sir Painted and Bard Sir Plain as well as Bard Sir Red Slipped. This association of Lalehzar Coarse ware and the fine Bard Sir types is what we are now calling Iblis I, dated to about 4400-4200 B.C. Iblis I apparently has the best preserved structures on the site. The three buildings excavated by Evett and described by him in Paper XI: Artifacts and Architecture of the Iblis I Period, all belong to this time as do those excavated and described by Caldwell and Sarraf in Paper XIII: The Exploration of Excavation Area B. In his stratigraphic work in Area E, moreover, Chase was able to show that the proportions of fine Bard Sir types increased during Iblis I times. But what of Iblis O? Digging deeper in Excavation Area A Chase obtained a large sample of Lalehzar Coarse ware unmixed with the Bard Sir types. This level Chase would call Iblis O, noting that it is deeper than Iblis O as originally defined by Caldwell and Shahmirzadi. Caldwell, once burned, twice shy, still has some reservations concerning the existence of a pure coarse ware level at Iblis. In excavation Area B, Caldwell and Sarraf excavated two large structures without finding anything on house floors but Lalehzar Coarse Ware. Then, in a midden below these structures three Bard Sir sherds were associated with the usual Lalehzar Coarse ware. Whether there is actually an Iblis O level at Iblis is somewhat academic, for surely a pure soft-ware site or level will be found somewhere in the region. The more important observation is that at the beginning of Iblis I the common pottery is Lalehzar Coarse and the fine Bard Sir buff ware is extremely rare, probably imported. The firing was sufficiently controlled to suggest that this fine ware was fired in a kiln. By the end of Iblis I, fine ware is sufficiently abundant to have been made at the site.

A sample of the chipped stone industry of Iblis I is described by Evett in Paper XII. It is a blade industry in which the blade cores were maintained by a combination of flake and blade techniques, and a distinctive feature is the high proportion of used pieces. Evett suggests the reason to be the rarity of good raw material in the area, and that the small size of the raw material gives the industry a strong microlithic flavor. The industry continuing in Iblis II is essentially the same, but in later periods chipped stone is relatively rare.

In Theodore A. Wertime's contribution to this Volume, Paper XVI: A Metallurgical Expedition through the Persian Desert, he concludes with a comment that: "The truth of metallurgy will be known only by a simultaneous attack on the interconnected phases of pyrochemistry." For what it is worth, we may have in Iblis I four different kinds of pyrochemistry appearing at about the same time: (1) the possible use of pottery kilns, (2) our first fragments of crucibles used in reducing copper from ore, (3) our first devices which can be reasonably supposed to have been used in baking bread, and (4) a clay box set directly over a hearth and in which someone was heating specular (?) hematite, although for what reason we cannot guess. Perhaps when we know still older periods in the region this apparent simultaneity of pyrochemical activities will turn out to be an illusion -- I should not be surprised if the bread baking devices were older, even as old as the gathering of wild wheat and barley. Nevertheless, Wertime's suggestion is a good one, and additional investigations may support his thesis with more detail than we have at present.

We cannot leave our introduction to the Iblis I period without a word about its sophisticated buildings of handmade sun dried bricks. Parts of three large buildings are described by

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1 Joseph R. Caldwell and Sadeqh Malek Shahmirzadi, "Tal-i-Iblis, The Kerman Range and the Beginnings of Smelting," Illinois State Museum Preliminary Reports No. 7, Springfield, Illinois State Museum Society, 1966.

Evett in Paper XI: Artifacts and Architecture of the Iblis I Period: Areas, D, F, and G. Parts of two other buildings are described by Caldwell and Sarraf in Paper XIII: Exploration of Excavation Area B. No other site in Iran has yielded such a wealth of architectural information for such an early date. Of five partially complete building plans known so far, one is astonished by their size and complexity. Whatever they are, these are not the domiciles of nuclear families, but surely the homes of extended families of some kind. In three instances the plan seems to have been a core of small rooms, often lacking discernable floors, which we believe to have been for storage. Around these were larger rooms for living, and some of the latter showed red painted walls and impressions of floor mats. In the case of two burned buildings the fallen roof debris was preserved as burned clay showing pole impressions and we were able to note that roofs were undoubtedly flat, made of poles laid from wall to wall and plastered with mud. Architectural sophistication is also shown by the invariable use of mud plaster on exterior as well as interior walls, and in the construction of doorways. There were also windows, corridors, and exterior and interior piers. We have an example of a mealing bin where two saddle querns were set in a slanted clay bench and from which the ground meal fell into clay boxes below.

Faunal remains were numerous in Iblis I levels, but our sample is inadequate. On the basis of the limited materials brought to America, Sándor Bökönyi tells us in Paper XIV: The Prehistoric Vertebrate Fauna of Tal-i-Iblis, that we have domesticated breeds of Canis familiaris, Capra, Ovis aries, and Bos taurus, and that the Iblis I people were hunting Gazella, Bos primigenius, and Equus hemonius, and Equus caballus. There was also one turtle, fragment of one of Aves, and one phalanx of a lion. Dr. Bökönyi adds that this assemblage shows the environment of Iblis I times to have been desert or semi-desert, just as today. Our faunal samples from later periods are too small for comparison, but no new species are represented.

The Iblisi of this period were well acquainted with agriculture. Robert L. Stewart of Sam Houston State College identified breadwheat (Triticum aestivum L.) from the floor of Room 4 in Area B, and one sherd of Lalehzar Coarse ware examined by Hans Haelbek showed a possible impression of emmer wheat.

From various exposures and soundings we can calculate the extent of the occupation during Iblis I times as having covered a minimum of 14 acres, surely a respectable size for that period. At least one area, excavation Area E, seems to have been reserved for dumping purposes, but in two alleys in Area B we know that ashes from hearths were simply thrown out of the buildings. In one part of Area B was a free standing tomb, deliberately built as such with a bricked up entrance.

We still know little of the very ancient towns in western Asia and nearly all our information has come from Mesopotamia and is now coming from Anatolia and Turkmenistan. It is entirely possible that our present understandings of early towns are affected by the peculiarities of those regions, just as they are affected by the peculiarities of our outlook.

In Iblis I and II we might have actual towns, but "town" is one of the most ambiguous of words. Most of us can define a village, and there have been serious attempts to define cities. Speaking of the latter, mere size can be misleading. Max Weber[1] tells us of Russian villages of many thousands of inhabitants. Cities, according to Weber, have economic versatility. A market with a regular rather than an occasional exchange of

1 Max Weber, "The City," reprinted in Theories of Society, Talcott Parsons, Edward Shils, Kaspar D. Naegele and Jesse W. Pitts, Eds., Vol. I, New York, The Glencoe Free Press, pp. 380-385, 1961.

goods is a principal means of establishing this. A city, moreover, can also have a broad stratum of residents who satisfy a large part of their food needs through cultivation. I do not intend to call Iblis a city. The word is so loaded with more recent functions as to be practically useless for characterizing the time and place with which we are concerned. Nor is our evidence for long-distance trade in certain articles of stone and shell ornaments of much importance to the argument. Items obtained from elsewhere have been treasured since Upper Paleolithic times. Nevertheless, Iblis II at least, obviously producing copper in excess of its needs, shows one aspect of economic versatility. In future investigations we shall be on the lookout for other forms of such versatility, and this, interesting us far more than whether we are to call Iblis II a city, town, or village, may also have more relevance to understanding the nature and origins of what we are today calling "cities." We probably do not have many Iblis II structures left but a nearly complete excavation of the slightly earlier Iblis I settlement should offer important comparative data for those who are interested in the origins of urbanization. For this site we need to know, and (as a result of the removal of most of the upper levels by the fertilizer diggers) can discover quite easily, the locations of streets, alleys, and nearly all the buildings. So far we have not discovered a single shrine, but does our town have a temple? Do we actually have public or private granaries? A market place? Other public structures? These things we would like very much to know.

Turning now to Iblis II (about 4100-4000 B,C.) we have little information except about pottery and metallurgy. Most of the materials were destroyed by the fertilizer diggers. We do not have an excavated Iblis II building, but the chances of finding some in the margins of the mound left by the fertilizer diggers seem fairly good. The settlement at this time may have been almost as large as that of Iblis I -- we cannot say for certain -- but we are fairly sure that it was no larger. At at least two points outside the mound, Iblis I materials lie on the surface with less material of Iblis II.

As previously noted, a certain amount of Lalehzar Coarse ware continues into Iblis II, but the fine wares, Iblis Painted, Iblis Plain, and Bard Sir Red Slipped are now in the majority. Chase's excavations in Area A, section C, and in Area E suggested a gradual transition from the fine Bard Sir to the fine Iblis pottery. His results are confirmed by one of the small samples taken by the Caldwell party in 1964 from an occupation in the standing profile: in this, Bard Sir Painted (buff ware) and Iblis Painted (red ware) occur together, although they were not recognized as different types in 1964. A number of the Bard Sir Painted designs continue in Iblis II times but our present impression is that the design repertory is smaller -- more standardized -- and that the Iblisi at this time were less receptive to foreign pottery designs than they were in Iblis I.

For the Iblis II period we do have a profile exposure of a dumping area 60 cm thick and at least 100 meters long. From this has come much of our evidence for early metallurgy: hundreds of small clay crucible fragments showing copper stain and dross. From one 20 cm level in a five meter square where this dump was penetrated by excavation Area C, came more than 300 crucible fragments. From another penetration in excavation Area A, section C, a 30 cm level 3 by 2 m in extent, yielded 128 crucible fragments. We have already seen that the first use of crucibles probably began in Iblis I, but crucible fragments were not nearly as abundant in our Iblis I dump (Area E) as they were in the dumping area (Areas A and C) of Iblis II. Clearly a much larger operation was taking place in Iblis II times. Each of the small crucibles would have produced only a limited amount of copper, but their very number suggests production far in excess of local needs and thus presumably for export. The one crucible fragment examined by Ralph C. Dougherty and described by Dougherty and Caldwell in Paper V: Evidence of Early Pyrometallurgy in the Kerman Range in Iran showed that the clay was not very refractory. The clay melted at a temperature of 1100°C while copper metal melts at 1083°C.

Dougherty judged that the temperature obtained during the process was less than 1000°C, most likely in the range of 700-800°C. These temperatures are quite sufficient for the reduction of copper ore but they are well below the melting point of the metal. The metallurgical team attached to the 1966 project was in complete agreement that the crucibles from Iblis had been used in reducing ore but they are still undecided as to the processes involved. Their views are given in the final three papers of this Volume, Paper XV: Preliminary Reports of the Metallurgical Project, by Cyril Stanley Smith, Theodore A. Wertime, and Radomír Pleiner; Paper XVI: A Metallurgical Expedition through the Persian Desert, by Theodore A. Wertime; and Paper XVII: Preliminary Evaluation of the 1966 Metallurgical Investigations in Iran, by Radomír Pleiner. The metallurgical project, however, had far wider interests than our early copper smelting at Iblis, and provided a wealth of new data and new questions about the histories of gold, lead, silver, zinc, and iron in eastern Iran.

In their own copper smelting experiments at Iblis, using poor grade, perhaps rejected, ore fragments found at the site and using crucibles of local clay, our metallurgists did manage to produce a bead of copper -- but melted their crucibles. In the meantime we hope their analyses of various crucible fragments and copper pins from Iblis I and II will yield additional information. Pleiner notes in his paper (Paper XVII, this Volume) that: "The use of a simple goatskin bellows produced in a shaft furnace adequate temperatures, 1200°C or thereabouts, to reduce any metal in antiquity," but this interesting observation need not apply to Iblis where neither shaft furnaces nor tuyères have been found. In this connection we may recall Dougherty's view that a temperature range of 700-800°C should have been sufficient to reduce copper from ore.

In Excavation Area G[1] we came upon a small hearth which contained many tiny fragments of copper oxide, one crucible fragment and a few pieces of brick which might have fallen in from a small superstructure. The hearth had been simply scooped out of the ground and showed neither much preparation nor evidence of repeated firing. We shall need other, better preserved examples of smelting places before we can offer definite archaeological information about smelting procedures.

Of particular interest is the fact that nearly all our crucible fragments have come from general dumps, intermixed with quantities of potsherds, animal bones, fragments of flint, charcoal and other trash. Writers on early metallurgy have stressed the idea that the metallurgist must be a professional:

> "Probably from the first metallurgy was a craft as well as a technique. The operations of mining, smelting, and casting are too elaborate and demand too continuous attention to be normally conducted in the intervals of tilling fields and minding cattle."[2]

If this were truly the case we should have expected our crucible fragments to be found in an industrial dump, but such specialization is not indicated here. We may also recall in this connection the small clay box built directly over a hearth in one of our domestic rooms which also contained pottery vessels, a stone cup, some fragments of malachite and a small store of breadwheat. In the very bottom of the clay box was a deposit of specular(?) hematite which we can only imagine was being warmed up for some reason. If this is an example of pyrometallurgy, it is perfectly possible to imagine the mistress of the house

1 See Evett, Paper XI, this Volume.

2 V. Gordon Childe, What Happened in History, London, Pelican, 1954.

to have been heating hematite at the same time she was stirring the soup over another hearth which lay in an opposite corner of the room. The Iblis evidence therefore may be telling us of a cottage or part time industry in metal working before it became a craft. Indeed, should such a stage not be expected?

Our next period, Iblis III with one radiocarbon determination of 3792 ± 60 B.C. (p-927) is known from the mound remnant where the 1964 party extracted samples of sherds and charcoal, and where it is penetrated by Area A, section C, and by Area C nearby. An Iblis III occupation zone is clearly distinguishable and a gypsum burning furnace originates from this zone a short distance west of Area A. This is all we have from Iblis III except for pottery.

Iblis III pottery (Dashgar complex), shares few traits with Iblis II. The redness of Iblis II pottery has disappeared. Some sherds are a true buff ware but others show a pinkish paste. Chase was able to separate some Iblis III sherds, especially in his 150-200 cm level of Area A, section C. A number of other sherds found in the gypsum burning furnace confirmed his judgment. Iblis III pottery is essentially different from Iblis II in decoration. It is usually plain but often has a brushed or scratched exterior surface. Paint is used much more sparingly than in the preceding period and at least some designs are similar in style to those of the following period, Iblis IV, with which there is more evidence of continuity than between Iblis II and III. Dashgar Painted may be an early stage of the succeeding Aliabad Painted, and Dashgar Brushed continues upward to become Aliabad Brushed. The sherds extracted by the 1964 party from an occupation zone immediately above this Iblis III level and which Caldwell and Shahmirzadi[1] called "early Aliabad," had a C^{14} determination of 3646 ± 59 B.C. (p-928) and comprised both Dashgar and Aliabad types. We may call it early Iblis IV.

Iblis IV, proper, with one C^{14} determination for its upper levels of 2869 ± 57 B.C.(p-929), is also known only from the mound remnant where excavation Areas A and C were located. This date is toward the end of the period, and may also be a little too late. My guess is that Iblis IV extends from about 3600 B.C. (Early Aliabad) to possibly as late as 3000 B.C. I say possibly, because we must also leave room for Iblis V and reckon with the ceramic similarities of Iblis VI to Sialk IV; Sialk IV can hardly be later than 2700 B.C.

Our information, comes almost entirely from a dumping area. Aside from this, there was part of a building in the upper levels of Iblis IV in Area C but the mud bricks were poorly preserved and we did not attempt to follow them outside the excavation area. There was also a curious mass of burned bricks, probably not fired intentionally, in the Iblis IV deposit. On the profile of the mound remnant there was a deliberately laid lower course of these, behind which was a kind of a black burned floor with a mass of fired earth and bricks above this. One of our reasons for excavating Area C was to reach some understanding of this feature. In the latter area, however, it appeared simply as a steeply sloping mass of burned earth and tumbled bricks, with much black burned sand and earth with quantities of potsherds. It should be further exposed before we attempt to cut into it.

For the time being, therefore, we know Iblis IV chiefly from its pottery and from the occasional other kinds of artifacts discovered during the excavation of Area C. The main pottery types are Aliabad Painted, Aliabad Bichrome, and Aliabad Plain. Of these the painted and bichrome types are almost invariably handmade, but at least some of the plain is wheelmade with some examples showing string cut bases. Another minority type, Aliabad Brushed is probably a descendant of Dashgar Brushed, which we first

1 Caldwell and Shahmirzadi, Ibid., pp.14-15.

countered in Iblis III, and as previously noted, some of the Iblis IV forms and painting make their first appearance at that time.

The Aliabad pottery types are sometimes a buff, but more frequently a pinkish ware, probably tempered with finely divided vegetal material. Buff slips on a pink paste are common, and painted designs occur on the outside or inside of a vessel. In such cases, the side without the painting is less likely to have a buff slip. Designs are bold and carelessly painted; about one-sixth of the painted sherds are bichrome. The few bichrome sherds found by Casal in Mundigak I in Afghanistan[1] regarded by Dales as heralding the introduction of bichrome pottery into south Asia,[2] show some degree of similarity to Aliabad Bichrome and it is possible that the bichromes at Mundigak and Iblis stem from a common source, and indeed they may be approximately contemporary. Mundigak I and Iblis IV both see the introduction of the potter's wheel, and both are correlated with Uruk times in Mesopotamia. The respective pottery painting traditions of the two sites are, however, quite different, although both share a certain sloppiness in their rendering of painted pottery designs. Iblis IV does not have any dot tipped triangles, and no naturalistic motifs except an occasional stylized scorpion.

Fragments of beveled rim bowls identical with the southern Mesopotamian and southwestern Iranian type occurred throughout the Iblis IV levels, although as a minority type. There were also some fragments of shoulder spouts, as well as the early Protoliterate "flower pot" vessels mentioned at the beginning of this chapter as having been recognized by Kantor.

During Iblis IV times there are few ceramic similarities to Sialk. Iblis IV may be roughly contemporary with Sialk III, 4, 5, when wheelmade pottery is said to appear.[3]

Iblis IV yielded some evidence that copper metallurgy continued at the site. A few copper pins were found in these levels in Area C, some fragments of malachite, and one piece of a crucible. The crucible had been much larger and deeper than the small crucibles of Iblis I and II. Unlike the latter, it would hardly have been used for smelting ore, but for handling molten metal.

What we believe to be our next period, Iblis V, is not known from excavations. The wide scatter of pottery around the mound and marking by far the greatest extent of the settlement, is mostly of the type Mashiz Plain, a very hard, genuine "stone ware." The forms seem similar to those of Iblis IV, but in addition to being harder, this variety of pottery is often heavily tempered with grit. We believe there is a type Mashiz Painted, but it is not easily distinguished from Aliabad Painted of the preceding period. The type Aliabad Ridged probably continues into this period and in greater frequency than it occurred in Iblis IV. There are questions here which will not be decided without excavation.

The same mixture of Mashiz (Period V) pottery and Period IV (or Period IV derived) ceramic features occurs on a series of small knolls SSW of Iblis, all near the abandoned channel of the Lalehzar River. On each one of these knolls is what looks like a very crude

1 Jean-Marie Casal, "Fouilles de Mundigak," Memoires de la Delegation Archéologique Française en Afghanistan, Vol. II, Fig. 50, 21, 29. Paris, Librairie C. Klincksieck, 1961.

2 Dales, Ibid., p.262.

3 McCown Ibid., p.6.

stone industry which we would have expected to be much earlier, but so far it has invariably occurred with pottery of Iblis IV and V.

No later pottery has been found on these knolls, and this with the fact that Iblis V marks by far the greatest extent of the Iblis settlement, suggests that the Lalehzar River changed to its present course shortly after that time. Sherds we believe to be Iblis V have been found on the Chari River, a perennial stream some 25 km to the east of Iblis. Chari River site B-4, the medieval city of Ghubeyra, at the junction of three streams, and probably the richest and most impressive site in the Bard Sir Valley, is described in Paper VIII by Chase, Fehérvári, and Caldwell. It is perhaps here that the main sequence of culture periods in the Valley will be continued, and Ghubeyra is well worth digging on this account, as well as for what may be learned about the medieval city itself.

The movement of the Lalehzar may have shorn Iblis of some of its former importance, but occupation continued for a considerable time into what we are calling Iblis VI. In a 5 m test pit (No. II) 200 m SSW of the edge of the mound the first 20 cm level contained 61 beveled rim bowl fragments, 4 trough spouts and other sherds reminiscent of Sialk IV. Seven sherds in this level had Sialk IV painted designs, and the only items which might possibly have been Iblis IV or V were 6 annular bases. Level 2 was not counted, unfortunately, but levels 3 and 4 had 25 and 13 beveled rim bowl fragments respectively. Level 3 had another sherd with painted horizontal hands like Sialk IV. Level 3 had only one sherd of Aliabad Painted, but levels 4-6 were clearly Iblis IV. In level 8, just above virgin soil, were 5 sherds of Lalehzar Coarse ware and 1 sherd of Bard Sir Painted, suggesting that the Iblis I settlement had extended outward this far.

We need more excavation in Iblis VI deposits and we now know the locality on the site where they are to be found. The importance of Iblis VI is in its specific connections with Sialk IV and to late Uruk and Jemdet Nasr in Mesopotamia. Ghirshman explained Sialk IV as resulting from an Elamite expansion.[1] Our discovery of Iblis VI now suggests that his explanation may have been too simple, for we can doubt if there was a simultaneous Elamite invasion into Kerman. For the moment, we prefer to see both Sialk IV and Iblis VI as participating in a grand interaction with Mesopotamia, a parallel to the old Ubaidian oikomenê of Braidwood and Howe, but even more far flung, reaching Egypt,[2] perhaps the Balkans,[3] and two extreme points, Sialk and Iblis on the western Plateau. The western Plateau, while maintaining in part its distinctive cultural areas, was perhaps now becoming a vast hinterland of the Mesopotamian cities of late Uruk and Jemdet Nasr times, perhaps about 2800 B.C. It is far too early to specify the positive contributions which may have come to Mesopotamia from these quarters, but the resurgence of painted pottery in Mesopotamia after its virtual absence in Early and Middle Uruk might be one such contribution from Iran. I have long been convinced that civilizations are above all nourished by interactions and exchange of ideas with adjacent regional traditions,[4] and therefore I do not think it an accidental coincidence that Late Uruk and Jemdet Nasr civilization reached

1 Ghirshman, Ibid., p.86.

2 Helene Kantor, "The Relative Chronology of Egypt and its Foreign Correlations." In Chronologies in Old World Archaeology, Robert W. Ehrich, Ed., Chicago, University of Chicago Press, pp. 7-14, 1965.

3 M.S.F.Hood, "The Tartaria Tablets," Antiquity, Vol.XLI No.162, pp.99-113, June 1967.

4 Joseph R. Caldwell, "Interaction Spheres in Prehistory," Illinois State Museum Scientific Papers Vol.XII, No.6, Springfield, 1965.

a stage of progress never before attained at the very time its hinterlands reached their greatest geographical extent.

In the last days of excavation we rather hastily dug the fill out of what appeared to be a reservoir near the center of the mound. The fill, dug in 1 m levels, contained some Aliabad sherds, others we did not recognize, and also two beveled rim bowl fragments. At the very bottom was a sherd with a perforated nose lug of the kind known from Late Uruk and Jemdet Nasr. Judging from the fact that such nose lugs are certainly later than Iblis IV and V, we tentatively include this ruin in period VI,. but more investigation will be required for certainty.

In the topmost level of Area C were a few small sherds of a gray ware, with a grit tempered gray paste and gray surfaces. In Paper X of this Volume are illustrated some better examples which came from the fertilizer diggings.

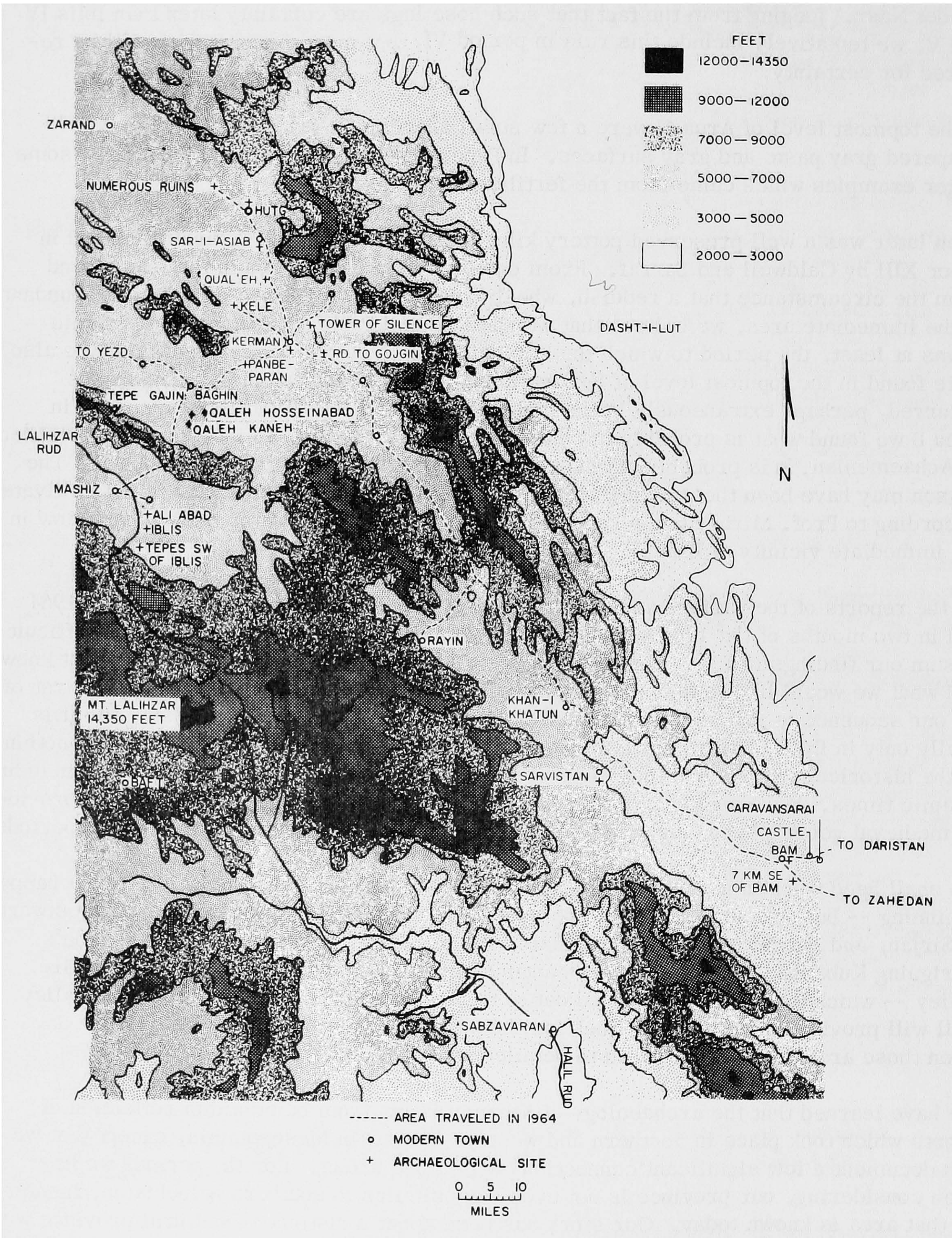
Even later was a well preserved pottery kiln, dating about 1100 B.C. and described in Paper XIII by Caldwell and Sarraf. From one burned incised sherd in the firebox and from the circumstance that a reddish, wheelmade wavy-line incised pottery was abundant in the immediate area, we believe that we shall soon be able to describe, in ceramic terms at least, the period to which the kiln belongs. A very few sherds of this type also were found in the topmost level of Excavation C, and at least two more such sherds occurred, perhaps extraneously, in the higher deposits of Iblis IV in Area C. Also in Area B we found what is probably the latest artifact on the site, an iron dagger, identified as Achaemenian. It is probably at about this time that Iblis was finally abandoned. The reason may have been the growing scarcity of water. At present the area is not cultivated. According to Prof. Mirheydar in Paper VII of this Volume, the water table is very low in the immediate vicinity of Iblis.

As the reports of the various authors of this volume show, we have in two days in 1964 and in two months of the 1966 season learned so much that is new to us that it is difficult to sum our findings in a few words. It is easier to say some of the things we do not know, and what we would like to learn by continued excavations in the Bard Sir Valley. First of all our sequence is incomplete. Periods V and VI are not firmly established, and it is really only in Iblis I that we have much cultural detail. Again we know practically nothing of the historical periods and there is a great gap in our knowledge up through and including Islamic times. If we could close this gap we could make use of the wealth of data provided by medieval geographers, and make interesting comparisons with our prehistoric periods.

We shall need work in nearer areas -- DiCardi's new explorations in Bampur are a happy beginning -- but new surveys should be made along the Halil River to the south, westward to Sirjan, and northward to link with Sialk, and of course in the region of Huckriede's intriguing Kubanan Culture. In the meantime our chief aim will be to know one entire valley -- which by chance has turned out to be the Bard Sir Valley. To know one valley well will provide essential guidelines for the surveys of the other valleys until the day when those areas can be subjected to detailed investigation.

We have learned that the archaeology of Kerman is far from being a dim reflection of events which took place in northern and western Iran or in Mesopotamia, except that we can document a few significant connections with those areas. For the periods we have been considering, our province is not even very similar to southern Baluchistan, insofar as that area is known today. Our story has been about a distinctive cultural province with a distinctive history which is already beginning to provide a wealth of comparative materials for students working in adjacent areas.

MAP 1


FEET
12000—14350
9000—12000
7000—9000
5000—7000
3000—5000
2000—3000
ZARAND
NUMEROUS RUINS
HUTK
SAR-I-ASIAB
QUAL'EH
KELE
TOWER OF SILENCE
KERMAN
RD TO GOJGIN
TO YEZD
PANBE-
PARAN
TEPE GAJIN
BAGHIN
QALEH HOSSEINABAD
QALEH KANEH
LALIHZAR
RUD
MASHIZ
ALI ABAD
IBLIS
TEPES SW
OF IBLIS
DASHT-I-LUT
N
RAYIN
MT. LALIHZAR
14,350 FEET
KHAN-I
KHATUN
BAFT
SARVISTAN
CARAVANSARAI
CASTLE
BAM
TO DARISTAN
7 KM SE
OF BAM
TO ZAHEDAN
SABZAVARAN
HALIL RUD
AREA TRAVELED IN 1964
MODERN TOWN
ARCHAEOLOGICAL SITE
0 5 10
MILES

VI

ISLAMIC SITES OUTSIDE THE BARD SIR VALLEY: SURVEYS OF 1964 AND 1966

Geza Fehérvári and Joseph R. Caldwell

The Islamic potsherds and glass fragments collected during Dr. Caldwell's reconnaissance in 1964 and by Mr. David Chase, Mr. Zebidollah Ramatian and Professor Fehérvári in 1966 derive from nineteen sites in southeastern Iran.[1] The sherds from these sites may be classified into three categories: (a) Unglazed ware of thick, slightly porous white or buff clay, and thin, closely grained white or red clay. These are decorated either with incised lines and fine combings, or are stamped or molded; a few pieces have applique decoration. A large number of them are, however, without any ornamentation: (b) Gray stoneware, mostly undecorated, some with punctated designs, and (c) Glazed wares, representing nearly every class of Persian Islamic glazed pottery. These range in time from the 9th to the 18th centuries A.D.

The first category, the unglazed ware, forms the bulk of the finds (Pls.1-3). Dating this pottery currently presents considerable difficulty because fairly similar techniques, shapes, and decorative patterns persisted for several centuries and were employed over vast areas. Nevertheless, approximate dating becomes possible by using material found in excavations in different parts of Iran, Afghanistan, and Soviet Turkestan. The task of compiling this paper was more inviting and interesting to Fehérvári since he had unearthed similar material at the medieval site of Tammisha in Gurgan Province in 1964.[2]

While our knowledge of glazed pottery from pre-Mongol Iran is fairly satisfactory, information on later wares is meagre and somewhat confusing. This is so because no archaeological field work has so far been attempted on sites from later periods; there are extant specimens of more recent date that have reached the antique markets in Persia and Europe exclusively by way of dealers and amateurs whose putative information on provenience is far from being reliable. There have been but few Islamic excavations in Iran, save in the north, where the Metropolitan Museum of Arts, New York City, has conducted excavations at Nishapur and Rayy.[3] The sole Islamic excavation in southern Iran was begun by the British Academy, the British Museum, and British Institute of Persian Studies at Tehran, in 1966 at Siraf. Islamic sherds have been produced by work

1 In this paper are described all the Islamic sites found outside the Bard Sir valley, where most of our work has been done. The Islamic sites of the Bard Sir valley are described in the paper, Reconnaissances in the Bardsir Valley by Chase, Fehérvári, and Caldwell, this volume. (Ed.)

2 Cf. Bivar and Geza Fehérvári, "The Walls of Tammisha," Iran, Vol. IV, pp. 35-50, 1966.

3 Cf. reports in the Bulletin of the Metropolitan Museum of Arts, Vols. XXXII, 1937; XXXVII. 1942; n.s. II, 1944; and n.s. IX, 1950.

elsewhere, e.g. at Shah Tepe, but these are unexpected by-products only. Sir Marc Aurel Stein visited southeastern Iran in 1931-34, but since his interests were mainly pre-Islamic, he mentions Islamic finds only occasionally, and deals with them but briefly.[1] For these reasons the present paper hopes to interest the scholar of Islamic art, and to give an impetus to archaeological work in these regions.

The sites here dealt with are spread over the following regions:

A. Sites in the Sarvistan Valley

(1) Qaleh-i-Sang

B. Sites in the vicinity of Bam

(2) The Arq-i-Bam

(3) Castle east of the Arq-i-Bam in Chehel Tokhm

(4) Site near the Daristan road, 4 km east of Bam

(5) Site on the Zahedan road, 7 km from Bam

C. Sites in the Kerman region

(6) Qaleh-i-Dukhtar in Kerman

(7) Qaleh-i-Ardeshir in Kerman

(8) Site southeast of Kuh-i-Panbe Paran (cotton throwing mountain)

(9) Site on the road to Gojgin

(10) Qaleh-i-Gojgin

(11) Tepe Gajin

(12) Qaleh-i-Hosseinabad

(13) Qaleh-i-Khaneh

(14) Small mound north of Qaleh-i-Khaneh

D. Sites in the region of Hutq

(15) Castle near Qaleh-i-Dukhtar on the road to Hutq

(16) Kele, near Zangiabad

1 M. A. Stein, Archeological Reconnaissance in Northwestern India and Southeastern Iran, London, 1937. Particularly Appendix A by R. L. Hobson on Islamic pottery, and pls. IV, V, XXI XXIII, and XXVI-XXVII; also Stein, "An Archeological Tour in Ancient Persia," Iraq. Vol. III, pp. 111-225, pls. XXXVII-XXIX, 1936.

(17) Stone graves between Sar-i-Asiab Shesh and Hutq

(18) Numerous ruins northwest of Hutq

E. Sites in the region of Anar

(19) Qaleh-i-Anar

Sites in the Sarvistan Valley

(1) Qaleh-i-Sang

Near the village of Sarvistan, about 50 km northwest of Bam there is a high rock dome surmounted by ruins called Qaleh-i-Sang. The site was visited by Stein, and described by him as an irregular and roughly built fortress of comparatively recent date.[1] The pottery collected from the surface consisted mainly of unglazed ware. The paste displays a rich variety, ranging from thin or thick white clay on, through yellow and buff, to red and grey colors. The decorations are mainly incised, in heavy lines, arranged in lozenges, in wavy patterns, or in double festoons. Some sherds have stamped cross patterns which run around the body between the incised lines. The types so far mentioned are mostly thick, and are presumably parts of large vessels. Two pieces have very fine stamped designs, are rather thin, of closely grained white clay, and are probably parts of smaller vessels.

There are three pieces of slip-painted ware of the Samanid type, on buff clay with a white slip, the design being in manganese purple and yellow. These sherds may be dated to the 10th and 11th centuries A.D. The Seljuq monochrome glazed wares are represented by sherds glazed in turquoise, green or blue over a fine white paste. Another group is of the under-glaze painted type, painted in black under turquoise, green or blue glaze. Two pieces of sgraffito ware were found, both have the characteristic green lead glaze and the incised scroll designs of the 12th and 13th centuries.

The date of the unglazed sherds cannot be exactly determined, but the presence of Samanid and Seljuq pottery points to a date between the 10th and early 13th centuries.

Sites in the Vicinity of Bam

(2) The Arq-i-Bam

This site was visited by Stein, who described it as one of the strongest fortresses in Iran.[2] This fortress played an important part in Persian history throughout the Moslem period, until it was abandoned in the 19th Century. Some of the sherds from the surface are unglazed, the rest are glazed. The unglazed sherds are mostly thick, of a coarse red clay, although there are a few pieces of white and buff clay. The decoration is mostly stamped, with a rope design in relief, sometimes accompanied by fine combed patterns. The rope design is rather crudely executed. Two pieces have stamped rosettes below incised lines, others have ring stamps set within geometrical

1 Stein, Old Routes of Western Iran, London, p. 115, 1940.

2 Stein, Archeological Reconnaissances..., p. 159, 1937.

PLATE 1 - UNGLAZED POTTERY FROM QALEH-i-DUKHTAR

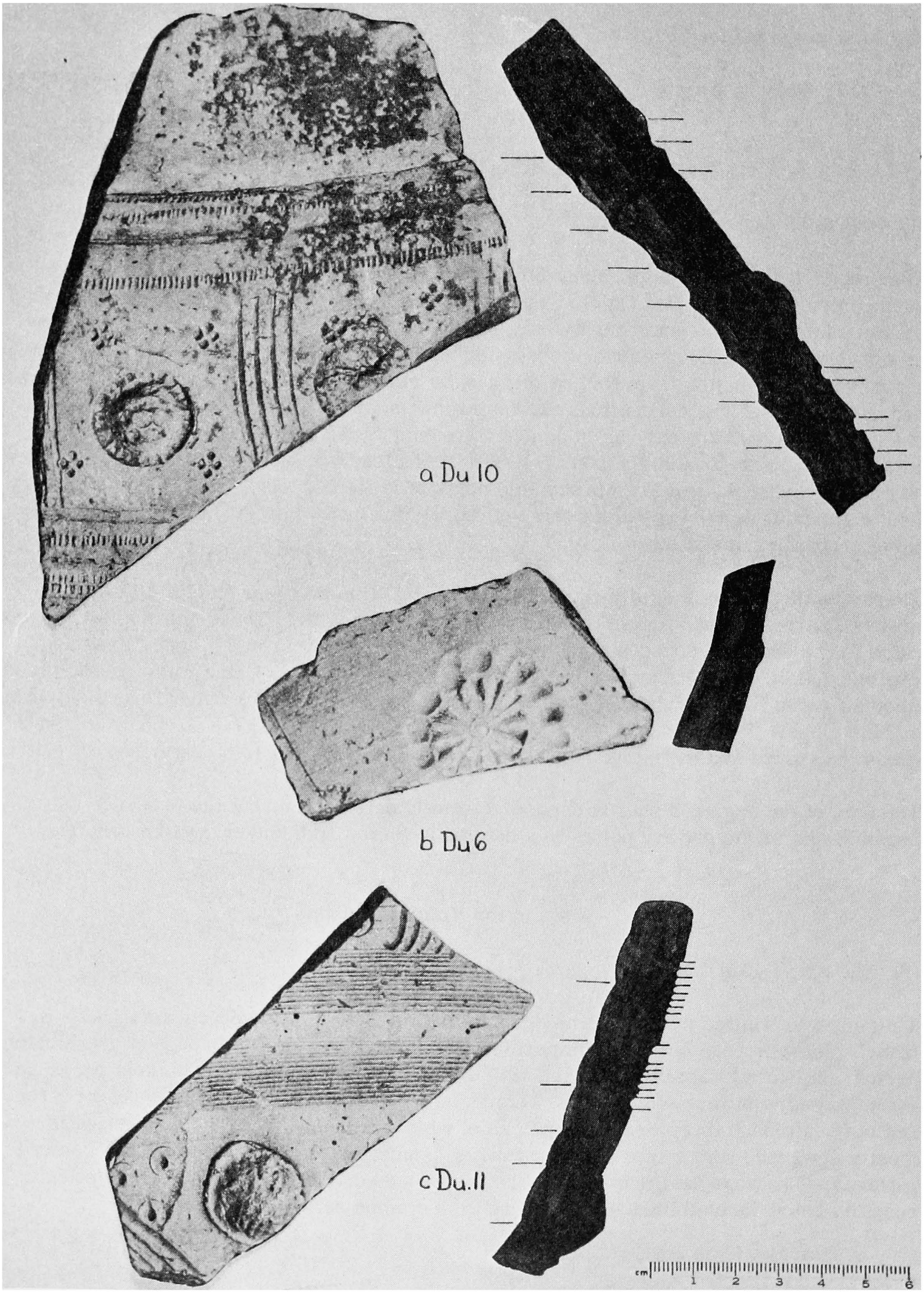


PLATE 2 - UNGLAZED POTTERY FROM QALEH-i-DUKHTAR

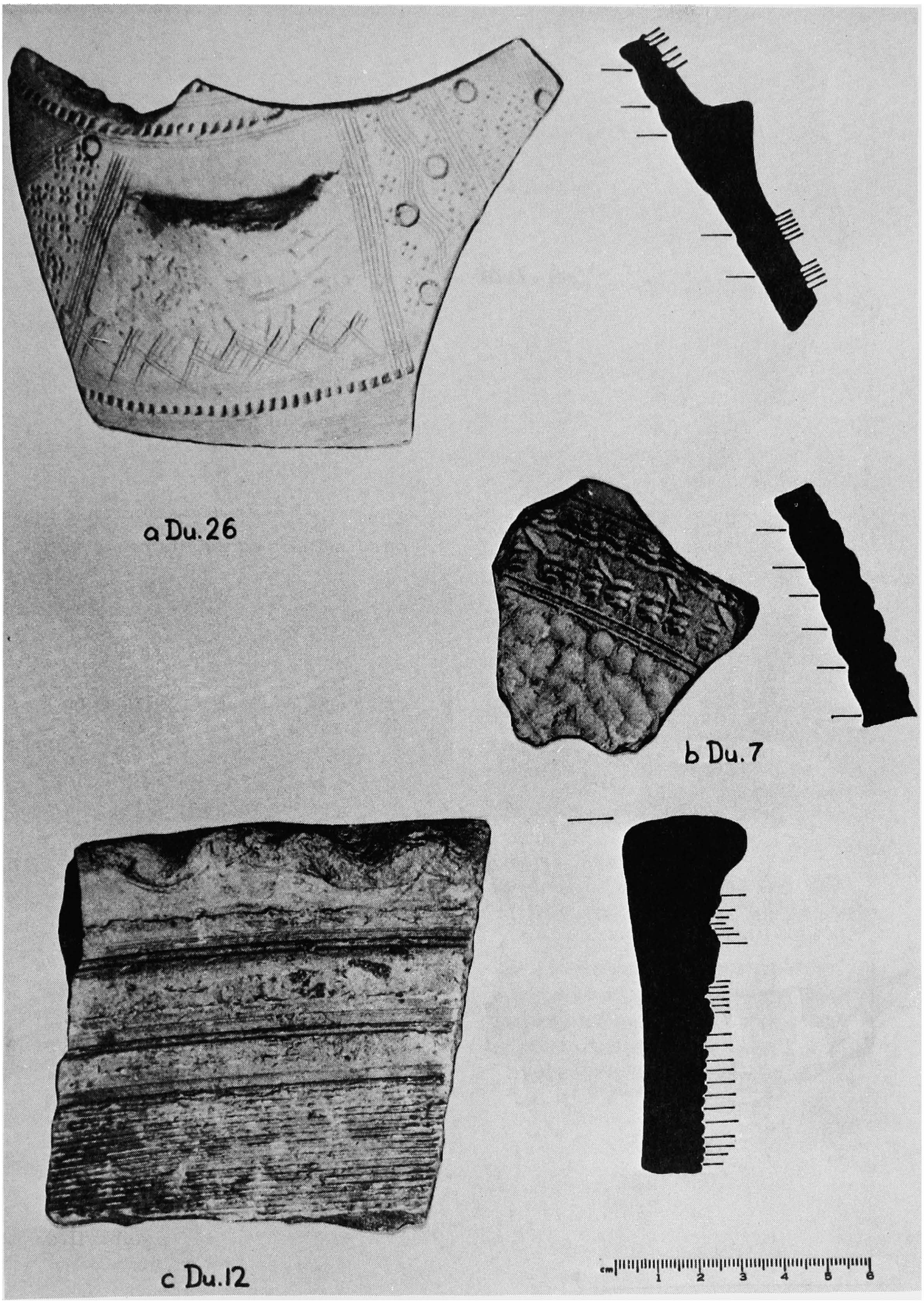
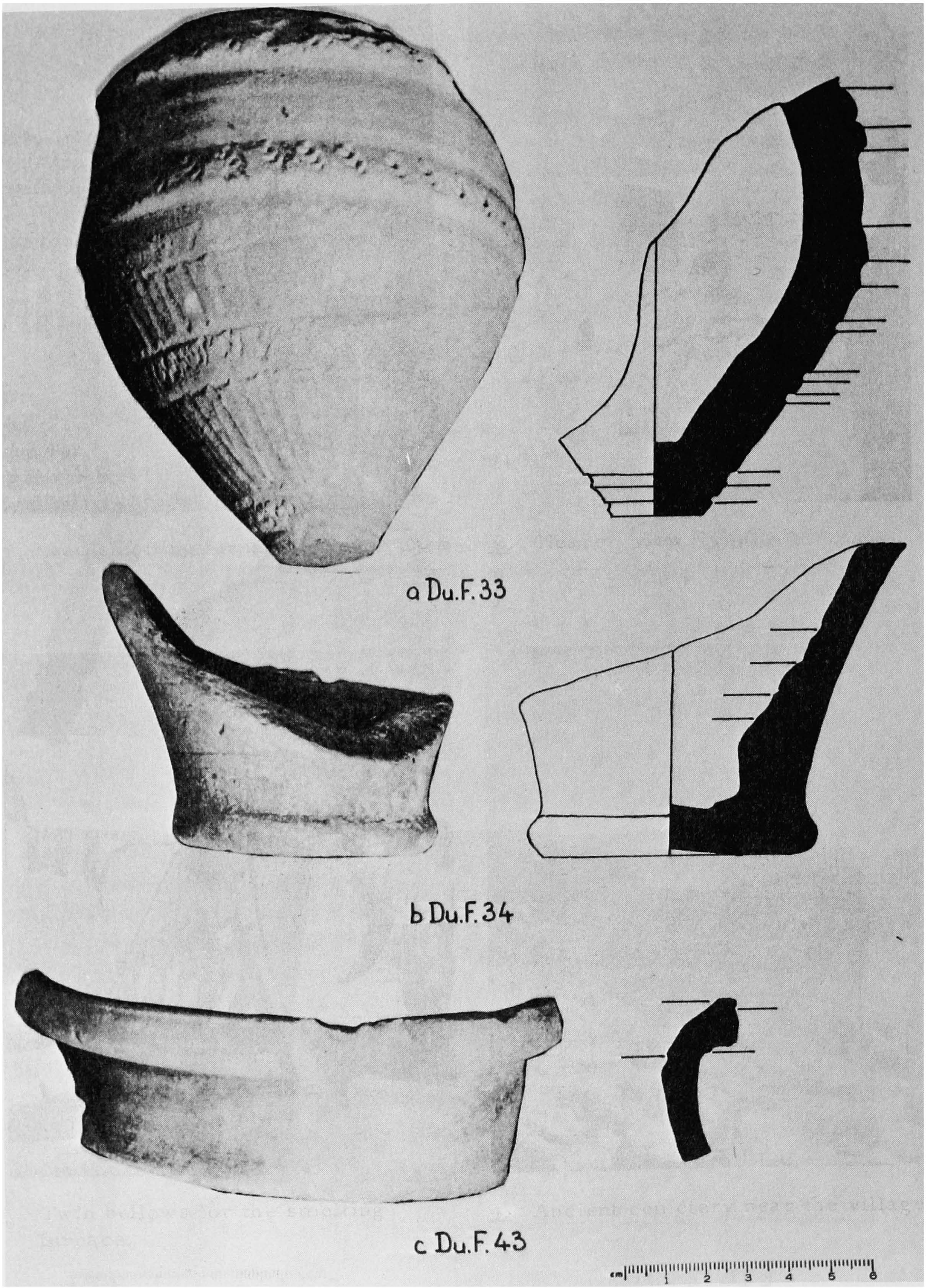


PLATE 3 - UNGLAZED POTTERY FROM QALEH-i-DUKHTAR



compartments outlined by incising. There are finer sherds of monochrome glaze that can be attributed to the Seljuq period, and some that are of a later date. The Seljuq pieces have the traditional incised scrollwork and molded ornaments of the 12th Century. Two small pieces are of the finest Seljuq ware, known as Seljuq white ware.

The underglaze-painted ware includes two different types. The first is painted in black under turquoise glaze, the second in blue and black under a transparent white glaze. These pieces may well derive from the second half of the 12th or the first half of the 13th Century. Two small sherds with blue decoration are thought to be imitations of Ming blue and white porcelain and, if so, they must date to the Timurid (15th Century) or even to early Safavid times in the 16th Century?[1] Lustre-painted ware from the 17th or 18th Century is represented by a small sherd with a hard, white, nearly porcelainous body. This specimen has a dark brown lustre glaze. In general the sherds seem to date from Seljuq to Safavid times.

(3) Castles east of the Arq-i-Bam

On the level plain east of the Arq-i-Bam, known as Chehel Tokhm (forty seeds), and within a 3 km radius are the ruins of several large mud brick castles. One of these which he visited, Dr. Caldwell called "the big room castle" because of the roomy areas enclosed by former arched ceilings. The mudbricks of this structure are also extraordinarily large.

Only a few glazed sherds were found, most of these of the Nishapur type of slip-painted ware. There are two _sgraffito_ sherds, and one of the underglaze painted type. These last three have black paint under a turquoise glaze, and point to an early and rather limited date, 10th to early 13th Century. Perhaps they will help to determine the date of the few unglazed and monochrome glazed sherds also collected from the site.

(4) Site near the Daristan road, 4 km east of Bam

On the Daristan road, about 4 km from Bam, and about 1 km to the south one will see the ruins of a caravanserai. Here, once again, Samanid slip-painted ware and Seljuq underglaze and monochrome glaze wares were found, which point to an early Islamic occupation of the site. An angular "channel" shaped roof-tile (_sufal_ in Persian) is of special interest. The type is not known in Islamic times, but similar roof-tiles were found at Tammisha in 1964. The sufals of Tammisha come from the Bansaran, which is considered to be pre-Islamic.[2]

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1 There is a strong surmise, still to be proved, that in contrast to previous hypotheses, blue and white wares originated in the Middle East, and it was the Near and Middle Eastern potters which influenced the Chinese potters and not vice versa. Cf. A. Lane, _Later Islamic Pottery_, London, pp. 22ff., 1957. "The Arts of the Ming Dynasty," _Transactions of the Oriental Ceramic Society_, Vol. 30, p. 26, 1955-57; H. M. Garner, _Oriental Blue-and-White_, London, pp. 1-2, 1954; Basil Gray, "Persian Influence on Chinese Art from the Eighth to the Fifteenth Centuries," _Iran_, Vol. I, p. 16, 1963.

2 Cf. Bivar and Fehérvári, _op. cit._, p. 43, fig. 3-b.

(5) Site on the Zahedan road, 7 km from Bam

In an area of badly eroded bluffs, overlooking one of the intermittent upper tributaries of the Narmashir River sherds were encountered over several hectares. There is a standing mudbrick ruin here, but it is impossible to say whether it was contemporary with the bulk of the pottery. The ruin might be part of the site of Fahrabad, where during Stein's visit, large residences of late Muslim times were being pulled down.[1]

A few glazed sherds were found on the surface, also a large number of unglazed ones, of thick, coarse grit tempered, stony, red earthenware. Decoration is confined to heavy incised or stamped lines, with occasional X patterns on ribs. Dating this ware and the associated monochrome glazed pieces is a delicate matter. The greyish and greyish-blue glazes suggest a later, possibly Timurid or even early Safavid date. Two small sherds of the slip-painted Nishapur type can be confidently dated as Samanid, belonging to the 10th or early 11th Century.

Sites in the Kerman Region

(6) Qaleh-i-Dukhtar in Kerman

This site was visited by Dr. Caldwell's party in 1964, and again by Mr. David Chase and Fehérvári in the autumn of 1966. On both occasions a large number of sherds were collected from the surface of the citadel, mainly on the western slope and the top. This site, and the neighboring Qaleh-i-Ardeshir occupy high natural prominences rising from the valley floor, on the southern outskirts of Kerman city. The name Qaleh-i-Dukhtar (maiden's castle) occurs frequently in Iran. In the Kerman region alone there are three fortresses known by this name, only one of which will be discussed here. The most famous is Qaleh-i-Dukhtar in Kerman (Pl.4), which local tradition attributes to having been built during the reign of Ardeshir Papakan, the founder of the Sassanian dynasty. No more exact date has yet been determined. The city and its citadel played an important role in Islamic times.[2] Today Kerman remains a center of Zoroastrianism and with a Tower of Silence outside the town (Pl.5).

P. M. Sykes, who was consul in Kerman, devoted two chapters in his book to the history and topography of the town.[3] Sykes also collected some Islamic glazed pottery from the citadel.[4] Stein also visited here and found a number of glazed and unglazed sherds on the slope of the hill.[5] In his comments he mentions that a thorough excavation would be necessary to determine an exact date for the structure.

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1 Stein, Archeological Reconnaissances..., p. 158, 1937.

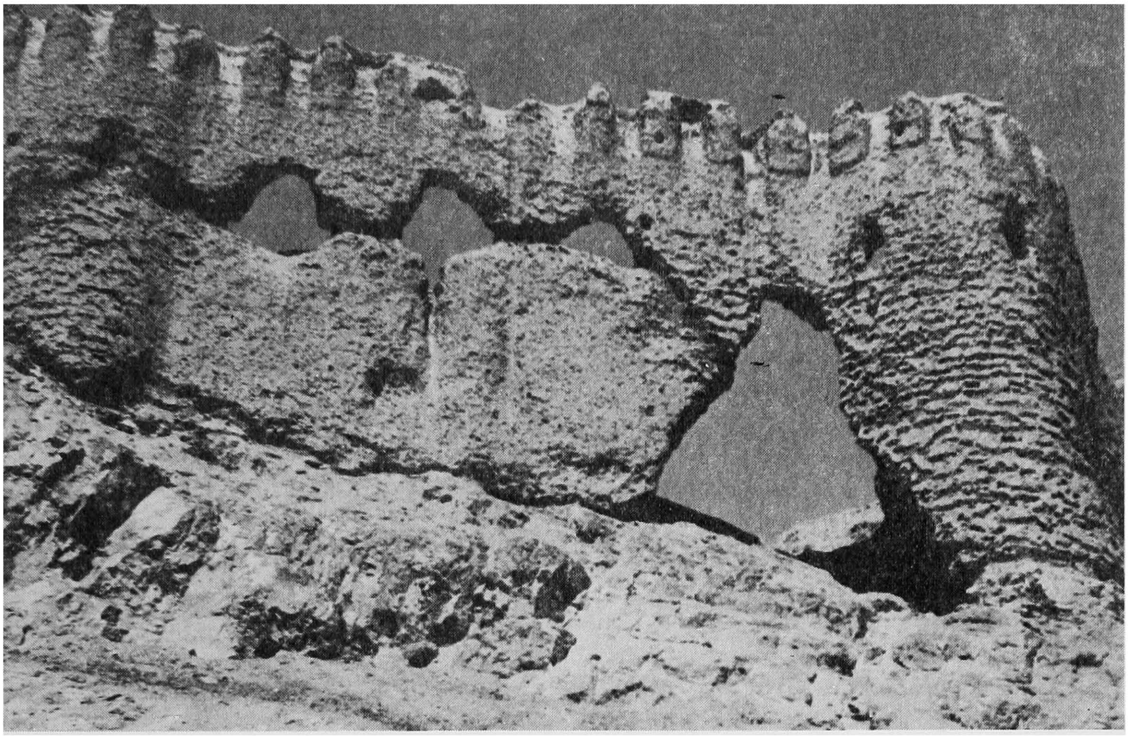
2 Stein, Archeological Reconnaissances..., Pl. LIII facing p. 158, 1937.

3 An Excellent study of the history of the province and its cities was prepared by Guy Le Strange, "The Cities of Kerman in the Time of Hamd-Allah Mustawfi and Marco Polo," Journal of the Royal Asiatic Society, pp. 281-290, 1901.

4 Sir Percy M. Sykes, Ten Thousand Miles in Persia or Eight Years in Iran, London, Murray, Chapters XVI-XVII, 1902.

5 Stein, Archeological Reconnaissances, p. 159, 1937.

PLATE 4. (UPPER) THE BATTLEMENTS OF QALEH-i-DUKHTAR.
(LOWER) INSIDE THE BATTLEMENTS.



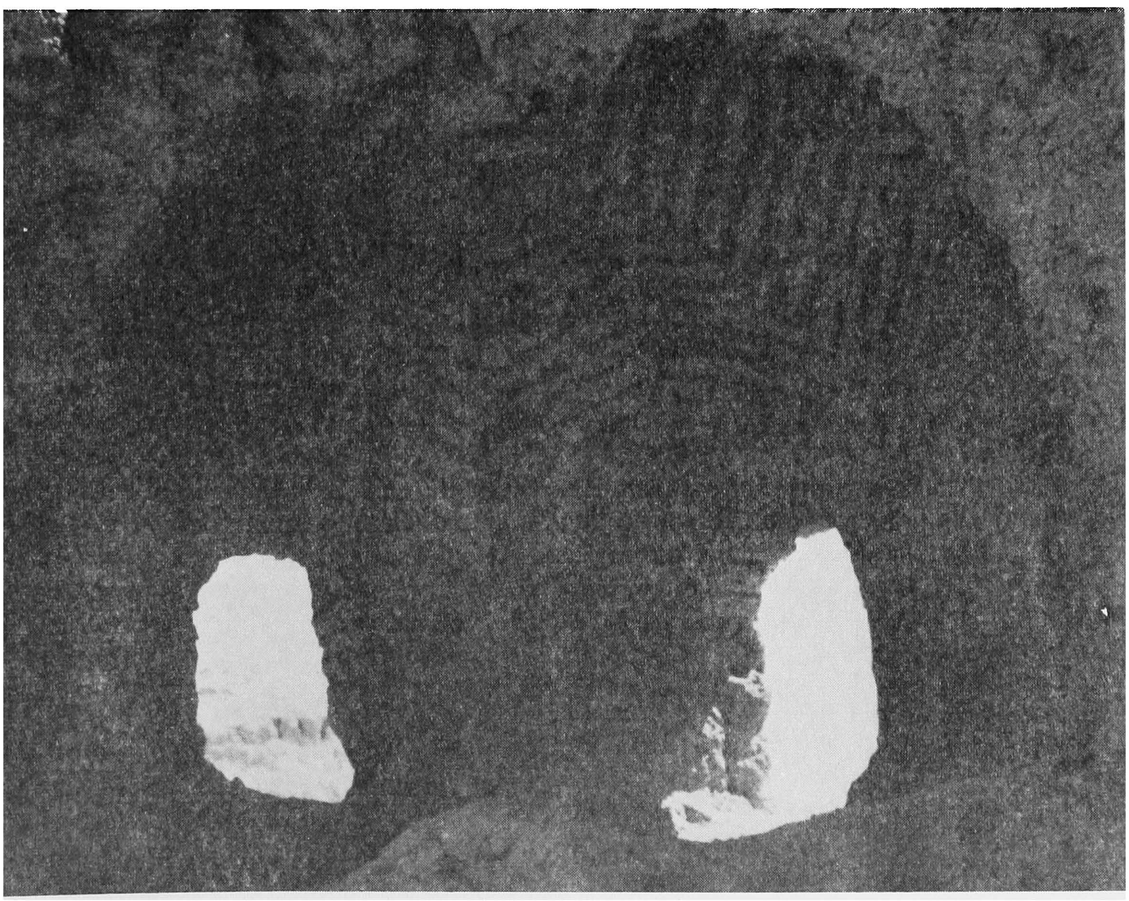
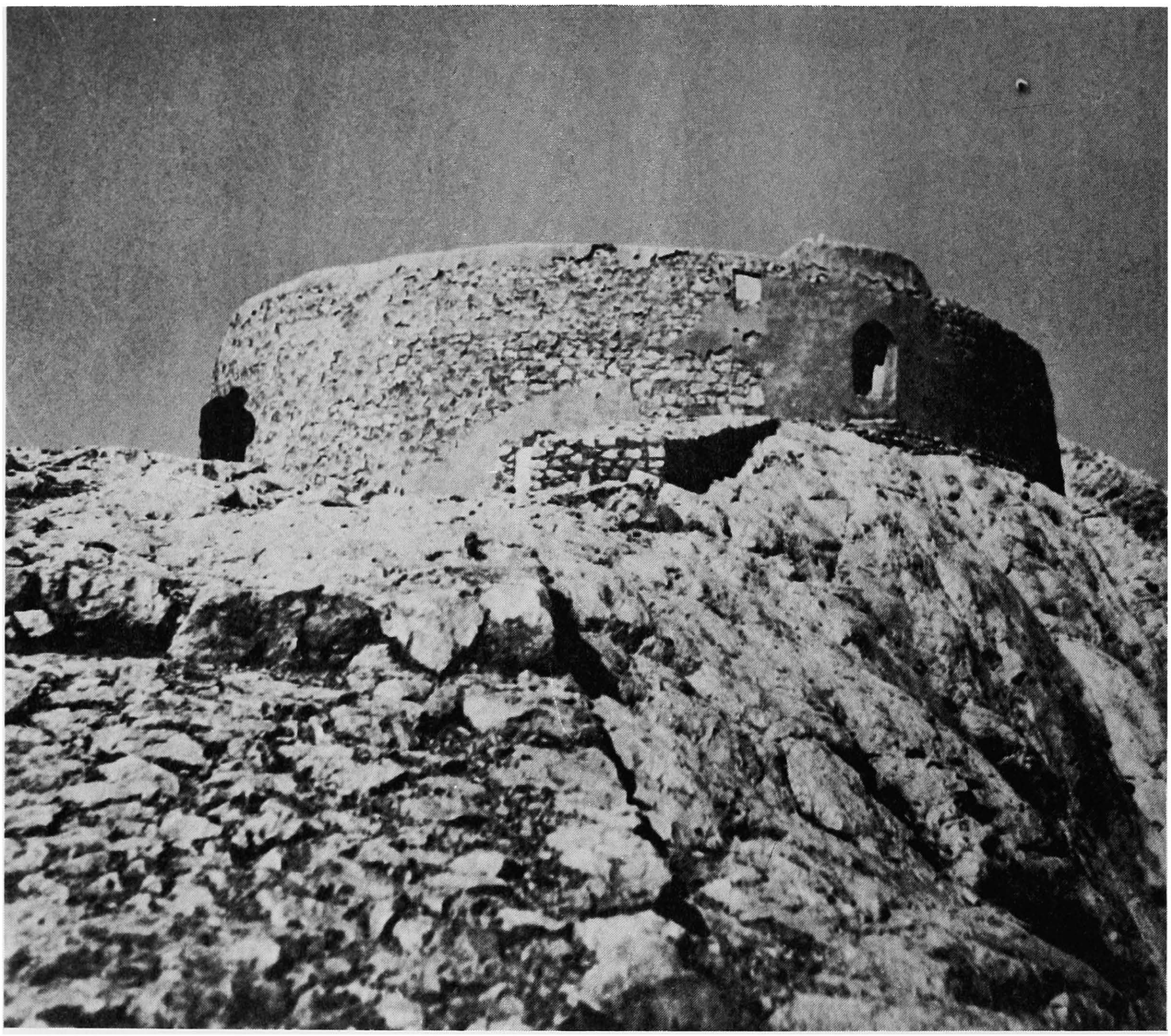


PLATE 5 - ZOROASTRIAN TOWER OF SILENCE OUTSIDE KERMAN CITY.



The ruins of Qaleh-i-Dukhtar are easily seen from any part of the modern city of Kerman, consisting of mud walls and various towers. These can be divided into two areas, which could be called a northern bastion and a southern bastion. The northern bastion is represented by ruins crowning a low summit, which marks the terminus of a long ridge extending upward to the main height, where the southern bastion is located (Pl.4). The 1966 reconnaissance of the site was confined to the area of the two bastions and along the terraces which border the lower slopes of the hill.

The earliest sherds collected in the 1964 reconnaissance date to about the 4th Century A. H., the 10th Century A. D. This is the period when the capital of the province was moved from Sirjan to Kerman, then known as Bardasir. The Samanid slip-painted ware of this date is identified with a dynasty that reigned over Turkestan and Khorassan between 847 and 999 A. D. The chief pottery centers of this period were at Samarkand and Nishapur, and a related type is known from Brahminabad in west Pakistan.[1] In the course of the last two decades the French Archeological Mission in Afghanistan has recovered a large amount of this type of slip-painted pottery.[2] Similar pieces were collected by Stein at Shahr-i-Daqianus, Jiroft, and at Siraf.[3]

In addition to the slip-painted wares, another early Islamic type, the splashed and mottled wares, was found on the slope of the hill. Some of these reveal sgraffito designs under colored and transparent lead glazes. Many of these sherds seem to have been conical bowls, which may be dated to the 10th and 11th centuries A. D. It is much more difficult to determine the date of the many sherds of monochrome glazed ware found on the site.

Wall tiles in many different shapes had been produced in pre-Mongol times. These are much finer than those found on the site and were usually painted with metallic lustre pigments. On the other hand, the monochrome glazed wall tiles, in various colors found at Qaleh-i-Dukhtar are of a coarse buff clay and are rather crudely made. They seem to derive from a more recent period, possibly early Safavid times, or even somewhat later. The same observation applies to the monochrome vessels, which never approach in quality those of the Seljuq period.

More is known about the under-glaze painted types (Pl.6-b) which represent a wide variety of designs. This ware is usually made of closely grained white clay, but examples of buff and red paste occur. Apart from wall tiles, this type of ware appears most frequently as a conical bowl, resting on a tall foot ring. The finer specimens may be related to Seljuq under-glaze painted ware from Kashan and other contemporary centers. A later type is a thick ware, of closely grained white or buff clay, painted in black, blue and turquoise, under a transparent glaze. The cross-hatched design on some of this type points to a somewhat later date than the 13th Century. A similar ware was found at Tammisha, on the surface, and in the excavation at the Bansaran, which at present seems to date from Timurid times.[4] The under-glaze painted type, painted only in black under turquoise or blue glaze can also be attributed to the 14th and 15th centuries.

1 R. L. Hobson, Guide to the Islamic Pottery of the Near East in the British Museum, London, pp. 8-10, Pl. IV, Figs. 14-18, 1931.

2 J. C. Gardin, Céramiques de Bactres, Paris, Pl. XVII, 1957. Céramiques et Monnaies de Lashkari Bazar et du Bust, Paris, Pls. XIII-XXIV, 1963.

3 Stein, Archeological Reconnaissances..., Pls. XXI-XXVII.

4 Bivar and Fehérvári, op. cit., p. 47, Pl. VI.

PLATE 6. - UNDERGLAZE PAINTED TYPES FROM QALEH-i-DUKHTAR

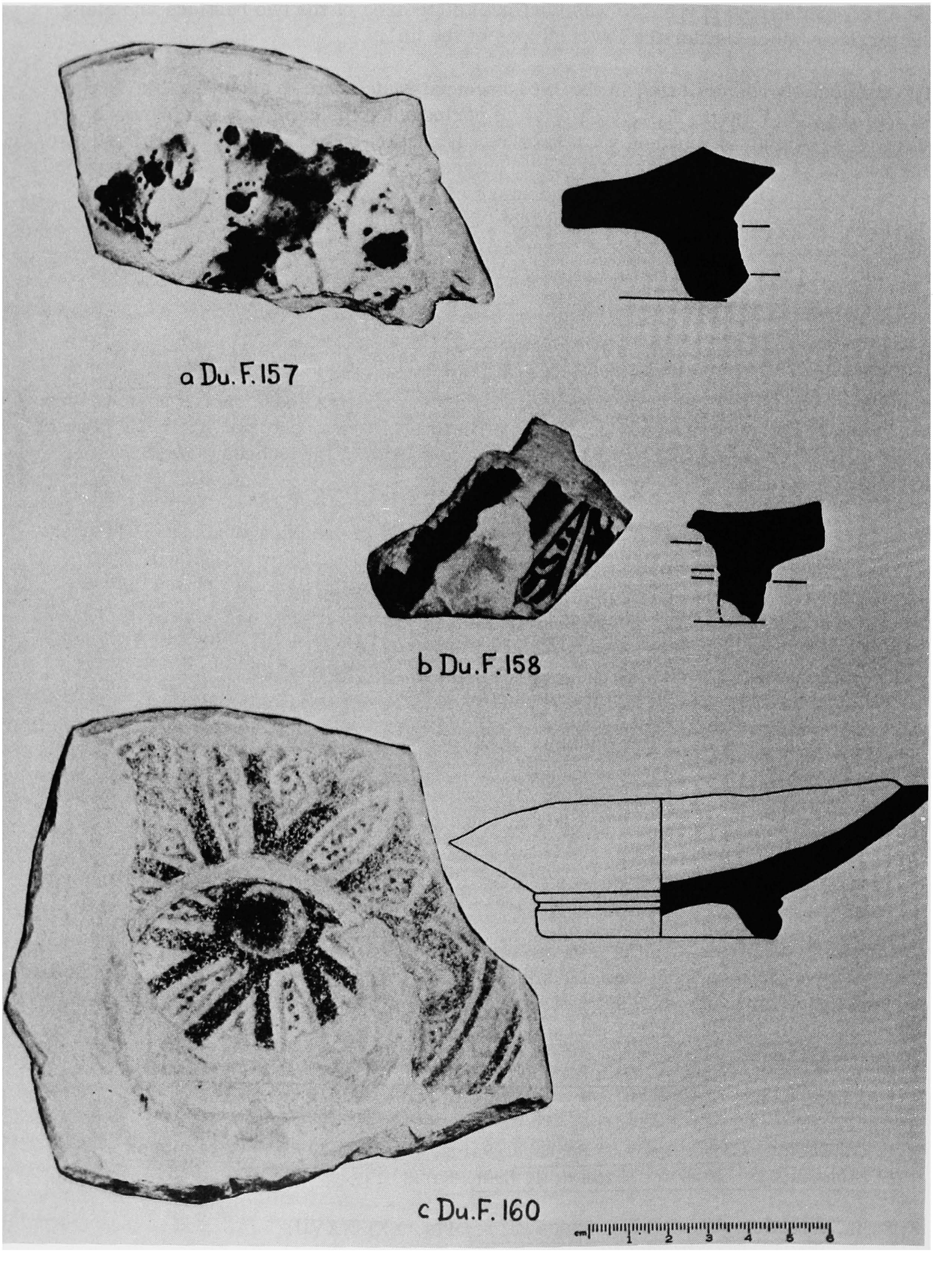


PLATE 7. - UNDERGLAZE PAINTED TYPES FROM QALEH-i-DUKHTAR

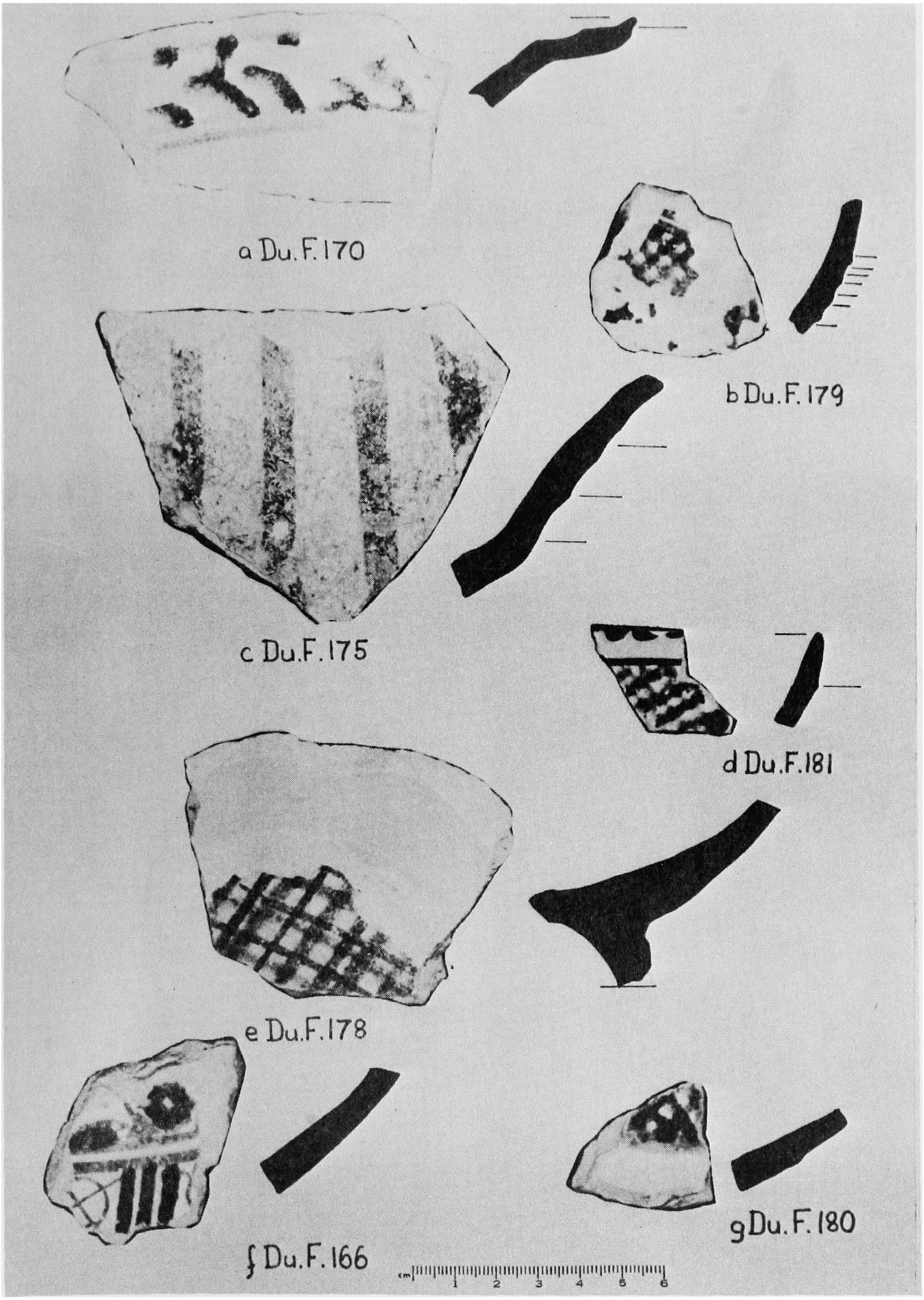


PLATE 8. - UNDERGLAZE PAINTED TYPES FROM QALEH-i-DUKHTAR

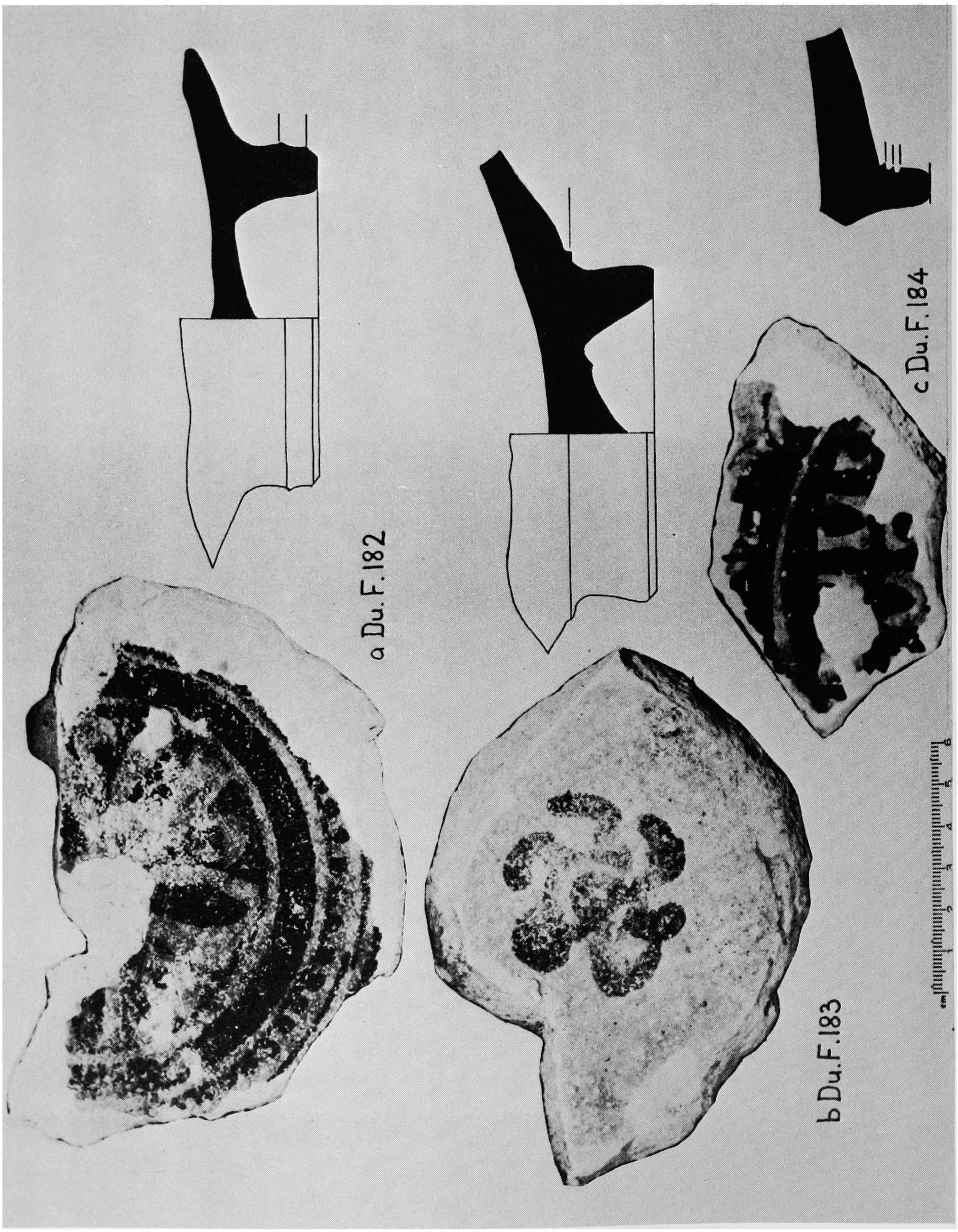


PLATE 9. - WALL TILES FROM QALEH-i-DUKHTAR

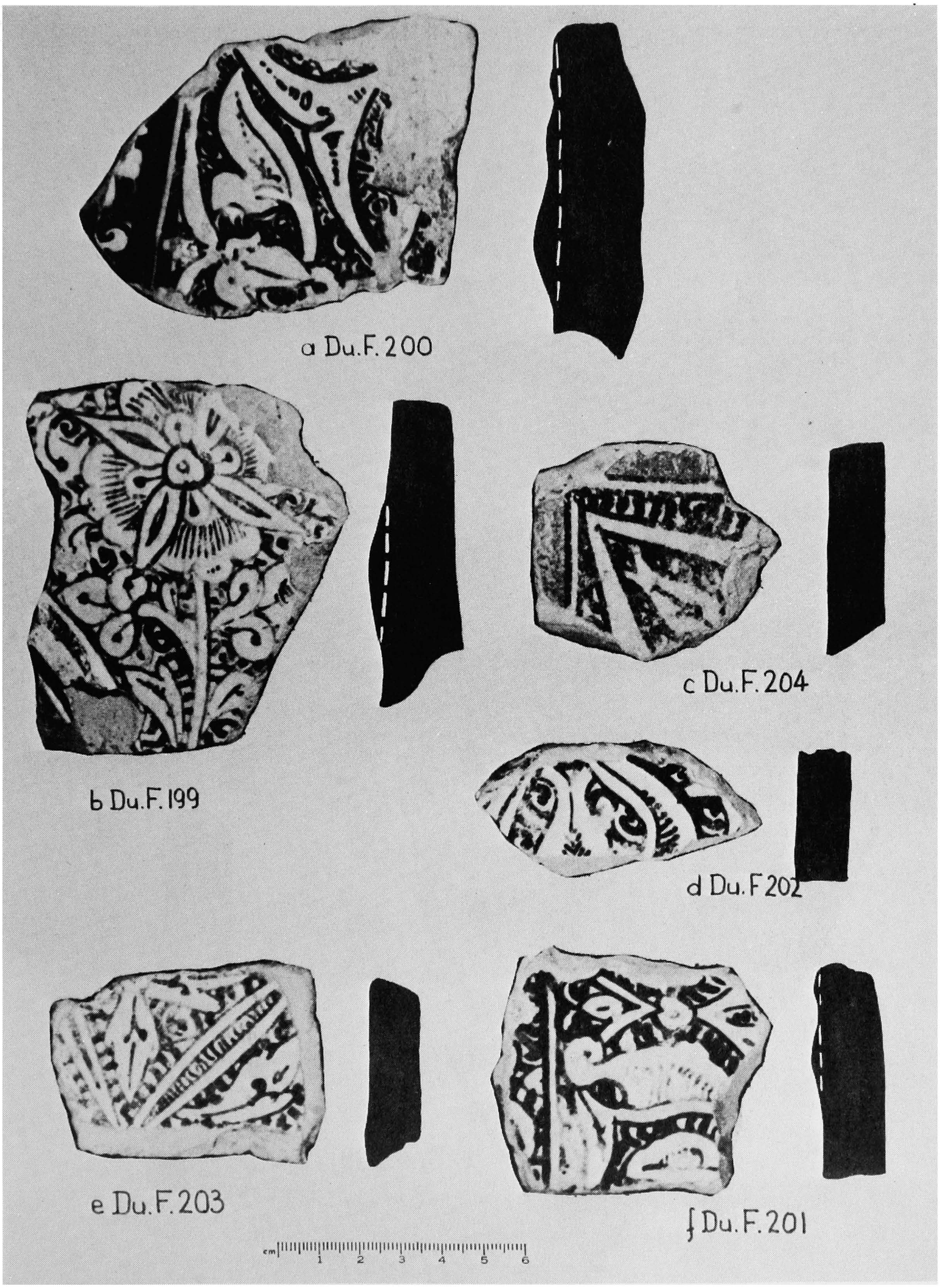


PLATE 10. - WALL TILES FROM QALEH-i-DUKHTAR

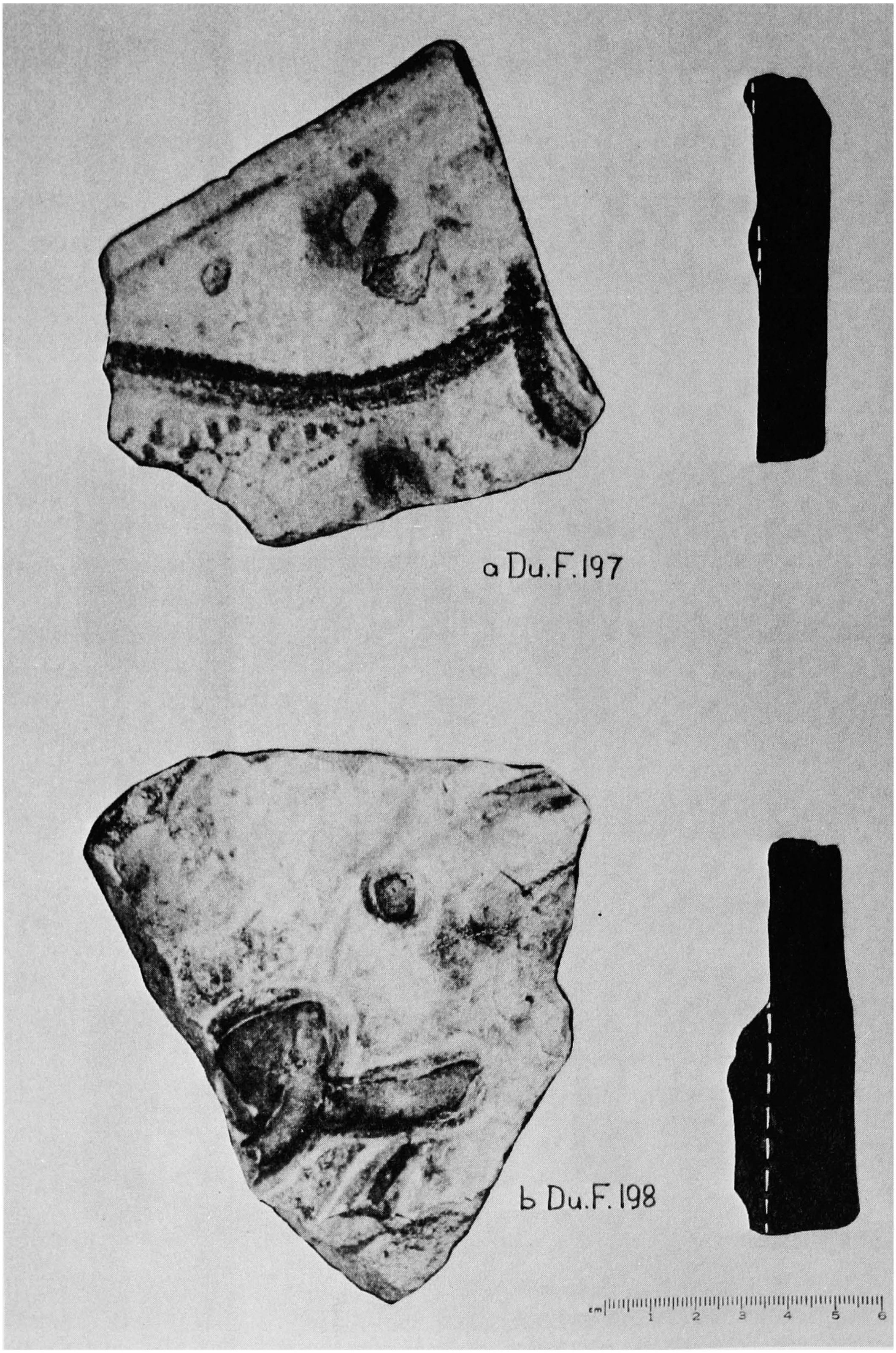
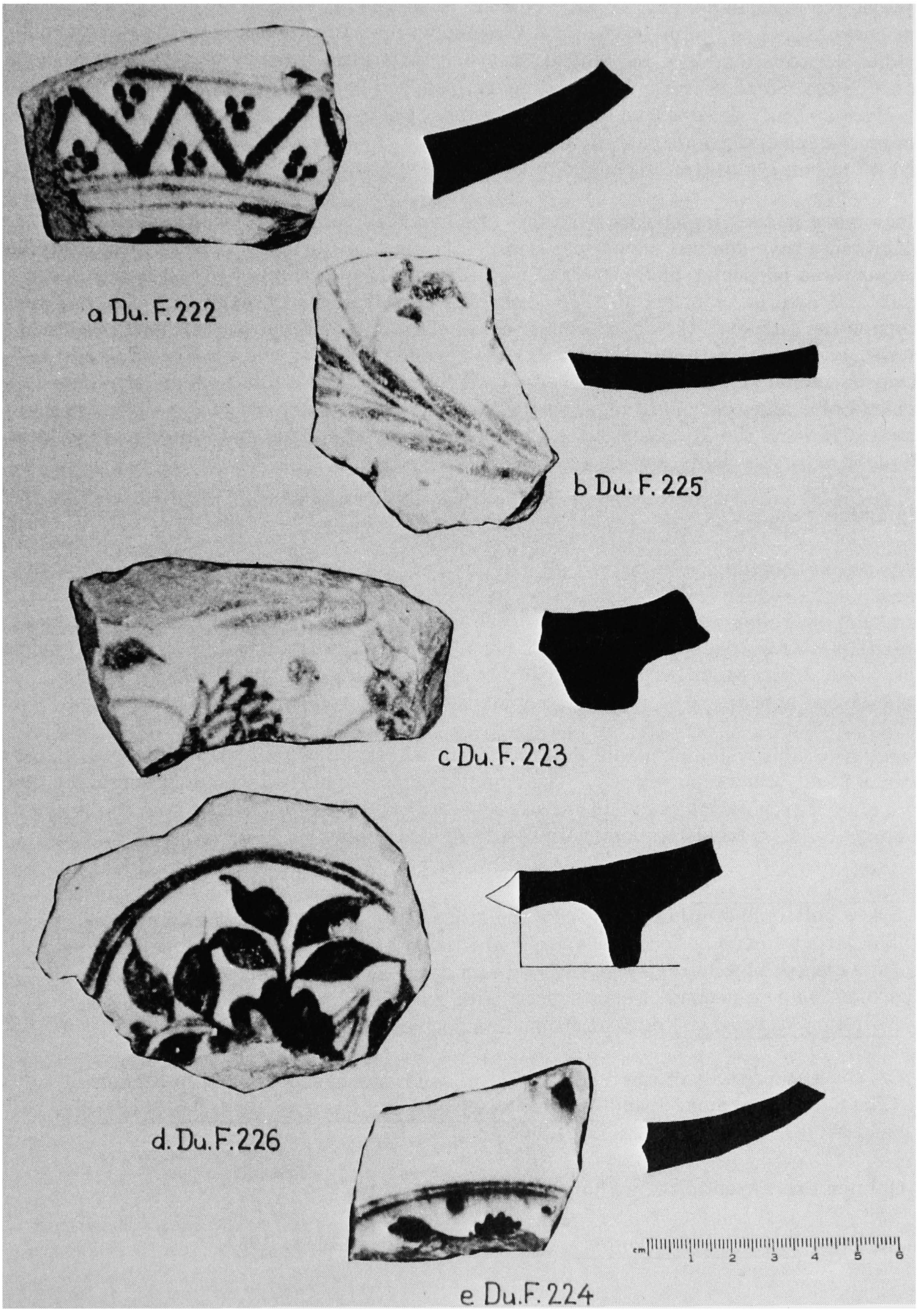


PLATE 11. PERSIAN BLUE AND WHITE WARE FROM QALEH-i-DUKHTAR



The lustre-painted sherds, of which a great number were collected in 1964 and again in 1966, are all parts of wall tiles. These are very thick, of a coarse buff clay (Pls. 9-10). The decoration is partly in relief and painted in brown lustre, occasionally in cobalt blue and turquoise. Similar specimens were found by Sykes.[1] In the 13th and 14th centuries Kashan produced wall tiles of this type, mostly for mihrabs, which were exported to all parts of Iran.

Besides the Persian pottery, a large number of sherds of Chinese porcelain were found on the lower slopes of Qaleh-i-Dukhtar. Chinese wares are extant from almost every medieval site in the Near and Middle East, but their presence was particularly obvious at this site. Some of these Chinese imports reached Iran by sea, arriving at ports on the Persian Gulf, from where they were transported overland to the north. One of the main trade routes ran through Kerman.[2] Both the celadon porcelains and the Ming blue and white porcelains are attributed to the late 14th and early 15th centuries.[3]

Much more interesting sherds from this site are Persian blue and white types (Pl. 11), which must have derived from local kilns. Accounts of European travelers indicate that Kerman was producing blue and white wares in the 17th Century.[4] A number of these were collected in 1964, and in 1966 Chase and Fehérvári found many more, on the west slope of the citadel. The decoration of these sherds, which must all be parts of small bowls, is restricted to floral patterns, and scrolls, some of which reveal Chinese influence. Fehérvári has also obtained a complete bowl with a similar design. This Persian blue and white ware must date to the early or middle part of the 15th Century since it reflects the presence of the Chinese import, Ming blue and white, and the later Timurid wares as well.

(7) Qaleh-i-Ardeshir

This site is located southwest of Qaleh-i-Dukhtar, the two hills being separated by an eroded valley which today serves as a city street, lined with shops and homes (Pl. 12). In terms of architecture, pottery, and general appearance, this site differs little from Qaleh-i-Dukhtar, except in size, covering 5-6 square km while Qaleh-i-Dukhtar covers only about 2 square km. Qaleh-i-Ardeshir also crowns a higher hill than Qaleh-i-Dukhtar and appears to be a more complex structure, possibly in better condition.

These two ruins which dominate the immediate landscape of modern Kerman were, for a time at least, contemporaneous. The name Ardeshir implies a Sasanian origin for that ruin and, if true, would indicate that the oldest parts of that structure date to the third century A. D. It would be desirable if both mounds could be subjected to controlled

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1 Sykes collected similar types from the slope of the hill at the Kerman citadel. The largest piece he found measured 24 x 18 1/2 in. "It consisted," he writes, "of sapphire blue lettering an inch wide in parts, with a relief of half an inch projection on a ground of shot brown, with turquoise blue conventional leaves," A History of Persia, Vol. I, London, MacMillan, Ltd., p. 190, 1963.

2 Cf. the recent study of the trade routes of south and east Iran, Philip Beckett, "The City of Kerman, Iran," Erdkunde, Archiv fur wissenschaftliche Geographie, Band XX (2), Bonn, pp. 120-125, 1966.

3 Opinion expressed to the author by Miss M. Medley.

4 A. Lane, Later Islamic Pottery, London, Pls. 70-a, 71-a, 1957.

excavations, at least of the terraces that ring the foot of both hills. It might be difficult to secure permission at Qaleh-i-Dukhtar, where erosion and borrow pits digging have exposed Islamic burials. Certainly the magnitude of the task, even in a limited excavation, is sufficient to dissuade all but the archaeologist who is prepared to give the best part of his productive years to either of these two sites.

In summary, the sherds found in two seasons' reconnaissance at Qaleh-i-Dukhtar and Qaleh-i-Ardeshir include:

Unglazed wares - Usually of white paste, occasionally of yellow, buff, red or grey paste, with incised, stamped, molded, and applique decorations, and various combinations. The date of these is uncertain, but must range through the periods represented by the glazed types, from early Islamic to late Safavid times. The presence of sherds with inscriptions in _naskhi_ would indicate that these specimens are not earlier than the 11th Century A.D.

Monochrome glazed wares Nearly as difficult to date as the unglazed wares, but presumably from the same range of time as the more identifiable types.

Slip-painted wares These were mostly of the Nishapur and Samarkand types, dating to the 10th and 11th centuries.

Sgraffito wares Only simple forms were found, with brownish-yellow or green glaze, dated from the 10th to the early 12th centuries.

Seljuq wares These fine types were produced in Iran, both the white and colored monochrome glazed form, during the second half of the 12th and the early part of the 13th centuries.

Under-glaze painted wares These are painted in black and/or blue under a clear glaze, and in black alone under a turquoise or bluish glaze. These date from post-Mongol times, and are probably from the late 13th through the 15th centuries.

Lustre wares - These are mostly tiles painted in chocolate brown, with a few specimens having the raised portion of the decoration touched with cobalt blue or turquoise paint. The motifs suggest Kashan as the kiln of origin, and a date about late 13th or more probably the early 14th Century.

Chinese porcelain wares Two types are represented, the celadon, which is very fine and thin, and according to Miss M. Medley of the Sir Percival David Foundation of Chinese Art, belong to the 13th and 14th centuries. The type Ming blue and white, of similar date, is also represented, together with some interesting Persian copies of celadon. The Persian copies of the import ware are known to have been made from the 14th Century onward.

Persian blue and white wares - These interesting wares, probably of local origin, cannot be dated with any certainty. They may begin as early as the 14th Century, but similar finds made by the British Institute of History and Archeology on the east African coast are dated to the 15th Century. These were imported to Africa from the Kerman region. A later type of blue on white has the decoration outlined in black, and probably dates from the 17th and 18th centuries.

Polychrome wares - These too are probably of local origin. The decoration is painted in blue, brown, a brownish red and green under a clear glaze on a white slip. The paste is very fine, nearly porcelainous, and part of the decoration may be in low relief. These are dated to the 17th Century by Lane.[1]

Glass - Although a great deal of glass was collected, most pieces are too small to be of use for dating purposes. Most of them probably belong to the period between the 12th and 13th centuries.

(8) Site southeast of Kuh-i-Panbeh Paran (cotton throwing mountain)

A dozen or more low tepes, none exceeding 1 m in height and 50 m in diameter occur on the north side of the road to Baghin, about 7 km from the Kerman airport. On the largest of the series there are many broken fired bricks. The sherds collected here are mainly glazed Islamic types. A few pieces of the Samanid slip-painted type, and two pieces of _sgraffito_ are the earliest in date. The majority of the sherds are monochrome glazed and under-glaze painted types which may be attributed to the 12th and 13th centuries A.D. A 13th Century lustre sherd has a yellowish-brown interior and a cobalt blue exterior. The sherd is probably part of a small conical bowl. Two pieces of blue and white type recall similar pieces from Qaleh-i-Dukhtar at Kerman, and are probably of the same period.

(9) Sites on the road to Gojgin

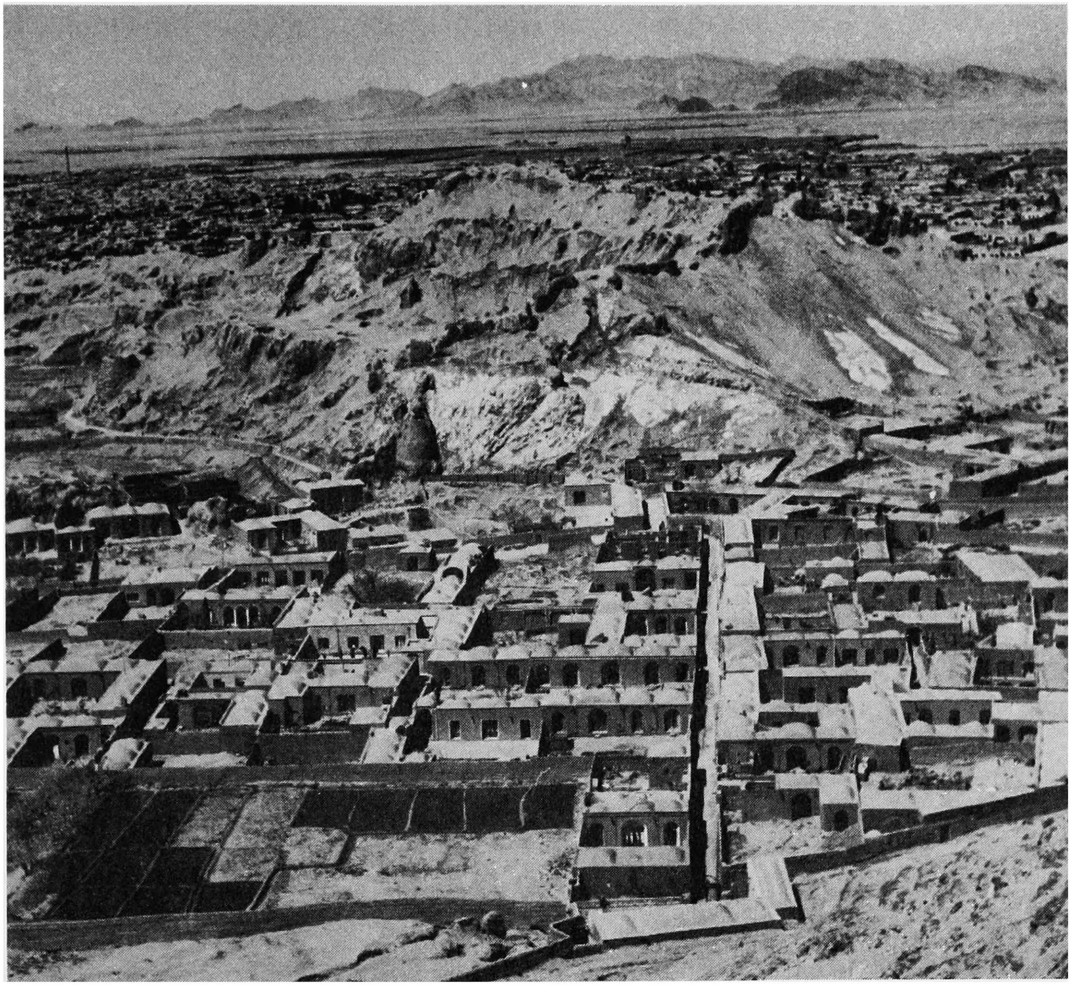
Approximately 6 km from Kerman on the Zahedan road there is a turn to the left that leads to the village of Gojgin. Proceeding a short distance along this road one passes the ruins of a recent caravanserai, and then past a line of tepes, averaging about 1 m high, and about 7 m in diameter. Sherds from these are mainly of the unglazed type, some with a white slip, while others have a polished surface. The paste varies from white to buff and red. There are two pieces of fine white glazed Seljuq ware. Other monochrome glazed pieces, in yellow, brown and black cannot be identified, but must be of very recent date.

(10) Qaleh-i-Gojgin

Near Gojgin on a rocky hill are the ruins of a small castle, made of rock and plastered inside. Islamic sherds here consisted of unglazed specimens with a thick white paste, apparently from large vessels. There were also glazed fragments among which were three slip-painted pieces, one _sgraffito_, the remainder being monochrome glazed and under-glaze painted specimens, presumably from Seljuq times.

1 Lane, _op. cit._, pp. 81-84, color plate D; Pls. 57-60.

PLATE 12. - (UPPER) KERMAN CITY SEEN FROM QALEH-i-DUKHTAR WITH QALEH-i-ARDESHIR IN THE BACKGROUND.
(LOWER) STONE GRAVE NEAR SAR-i-ASIAB SHESH.



(11) Tepe Gajin

This site is located about 4 km south of the village of Baghin on the road to Mashiz. The tepe is clearly visible from the road which passes 50 m to the south. On the tepe and for a distance of 100 m to the south, and a lesser distance in other directions is a scattering of sherds. Of those collected some are useful as indications of the period of occupancy. A single small piece of early type lustre is identical with Mesopotamian types, and must date from the 9th or early 10th Century. Several fragments of the type Persian blue and white, and various polychrome wares belong to the 16th and 17th centuries.

(12) Qaleh-i-Hosseinabad (Qaleh-i-Nubera)

This site is 17 km from Baghin on the road to Bahramjird. A small collection of sherds includes glazed types, mainly Islamic, and unglazed wares, both Islamic and possibly pre-Islamic. There is one fragment of worked limestone, possibly from a building.

(13) Qaleh-i-Khaneh

Mr. Ramatian's brief survey indicated that this site is on the highway leading from Baghin to Rafsanjan. Fourteen sherds were examined, both glazed and unglazed, including one Seljuq fine glazed specimen, indicating a date from early to medieval Islamic times.

(14) Small mound north of Qaleh-i-Khaneh

The collection from this site includes 19 fragments of a thick crude ceramic which appear to be parts of ceramic wall braces used in the construction of chain wells. The sherds include three plain red, grit tempered, and two grey examples, all unglazed. Judging from the collection, the site is of no great importance.

Sites in the Region of Hutq

(15) Qaleh-i-Dukhtar on the road to Hutq

15 km north of Kerman on the road to Hutq there is a ruined castle, built on level ground, quite near the road. Caldwell and his party, visiting this ruin in 1964, felt that it could not be the Qaleh-i-Dukhtar mentioned by Stein. They made a small collection of sherds, some unglazed. There was also a piece of slip-painted pottery, with the usual white ground and manganese purple decorations. Three monochrome glazed pieces are too small for dating.

(16) Kele, near Zangiabad

14 km from Kerman on the road to Zangiabad are standing brick ruins, which tradition says were occupied until one hundred years ago. The Islamic pottery is mainly unglazed, made of thick and coarse white or red clay, representing parts of large vessels. A few monochrome glazed sherds, mostly turquoise, were found. None of the pieces offer any indication of their date.

(17) Stone graves near Sar-i-Asiab Shesh

On the road just beyond Sar-i-Asiab Shesh, some 30 km northwest of Kerman there is a large group of stone cairns, covering several hectares of stoney desert. Although indiscriminately situated there is a tendency for the cairns to be in groups. Typical is a group of six or more cairns, each about 4 m long, 2 m wide, and 1 to 1.5 m high. Some of the cairns had been demolished by the construction of the road, others by small wadis. Little pottery was present on the surface, except in connection with destroyed cairns. Two splashed ware sherds might be dated to the 10th or 11th centuries. The monochrome glazed pieces are parts of jars and bowls with fine turquoise, green and blue glazes. They might be Seljuq and thus earlier in date.

Stein visited this site, opening three cairns, all containing human bones.[1] He attributed the graves to Zoroastrian burial practices.

(18) Numerous ruins northwest of Hutq

The USAF Aeronautical Approach Chart for the Kerman area shows a spot marked "numerous ruins" about 8 km northwest of Hutq. Examination of a few of these showed them to be rectangular patterns of stone, identical in appearance with the stone foundations on which nearly all the present mudbrick houses of this area are built. Only a few sherds were collected here, mostly unglazed. The one glazed sherd was painted in heavy black lines with splashes of turquoise under a transparent white glaze, and is quite similar to specimens dating to the 13th Century from Qaleh-i-Dukhtar at Kerman. The unglazed pottery, possibly of the same date, is thin, of close grained clay, decorated with combing and molding.

Sites in the Anar Region

(19) Qaleh-i-Anar

This rather typical mudbrick fortress stands just outside the present village of Anar. A wide variety of sherds were collected within the walls, and rooms, some of which still have the plastering intact with traces of paint on the molded trim. The unglazed specimens reveal elaborate designs composed of fine lines and combings. Among the monochrome glazed wares a few are coated with fine glazes in turquoise, blue and white, and can be attributed to the 13th Century. Others in this monochrome glazed group seem to be of more recent date. The under-glaze painted group represents characteristic examples of 13th and 14th Century types.

There is a very interesting group of imitations of Chinese porcelains, both the celadon and the Ming blue and white. There are six sherds of imitation celadon with glazes of various colors. Such imitations are known to have been made in Iran from the beginning of the 14th Century.[2]

The production of this type of pottery continued until the 16th and 17th centuries. Its manufacture is attributed to kilns at Kerman.[3] The color of these later imitations varies from green to olive-brown, to grey or greyish blue. In several instances they have relief patterns, such as fish, at the base. The imitations of Ming blue and white found at Qaleh-i-Anar may also have originated at Kerman and belong to the same period, that is the 16th and 17th centuries.

1 Stein, Archeological Reconnaissances..., p. 163.

2 Lane, op. cit., p.9, Pl.86 a-b.

3 Lane, op. cit., p.106.

In general the sherds from Anar, apart from a few earlier monochrome glazed and under-glaze painted types date from the 14th to the 17th centuries, and probably later.

VII

THE GEOGRAPHY OF THE BARD SIR VALLEY

Dorreh Mirheydar

I was quite fortunate to meet Dr. Caldwell, of the Illinois State Museum, at the cultural division of the United States Information Service. Dr. Caldwell, who was then directing an archaeological project in Kerman, was so kind as to invite me to go along with his party to the ruined site of Tal-i-Iblis in order to make a geographical study of the valley in which the tal stands. I welcomed the opportunity and gladly accepted the invitation to take the trip.

We left Tehran by plane on September 14th and spent the night in Isfahan. Next day, early in the morning, we left Isfahan by car for Kerman. The highway between Isfahan and Kerman crossing the Isfahan-Sirjan Basin is under construction and the present road, which stretches for a distance of 740 km, is rough and in places is covered with sand. It is not in altogether good condition. We were forewarned not to travel over this road, which runs along the edge of the kavir (salt desert). The urge to see the surrounding desert landscape was great enough to enable us to overcome the fear of having any number of flat tires. Actually the drive was not as bad as we expected. We had only two flat tires resulting in only an hour's wait to have them repaired. One of the dangerous aspects of driving into the desert is the frequent occurrence of high velocity winds carrying sand which blocks the view of the driver. Fortunately, on that day the weather was not too hot, and no fierce winds were blowing. However, a number of dust-devils were whirling about some distance away, and in their passage sometimes swept the road from one side to the other.

One of the noticeable features of settlement in this part of Iran is the type of architecture in the villages which lie along the road. The houses consist of a series of mud brick walled rooms, the roofs of which are in the form of domes. The rooms are completely covered and, with the exception of a single door, have no other openings. This type of architecture is well suited to the climate of the kavir since it has the necessary means of protection against both the summer heat and the sand-bearing winds of the desert. The buildings used for preserving water in this part of Iran are also unique. The body of the reservoir is in the shape of a cone with two minaret-shaped towers, one on each side (Plate 1). Apparently, the shape of the building helps to keep the water cool. The brick work on the curved body of the reservoir is very neat and is evidence of a great amount of skill on the part of the builder.

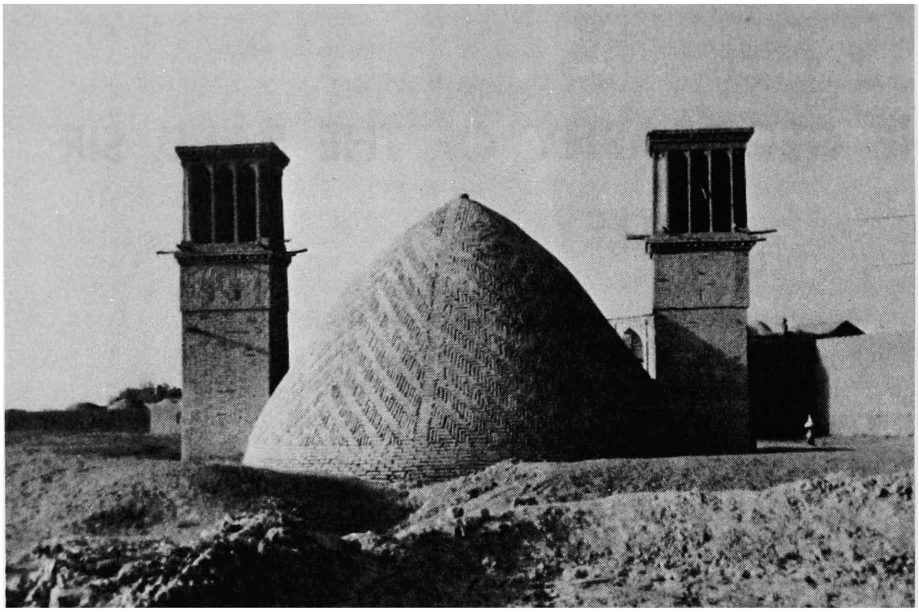


Plate 1 - Water Reservoir

There are only two cities of any importance on the way to Kerman, one being the city of Yazd and the other the city of Rafsanjan. Yazd, with a population of about 95,000, is the larger and the more important of the two. Yazd has the largest Zoroastrian population among the cities of Iran and is famous for its fine woolen handicrafts. The elegant Yazdi shawls are sometimes made of golden thread mixed with woolen yarn. Rafsanjan is famous for its pistachio nuts.

Having driven for fourteen hours, we finally reached the city of Kerman on September 15th, late in the evening. Kerman with 82,000 people **constitutes** the second center of population in the south-east of Iran. It has been the capital of Kerman Province for centuries. Although the people of Kerman have been attacked and massacred several times during history,[1] the city has struggled to maintain its character after each catastrophe. However, the effects of all these unfortunate historical events still remain in the spirit of the new generation as well as the old one.

There are two mosques of considerable importance in Kerman symbolizing the types of architecture in two different periods of Iranian history; one is the mosque of Malek, and the other, the mosque of Jameh. The mosque of Malek was built in the 12th Century A. D. during the Seljuk Dynasty. Although the mosque has been recently rebuilt, there is still a section remaining which represents Iran's architecture in this period. The mosque of Jameh was built in the 14th Century A. D. during the Ali-i-Mozaffar Dynasty. The tile work of this mosque is very artistic, and in the beauty of its colors it competes with the most beautiful mosques of the Safavid Period in Isfahan.

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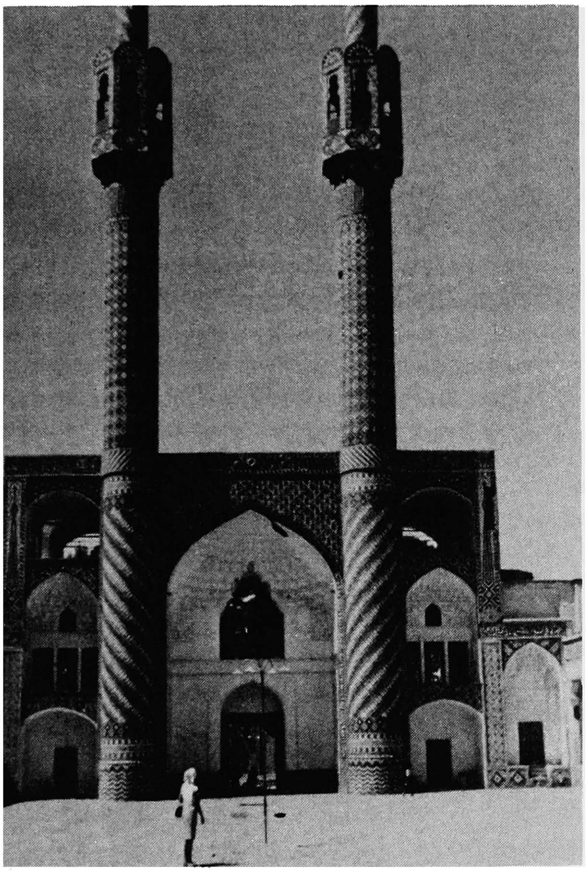
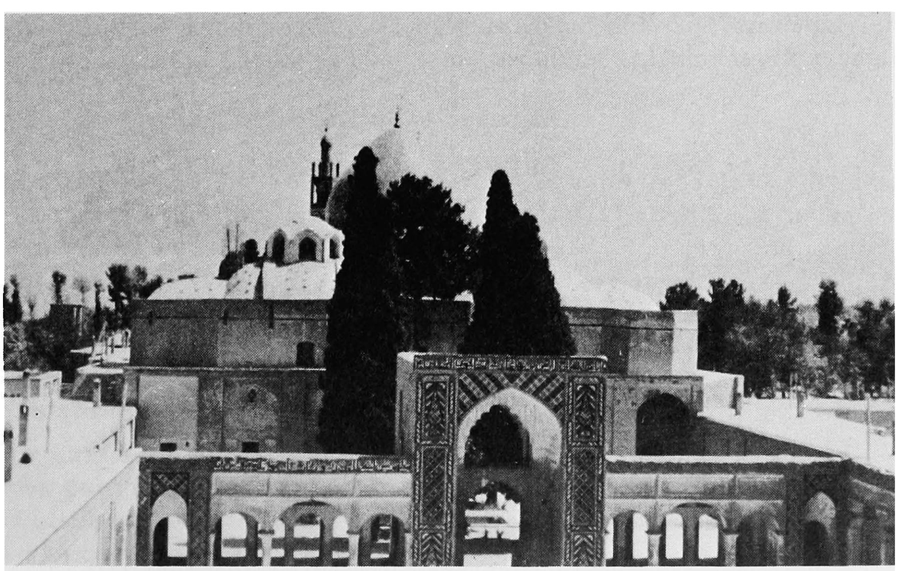
1 The last occasion was in 1794 when Aga Mohammed Khan, founder of the Kajar Dynasty, after a valient defense of Kerman City by Luft Ali Khan, last of the Zands, turned the city over to rapine and ordered that 20,000 pairs of eyes be turned over to him. These he carefully counted. (Ed.)

There are two old forts in Kerman known as Qaleh-i-Ardeshir and Qaleh-i-Dukhtar. Both of these forts are traditionally believed to have been built during the Sasanian Period. While visiting Kerman we were able to take a short trip to Mahan. The town of Mahan is located in 40 km southeast of Kerman on the road to the city of Bam. The historical significance of Mahan is due to its being the shrine of the religious leader of the Dervish sect known as Nematollahi. The shrine was built in the 15th Century A. D. and is famous for its beautiful tile work. (Plate 2)



Scenes from the shrine of Nematolla in Mahan - Plate 2.



Physical Geography of the Bard Sir Valley

Having visited Kerman for two days, we left for Mashiz which was our final destination. Mashiz is the center of Bard Sir Bakhsh (administrative division) and is located 72 km southwest of Kerman on the road to Sirjan. The Bakhsh of Bard Sir includes several lesser divisions called Dehestan. The Dehestans included in Bard Sir are: Negar, Qariyat-al-Arab, Bahramjird, Lalehzar, Qaleh-Asgar, and Mashiz. Since the boundary of this Bakhsh almost coincides with the limits of a valley which includes most of these Dehestans, I give the name Bard Sir to the valley and will discuss its geographic characteristics in the following pages.

The Bard Sir Valley, which stretches from northwest to southeast, is surrounded by high mountains. The valley's bottom has an elevation of 2000 m gradually rising until it reaches the foot of the surrounding mountains. Traveling in the area between Rudkhaneh-i-Surkh and Rud-i-Chari, the land appears to be flat, spotted with hills and sand dunes. On the north, the valley is flanked by several single mountains which are known as Kuh-i-Kaleh Gave (the cow's head), Kuh-i-Kohan-e-Gave (the cow's hump), Kuh-i-Balderaz (the long winged mountains), and Kuh-i-Kaleh Qermez (the red-headed mountain. The name is due to the red color of the high iron dioxide content of the mountain.) East of the Kuh-i-Kaleh Qermez is the valley of the Chari River which separates the latter mountain from Kuh-e-Jupar on the east of the valley.

On the southern side, the valley is flanked by several mountain ranges. Kuh-i-Hazar is located in the southeast corner of the valley and with an elevation of 4500 m forms the highest peak among the mountains surrounding the valley. To the west of Kuh-i-Hazar is the mountain of Tom-i-Baluchi (the mound of Baluchi; the reason given for the name is that a group of Baluchi lived here some time ago). The valley of the Chari River separates Kuh-i-Tom-i-Baluchi from Kuh-i-Sang-i-Sayyad on the west. To the west of the Sang-i-Sayyad Mountain are the mountains of Ahurak and Narp. To the west of Kuh-i-Narp is the valley of Ab-i-Lalehzar which separates the latter mountain from Kuh-i-Chehelitan which has an elevation of 3700 m and forms the second highest mountain after Kuh-i-Hazar. On the west of the Bard Sir Valley lies the mountain of Panj (five). On the south of the valley parallel to and beyond the above-mentioned mountains (Tom-i-Baluchi, Sang-i-Sayyad, Ahurak, and Chehelitan) are several higher mountain ranges, which, though farther from the valley, contain its important water sources. These mountains are called Kuh-i-Shah, Kuh-i-Lalehzar, and Kuh-Bidkhan. Kuh-i-Lalehzar is the source of Ab-i-Lalehzar (Lalehzar River) and has an elevation of 4400 m (Map 1 in Paper VIII following.)

Climate of the Bard Sir Valley

Due to the lack of necessary climatic data for the entire valley, any climatic account of the Bard Sir Valley must be short and generalized. On the whole, Bard Sir has pleasant weather in summer and cold weather in winter. The most conspicuous climatic feature of the valley, however, is the high daily temperature range, both in winter and summer. According to the climatic data received from the office of the Sugar Refining Plant in Mashiz, the average daily temperature range is around 30°C. There are untimely occurrences of frost in the last month of summer, or late in the spring. This year, for instance, during the last days of August an unexpected low temperature of three degrees below zero damaged the sugar beet plants. Aridity is another climatic feature of this valley. The total amount of annual rainfall usually does not exceed 120 mm except during an exceptionally wet year. The high velocity winds which occur during the winter months are also harmful to the crops, and blowing sands are another problem.

Vegetative Cover

The climatic characteristics of the valley have an important role in forming the vegetative cover of the area. However, the role of man in transforming the vegetational species represented should not be disregarded. Misuse of the land, over and over again during the past centuries, has destroyed the natural vegetative cover. Where forest existed ages ago the land now has only occasional tamarisk. In other places, scrub-thorn, which resists the aridity of the climate is predominant. The condition on the slopes of the mountains is, however, different. The slopes of Kuh-i-Chehelitan were once extensively covered by wild pistachio trees (Pistachio mutica) and even today the remainder of the former forested area is to be seen. Forests of wild almond are also to be found on the slopes of the mountains in the south of the valley. Small trees, known as Calligonum, and the plant, Zygophyllam triplicoides, are seen on the valley's floor. The plants are used as fodder for raising sheep and the trees are used for firewood and charcoal.

Water Resources

Presently, underground water forms the main source of water for the valley. There are, however, several dry river beds which carry some water during the rainy season. These waterways, mostly dry during the summer months, are of no use when water is needed. Ab-i-Lalehzar, formed by the confluence between two branches, one of which originates in Kuh-i-Lalehzar and the other one in Kuh-i-Bidkhan, constitutes the longest river of the valley. Ab-i-Lalehzar in its upper section, when it passes by the villages of Lalehzar and Qaleh Asgar, is perennial. In its middle course when it flows towards the town of Mashiz it is non-perennial and here the river is known as Ab-i-Bakhshha (the water of many shares). As the river flows to the northeast of Mashiz, its bed deepens and, tapping a lower water table, collects some water and again becomes perennial. Consequently, when Ab-i-Lalehzar flows to the town of Kabutarkhan, on the road to Rafsanjan, it carries some water throughout the year. Next to the Ab-i-Lalehzar in importance is Rud-i-Chari which flows in the easternmost section of the valley. The Chari River starts from Kuh-i-Shah and having received several branches from Kuh-i-Hazar, Rudkhaneh-i-Tal and Rudkhaneh-i-Khoshk, it flows to the north, passing by the villages of Qariyat-al-Arab and Bahramjird. Since it collects the water of surrounding qanat (chain wells), the river carries some water in summer as well as in winter. Next to Rud-i Chari in importance is Rudkhaneh-i-Surkh (the red river) which originates at Kuh-i-Panj, flows to the northeast and enters the valley, passing through the villages surrounding Mashiz.

Water from underground sources is extracted either by the natural flow from the chain wells or by pumping from deep wells located in or near the villages and other points of ultimate use. Mother wells of chain wells are located at the higher points of the alluvium where the ground water table is at its highest elevation near the base of the mountains. A qanat or chain well is an earth tunnel generally unlined and pierced by vertical openings from 50 to 100 m apart. These openings are necessary for removal of tunnel spoil during the course of constructing the qanat. Deep wells generally average from 40 to 100 m in depth and since they pierce the water table at elevations lower than the qanat mother wells, form a more reliable source of water. Yet they are very expensive to install, and not many farmers in this area can afford them. There is, however, another type of well,known as a payabee, ordinarily about six meters deep and which is connected with the tunneled qanat system to maintain the flow of water. The water from a payabee well is extracted by pump motors which are simpler and much cheaper than deep-well motors. Moreover, drilling of any deep well might cause great damage to all the surrounding qanats by collecting their water, unless it is located at a sufficient distance. For these reasons, out of 100 wells existing in the Mashiz area, only 14 are deep wells and the rest are of the payabee kind.

Population Distribution of the Bard Sir Valley

The availability of water plays the most significant role in population distribution of the valley. The soil is almost everywhere fertile and needs only water to be quite productive. As the historical and archeological evidences indicate, people have always lived along the river valleys in order to have an easy access to water. The exploitation of underground water resources was later. Iran is one of the oldest nations to use underground water, by invention or adoption of the qanat system. In southeastern Iran, where perennial rivers are few, the existence of qanats has been the main factor in population concentration.

Considering the above-mentioned facts, the reason for the pattern of the population distribution in the Bard Sir Valley is clear. There are four lines of population concentration, three of which are along the river banks, whereas the fourth one is based on the existence of numerous qanats. The Dehestans of Mashiz, Lalehzar, and Qaleh Asgar with their numerous villages are located along Ab-i-Lalehzar. Bahramjird and Qariyat-al-Arab are located near Rud-i-Chari. The villages of Mahmudabad, Hoseinabad, and Roknabad are located along Rudkhaneh-i-Surkh. Only the Dehestan of Negar and its villages are not located along any river and make exclusive use of qanat water.

Due to lack of a reliable census, it is very difficult to estimate the population of the Bard Sir area. According to the census obtained from the office of Social and Economic Development of Villages, the population of the valley is around 15,000. The center of the Bakhsh is the town of Mashiz which according to the 1956 census (1335 A.H.) has a population of 1,125. Being the administrative center, Mashiz includes the Bakhsh Hall, and several other offices. There are two elementary schools for boys in Mashiz and one infirmary known as Bard Sir Darmangah. The prosperity of Mashiz, compared with other towns of the valley is mainly due to the existence of a sugar refining plant which was established twelve years ago 3 km northeast of the town.

Economy of the Valley

The two factors of climate and soil have a major role in forming the economic features of the valley. The aridity of the climate makes irrigation a necessary part of agriculture. The soil is mostly sedimentary, with old alluvial material covered with sand; where water is available it is quite fertile and especially suitable for sugar beet cultivation. The valley's economy is based on agriculture. The main winter crops are wheat and barley. The main summer crops are sugar beets and potatoes. Sugar beets are a cash crop and in good years close to 4000 ha of the valley are under sugar beet cultivation. The following Table shows the area under sugar beet cultivation, and the area from which sugar has actually been produced during the period of twelve years since the sugar refining plant has been established near Mashiz.

TABLE 1

Year A. H.	Year A. D.	The Area Under Sugar Cultivation	The Area at the Time of Harvest
1335	1956	480.5 ha	430 ha
1336	1957	1808 ha	1416.5 ha
1337	1958	2583 ha	1645 ha
1338	1959	2768 ha	2456.75 ha
1339	1960	2480.75 ha	2269 ha
1340	1961	2560.25 ha	2110 ha
1341	1962	2637 ha	2384.25 ha
1342	1963	2235 ha	2054 ha
1343	1964	3616.25 ha	2721 ha
1344	1965	2947 ha	2106.5 ha
1345	1966	2523.25 ha	2127.75 ha

Table 1 reflects the fact that each year some planting is lost as a result of damage caused by parasites, early frost or harmful winds. However, there has been a steady increase in the area of sugar beet cultivation. This is mainly due to the Sugar Refinery's policy in granting loans and subsidies to the farmers for the purpose of drilling wells, and for increasing the use of fertilizers. As a result of an increase in sugar beet production, the refinery has recently enlarged its capacity from 350 metric tons to 1000 metric tons.

Wheat constitutes the most important winter crop and an extensive area is under wheat cultivation. The method of farming is a mixture of old and new. Along with oxen, tractors are used for cultivating and harvesting the fields. Irrigation is a necessary part of this agriculture. Dry farming methods are restricted to the slopes of the surrounding mountains. On every farm, along with agriculture, some animal husbandry, especially sheep raising, exists. The sheep and cows are fed fodder crops as well as the remainder of the sugar beets after harvest.

Geography of Tal-i-Iblis

As I mentioned at the outset, the main purpose of our trip to Mashiz was to make an archaeological investigation at Tal-i-Iblis. Tal-i-Iblis (mound of the devil) is located 18 km southeast of Mashiz. It is now largely destroyed because the soil of this mound, which thirty years ago had a height of eleven meters, has been used by the surrounding villagers for fertilizing their lands. The high potassium content of the Tal's soil is a very important factor in making it useful as a fertilizer for the surrounding fields. Only after Dr. Caldwell's first visit to the site did the government become aware of its archeological significance and prevent further destruction.

There is nothing certain about the name of this Tal. On maps the word Iblis appears which means the devil. The local people, however, call it Tal-i-Belis which might be the distorted form of the word Baluch, taken from the name of the people who lived here in recent years.

The archaeologists tell us that about 6000 years ago a highly industrious people lived at the Tal. According to the findings described in this volume, particularly crucibles, copper pins, ore fragments, slag, etc., these people smelted copper ore, probably mining it in the surrounding mountains and probably burning wood obtained from wild pistachio forests. Evidence of copper mining still exists in the slopes of the Chehelitan Mountain near the village of Bagh-i-Abbas, but which of these particular mines were worked by the Iblisi remains to be seen.

The question may be raised here as to why this area was so prosperous at such an early time as to support a sophisticated metallurgy, but has been abandoned for many centuries. One possible answer to this question may be the lack of surface water at the present time. As the trace of an old river bed lying to the east of the Tal indicates, Ab-i-Lalehzar previously passed the east of the Tal and flowed to the north. The existence of the river at a distance of about 450 m to the east of the Tal played a major role in the economic prosperity of the old settlement. Later on, for a reason unknown to us, the river changed its course and began to flow about 7 km to the west of Iblis. The possibility of digging chain wells in this area is limited due to the low ground-water table. Therefore the nearest modern village is located three km north of the Tal.

VIII

RECONNAISSANCES IN THE BARD SIR VALLEY

David W. Chase, Geza Fehérvári, and Joseph R. Caldwell

During the 1964 and 1966 work at Tal-i-Iblis a number of reconnaissances were made by expedition personnel to other parts of the Valley. Twenty-four sites have been numbered (Fig. 1) and there is every reason to suspect that additional survey will show many more.

The four lines of modern population concentration mentioned by Professor Mirheydar (this volume) all possessed historical Islamic sites of varying age, but the Chari River near Bahramjerd showed some prehistoric sites, and the abandoned channel of the Lalehzar River where Tal-i-Iblis is situated had several other prehistoric sites but no Islamic sites. After a brief statement about collection, sampling and identification procedures, we shall begin with (1) the site of Aliabad, and the sites on the abandoned channel of the Lalehzar, then (2) turn to the Mashiz and present Lalehzar River sites, the (3) sites near the Sorkh River, then (4) the sites in the vicinity of Negar which, as Mirheydar pointed out, are entirely served by chain-wells, and finally (5) the sites on the Chari River where we made the important discovery of the Medieval city of Ghubeyra.

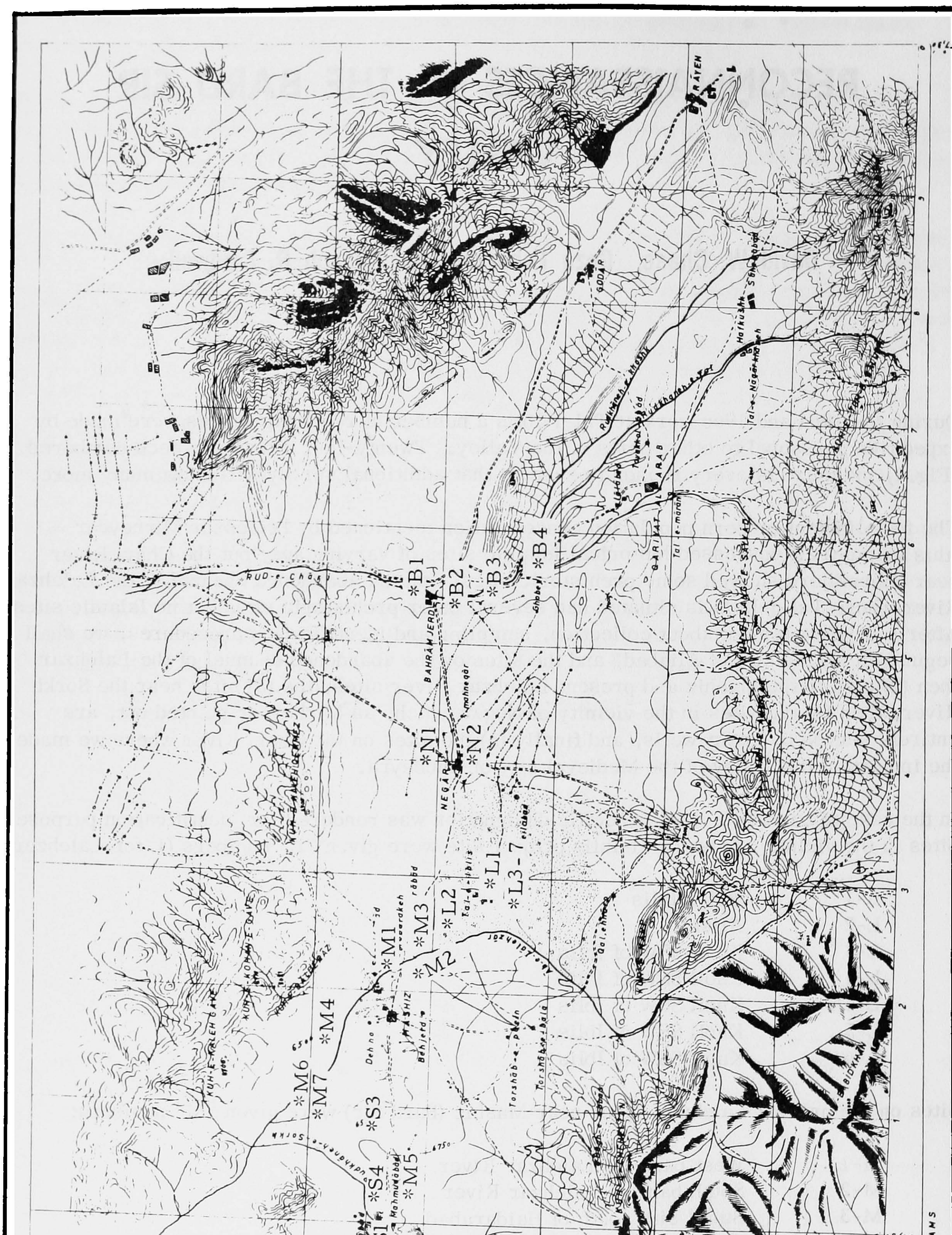
In the case of each site, some specific designation was rendered for identification purposes. Sites in the vicinity of the Tal-i-Iblis project site were given "L" numbers (L for Lalehzar):

L-1	Tal-i-Iblis
L-2	Aliabad
L-3	Knoll SSW of Iblis
L-4	Knoll SSW of Iblis
L-4A	Knoll SSW of Iblis
L-5	Knoll SSW of Iblis
L-6	Knoll SSW of Iblis

Sites on the present Lalehzar River near Mashiz (Bard Sir) were given "M" numbers:

M-1	West bank of Lalehzar River
M-2	South bank of Lalehzar River
M-3	Small site south of Haidarabad
M-4	North side of Lalehzar River on road to Rafsanjan
M-5	Site west of Mahmudabad
M-6	Site near Kamalabad
M-7	Mileh Hajim south of Kamalabad

FIGURE 1 - HISTORIC AND PREHISTORIC SITES IN THE BARD SIR VALLEY



0 5 10
KM.

The base map was prepared under the supervision of Professor Mirheydar. (Ed.)

Sites in the neighborhood of the Sorkh River

S-1	On Sirjan Road
S-2	Sorkh Cave site
S-3	Qaleh on Bandar Abbas Road
S-4	Qaleh-i-Minar

Four additional cave sites were located by Mr. Gary Hume (this volume) some of which are outside the Bard Sir Valley. Numbers have not yet been assigned. Radomir Pleiner (this volume, p. 374) mentions copper mines, smelting, and other sites at Tal-i-Homi, at the foot of Chehelitan mountain, and near Torsh-ab Bala. These also have not been numbered.

Sites in the vicinity of Negar:

N-1	Qaleh-i-Negar
N-2	Tal-i-Minegar

Chari River sites near Bahramjird:

B-1	
B-2	
B-3	
B-4	Medieval city of Ghubeyra

In order to establish a valid cultural representation for each discovered site, all artifacts of a reasonably definitive nature were collected -- these being, in most cases, ceramics. The materials were sacked, labelled, and returned to the Bard Sir headquarters for washing and identification.

The paucity of published data for the various historic and prehistoric periods represented in the survey samples made cultural identification extremely difficult in some cases. Of great help in making certain identifications were Mr. Zebidollah Ramatian, representative of the Iranian Archaeological Service to the Minnesota-Iranian Project and Mr. Mohammed Sarraf, representative of the Archaeological Service to the Illinois State Museum Project.

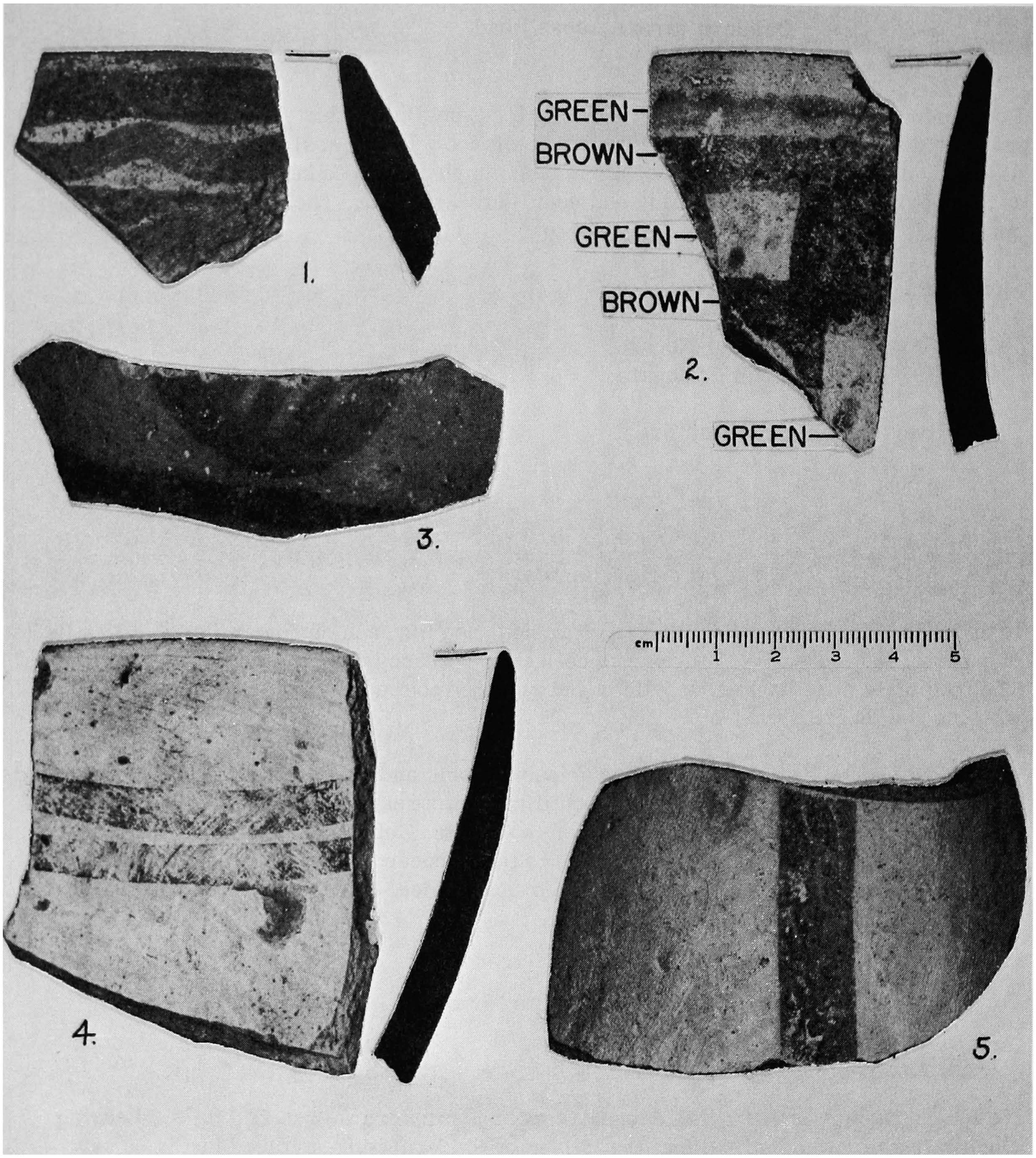
Aliabad and Sites Near Iblis

L-2 Aliabad (Pls. 1, 2, 3)

We found this site on our 1964 reconnaissance, just before we reached Iblis. Leaving Mashiz and after turning south at the village of Haidarabad (Kheyrabad in Fig. 1) our jeep bogged down in a narrow irrigation channel filled with spring melt water. While it was being dug out we noticed an area about 100 m long by 25 m wide with fragments of painted pottery. The site seemed to extend along the side of the rivulet where our jeep came to grief. There were also chain-wells adjacent to it. We did not know exactly where we were but local people told us the place was called Aliabad. The approximate location is shown in Figure 1. It can hardly be more than 2 km east of the present Lalehzar River and perhaps not more than 4 km north of Tal-i-Iblis.

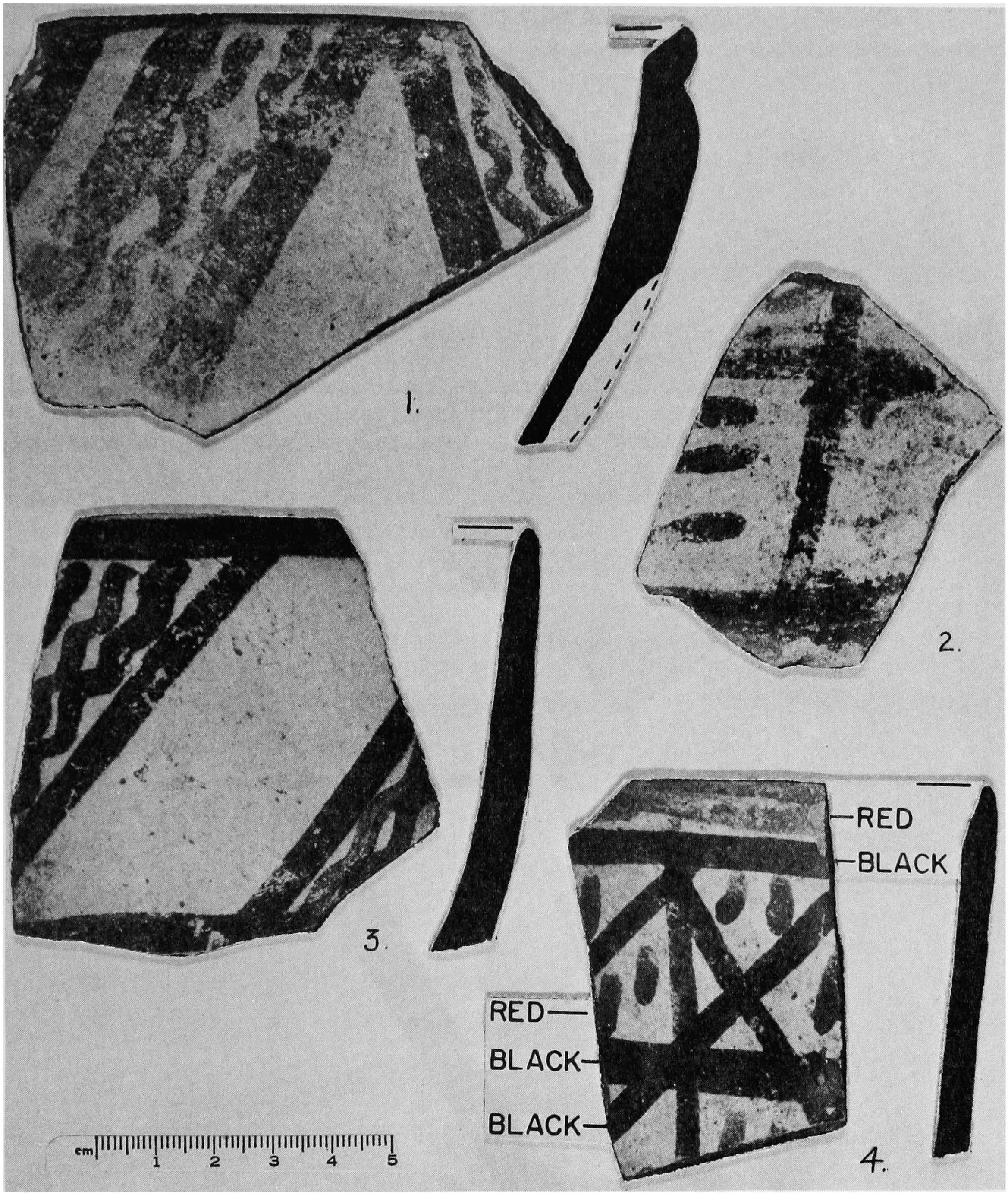
Our collection from this place consisted of about 50 pottery fragments and a piece of an alabaster vessel. With the help of information later obtained at Iblis we recognized the pottery at this site as a distinctive complex, which we have named Aliabad and which

PLATE 1 - ALIABAD



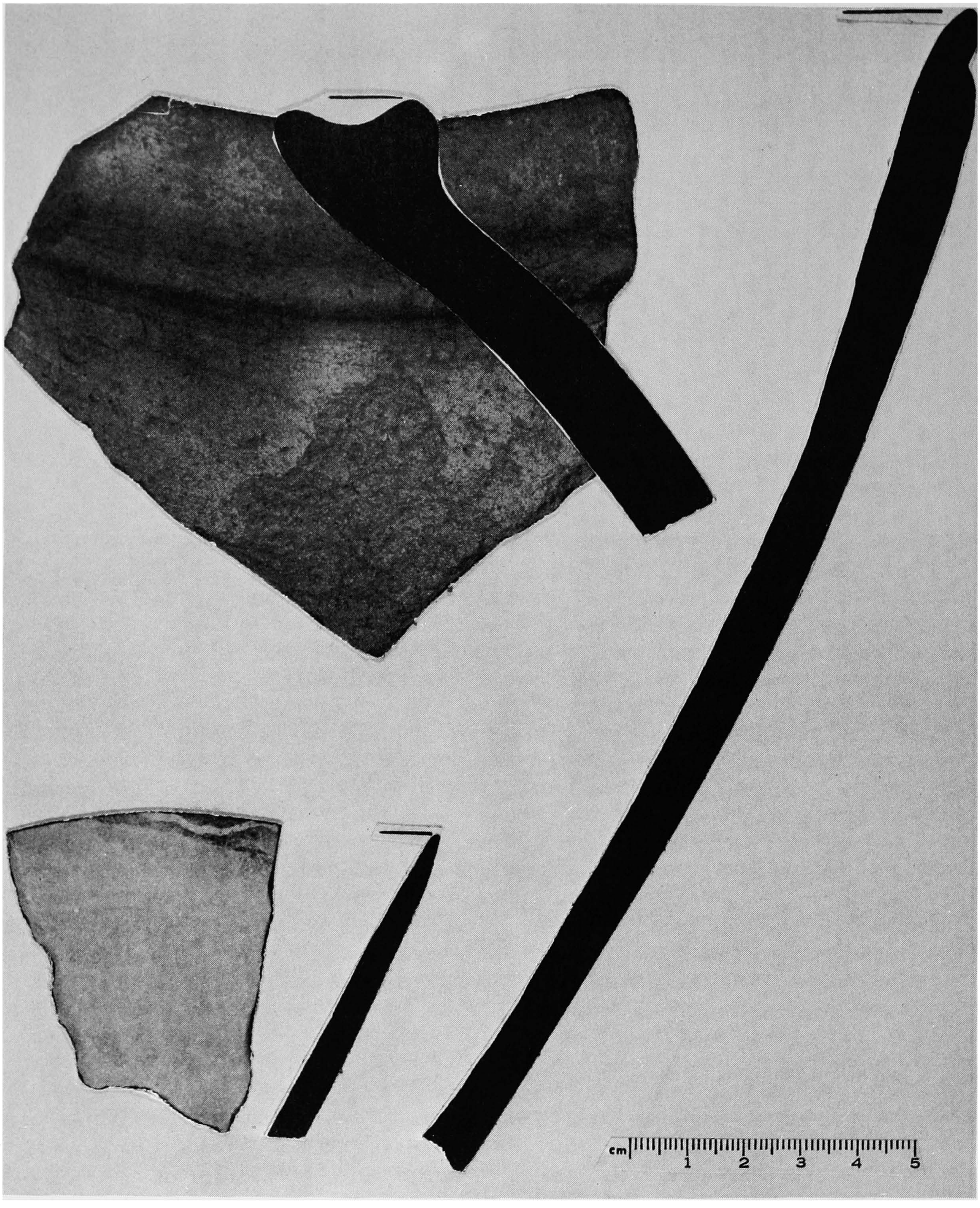
No.	Type	Diameter of Rim	Temper	Surface	Paste	Color of Paint	Remarks
1	Aliabad Painted	14	Fine vegetal	Exterior Buff Slip	Brick-red	Gray-brown	
2	Aliabad Bichrome	18	Fine vegetal	Buff Slip	Buff	Brown & green	
3	Aliabad Painted	--	Grit	No Slip	Brick-red	Gray-brown	
4	Aliabad Painted	20	Fine vegetal	Buff Slip	Pink	Dark Brown	Design on interior.
5	Aliabad Painted	--	Fine vegetal & Grit	No Slip	Brick-red	Dark Brown	

PLATE 2 ALIABAD



No.	Type	Diameter of Rim	Temper	Surface	Paste	Color of Paint	Remarks
1	Aliabad Painted	40	Fine vegetal	Buff Slip	Pink	Dark Brown	Paint on interior.
2	Aliabad Painted	--	Fine vegetal	Buff Slip	Pink	Dark Brown	
3	Aliabad Painted	12	Fine vegetal	Buff Slip	Pink	Dark Brown	
4	Aliabad Bichrome	16	Fine vegetal	Exterior Buff Slip	Red-brown	Red & Black	

PLATE 3 - ALIABAD



No.	Type	Diameter of Rim	Temper	Surface	Paste
1	Aliabad Plain	60	Fine vegetal	Buff Slip	Gray-Brown
2	Aliabad Plain	34	Fine vegetal	Buff Slip	Pink-Brown
3	Fragment of Alabaster Bowl	14			

is stylistically equivalent to Iblis IV. The occupation here seems to have been rather short. Since our sample is small and in our haste we tended to pick up decorated pottery in preference to plain, we have not noted the proportions of the various types in the collection. The types Aliabad Painted, Aliabad Bichrome, and Aliabad Plain constitute the bulk of the pottery.

The paste of the pottery from Aliabad is generally pink or brick red but buff slips, either on the interiors or exteriors or sometimes both surfaces of the vessels, are usual. Tiny lacunae in the paste suggest that a finely divided vegetal substance was most frequently used as tempering. A few sherds also show particles of grit. The thickness of the vessel walls is between 6 to 10 mm.

Aliabad Painted. The painted decoration tends to be placed on slipped surfaces, unslipped surfaces were usually not painted. So far as can be judged wide mouth bowls with curving sides were most common. Painting may be either on the exterior or interior. Particularly characteristic are arrangements of straight, curved or wavy lines. Colors are brown, red, or black.

Aliabad Bichrome. Three sherds were painted in more than one color: red and black, brown and green, and black and green.

Aliabad Plain. One specimen shows a channel below the rim, a feature also occurring on some painted sherds. Another had a distinctive rim made to support a lid.

Sites near the abandoned channel of the Lalehzar River

From Tal-i-Iblis (L-1) situated on the abandoned channel of the Lalehzar River there is a desert track leading south by southwest 200-300 m west of the old river bank and roughly parallel to it (Fig.2). Along this road scatterings of potsherds extend to a point about 1.5 km SSW of Iblis. With the exception of one Aliabad Ridged sherd and another which might be Aliabad Brushed, these seem to belong to the Mashiz complex, representing Iblis V, the time of the greatest extent of the site (Pl.4). Beyond this the area is mostly devoid of potsherds but between 3-5 km southwest of Iblis one comes upon a series of low, formerly occupied knolls. (L-3, 4, 4A, 5, 6).[1] All of these are on the present road or can be seen from it. Only one such knoll (L-6) is directly on the river bank. The others, like the road itself, are parallel to it and probably were supplied with water by the old river.

The most puzzling and distinctive feature of all these knolls is the abundance of cobbles and of spalls of a fine-grained basalt, less frequently rhyolite and other igneous rocks. So abundant is the stone that one can locate each knoll from some distance away (Pl.5) and it is possible that many of the cobbles were originally used in house construction. There are very few stone artifacts which one can recognize as completed objects but many showing clear indications of human workmanship (Fig.3). There is very definitely a stone industry on every one of the knolls found so far, and it looks like an extremely crude and primitive one, yet on every one of these knolls there is also pottery, most of which seems to be of the Mashiz complex (Iblis V) and which will be discussed below. Site L-4 however had a considerable representation of Aliabad (Iblis IV) pottery and a few Iblis IV sherds have been noted on other knolls as well. This concurrence of Iblis IV and V pottery with the stone industry on every one of the knolls located so far, as well as the

1 These are also briefly discussed by Hume, this volume.

FIGURE 2 - SITES SSW OF TAL-i-IBLIS
(sketch map by Gary and Valerie Hume)

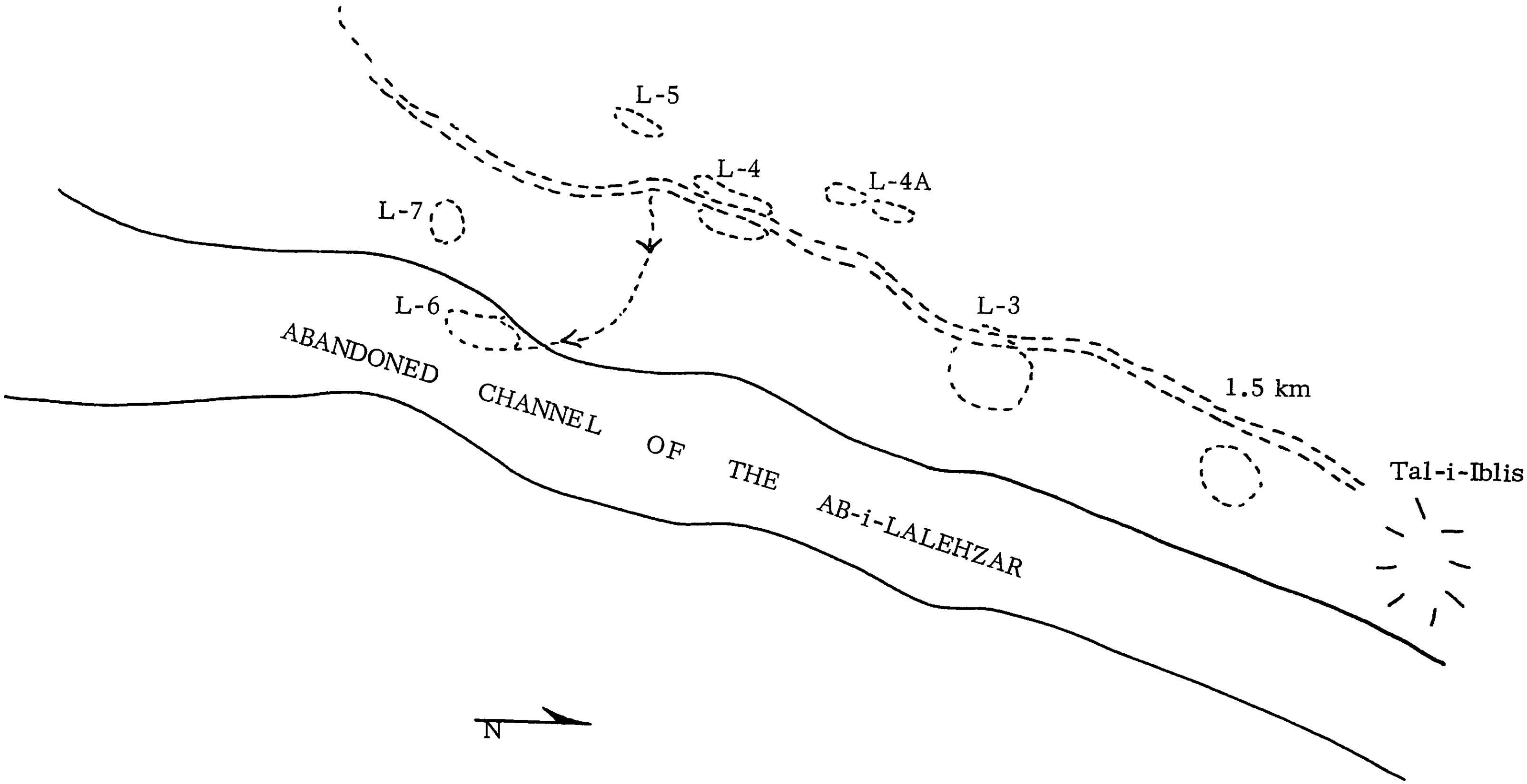


FIGURE 3 - STONE ARTIFACTS FROM SITES ALONG THE ABANDONED CHANNEL OF THE LALEHZAR.

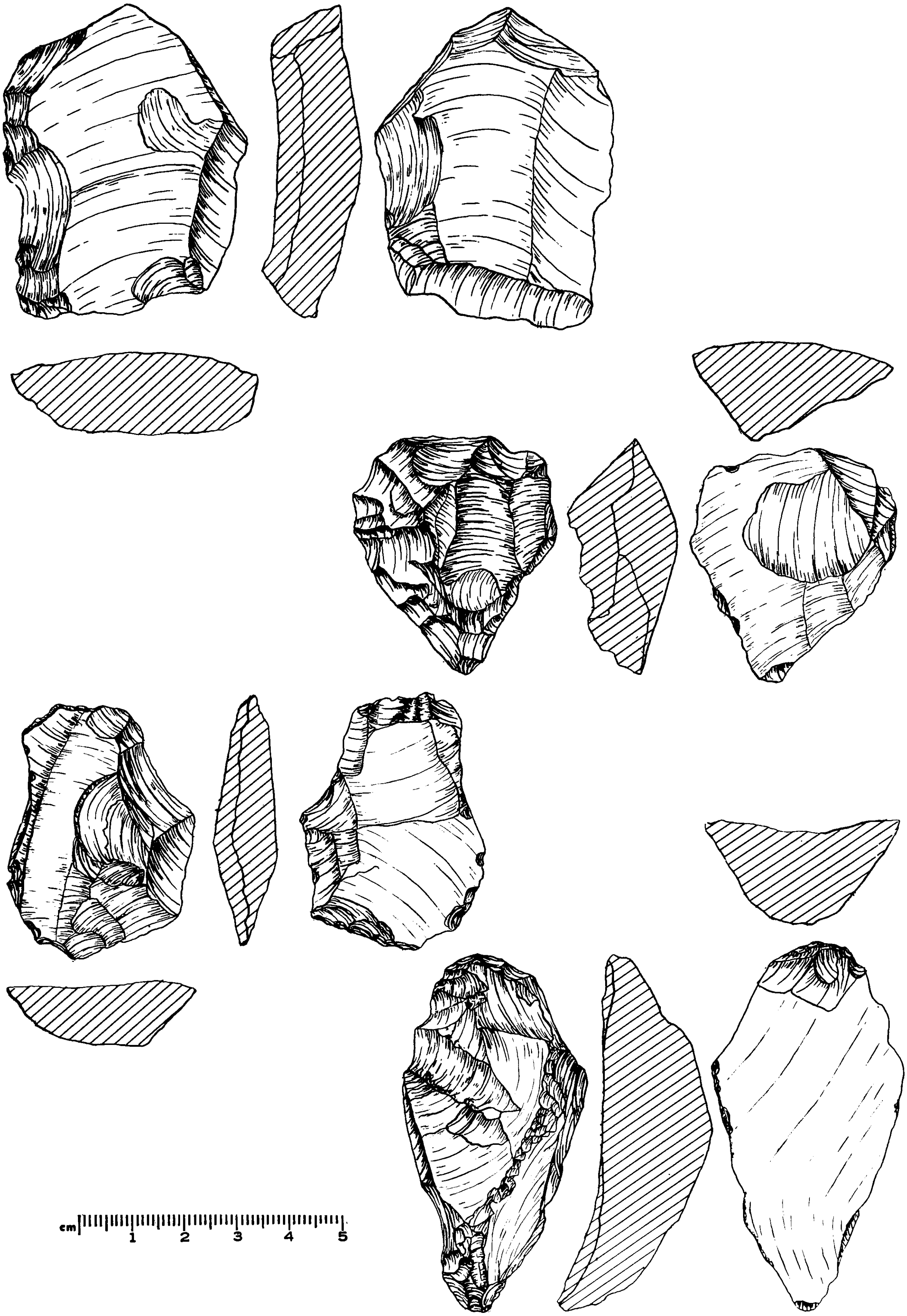
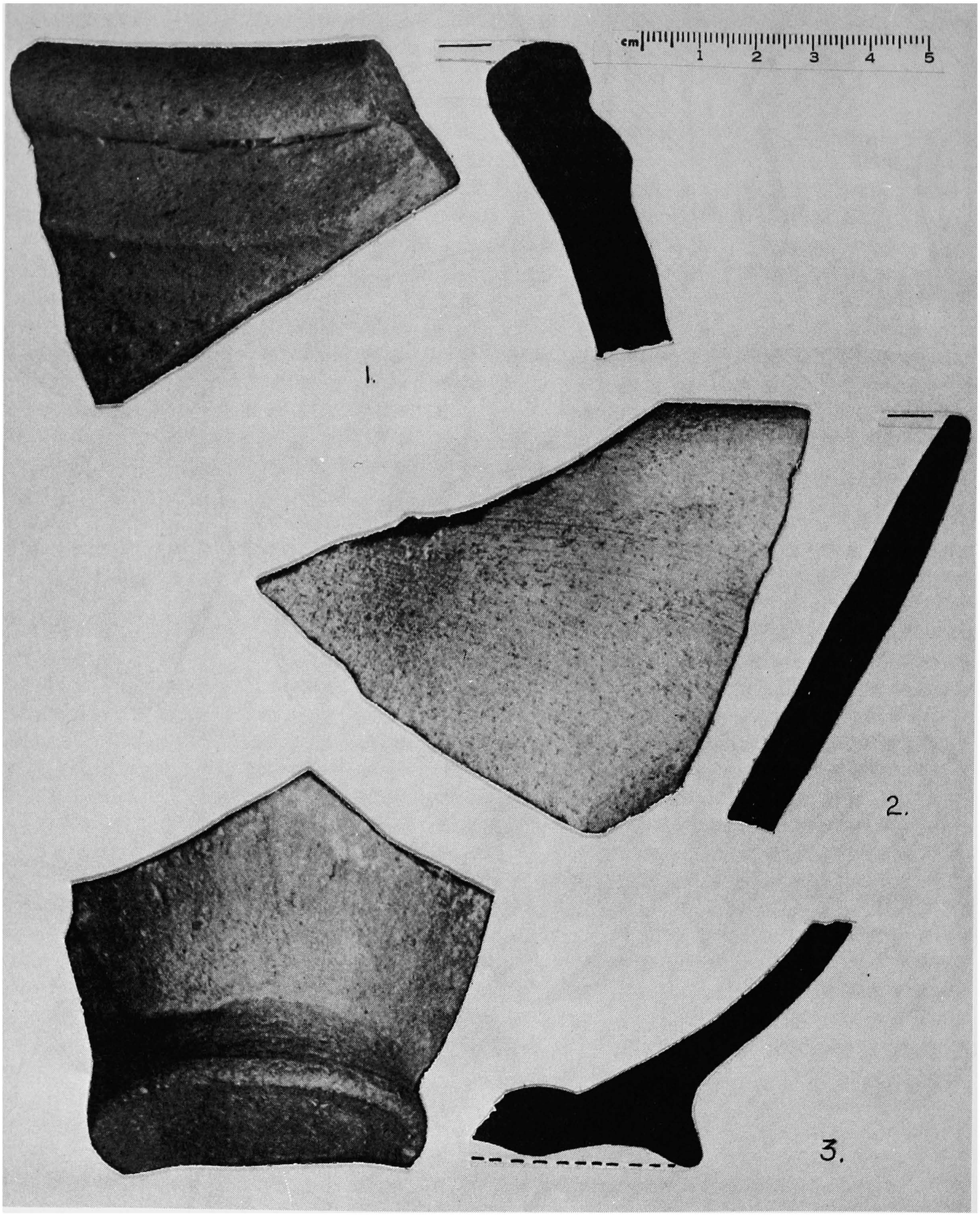
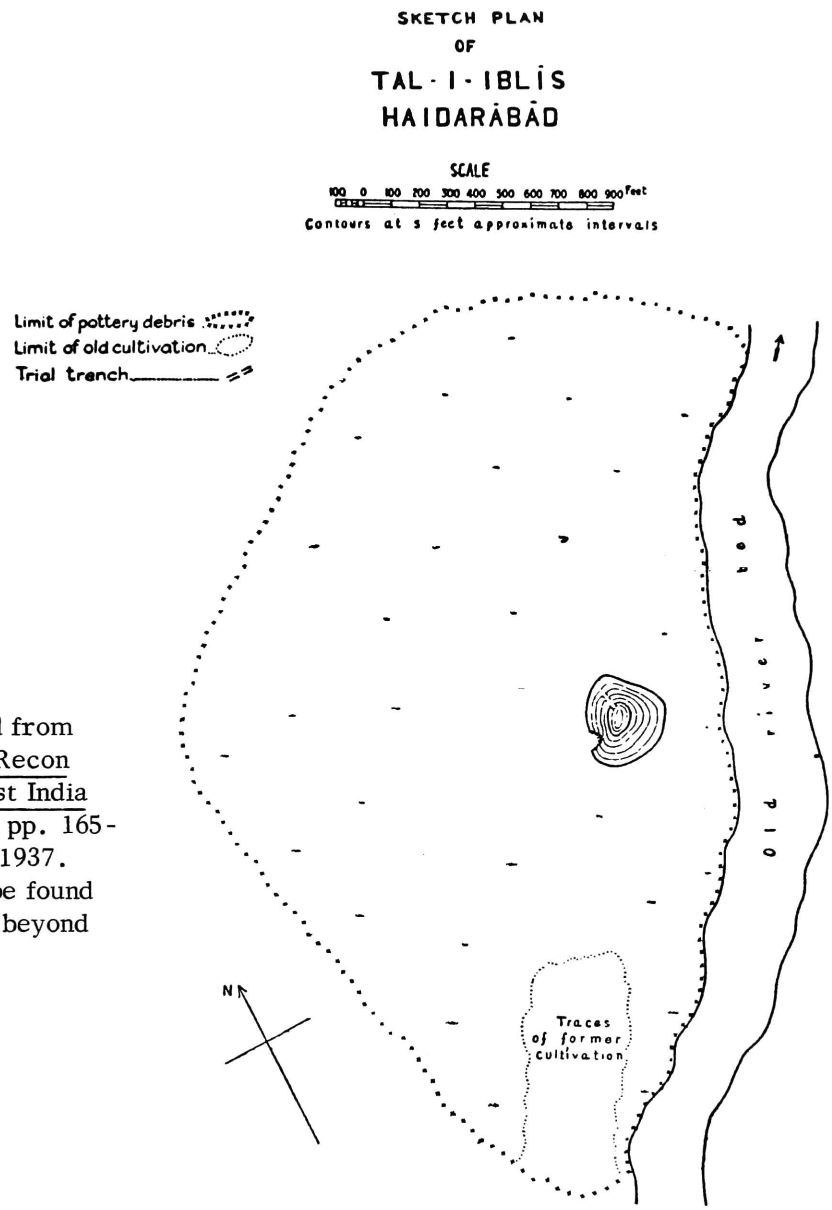


PLATE 4 1 1/2 km SSW OF IBLIS



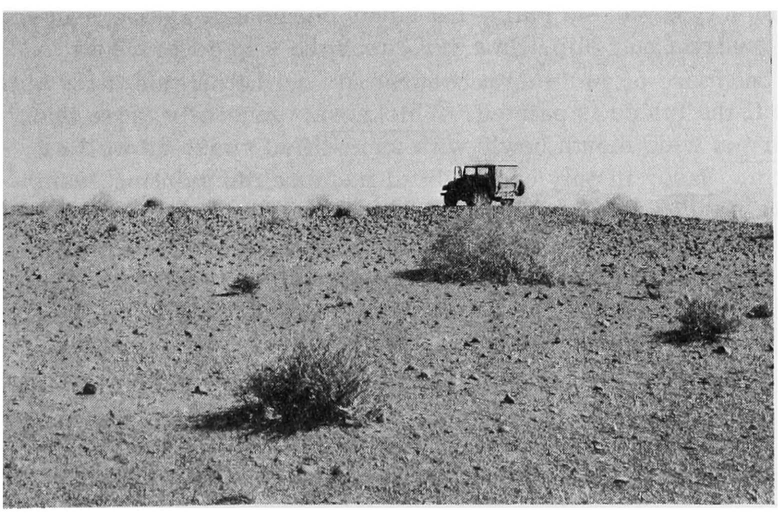
1	Aliabad Ridged?	34 cm	Grit	No Slip	Brick-red	
2	Mashiz Plain	--	Grit	Exterior Buff Slip	Brick-red	Exterior heavily striated
3	Mashiz Plain	Base 5 5 cm	Grit	No Slip	Brick-red	

PLATE 5 TAL-i-IBLIS (after Stein) AND SITE B-4 SSW OF IBLIS



PLAN 15

The plan is reproduced from Stein, Archaeological Reconnaissances in Northwest India and Southeastern Iran, pp. 165-169, Plan 15. London 1937. Additional debris can be found in discontinuous areas beyond the limits shown here.



Site B-4 SSW of Iblis.

occurrence of similar lithic materials on the surface of Iblis itself is the basis of Hume's argument that the stone industry must be contemporary with Iblis IV and V. He may well be correct in this, and the fact that at Iblis the chipped stone industry seems to have become negligible after Iblis II, does not mean that it was not carried on elsewhere, perhaps on these knolls. Yet there is probably something more to be learned about this situation. If this is truly a late industry one would expect it to be a blade industry, which it is not. One would also expect to find more of its products in the Iblis IV and V deposits at Iblis than we have found so far.

We do not yet have a clear picture of the Mashiz complex pottery of Iblis V. Although at Iblis we obtained some Iblis V pottery from the upper levels of the dump in area C, it was undoubtedly mixed with older and later sherds. Our best means of segregating and describing Iblis V is horizontal: it occurs in quantity over large areas west and southwest of the mound, as well as on the knolls here discussed. In none of these cases are we absolutely certain that it is unmixed with earlier or later materials. We also do not know whether such types as Aliabad Brushed and Aliabad Ridged continue from Iblis IV to Iblis V, nor can we always distinguish Aliabad Painted from Mashiz Painted. Given these considerations there are still reasons to believe that the ceramics of Iblis V will eventually be clearly separated from Iblis IV. Actually Iblis V looks like a direct development out of Iblis IV and may not be very much later. Where they differ is in the fact that a greater proportion of Iblis V pottery is very hard, probably a true stoneware, a greater proportion is wheel-made, a much greater proportion is plain, and a much greater proportion is tempered with larger and easily distinguishable particles of grit. The painted designs, although they seem in the Aliabad tradition of Iblis IV, also seem slightly different, simpler, and in less variety. It also appears that unslipped surfaces are more frequent in the plain pottery even though this may be partly due to the fact that nearly all our materials are from the surface and are therefore considerably weathered. Vessel forms are even more clearly in the Iblis IV tradition. The fact that no later materials occur on these knolls is perhaps an indication that the change in the bed of the Lalehzar River took place just after this time, when the extent of Iblis itself was greatly diminished. There are later occupations there, but so far their remains have been found only in drastically reduced areas. In those later times, unlike today, some water must have been available. Perhaps the old channel continued to carry water for a time, or perhaps the water table was still high enough for wells to be feasible.

The following descriptions and illustrations are based on materials collected 1.5 km SSW of Iblis and from the various knolls paralleling the old bed of the Lalehzar.

Mashiz Painted. Paste: usually very hard and brick-red in color. Temper: medium size particles of grit. Can be brown, black, red, or other color. Surface: generally better smoothed than the companion type Mashiz Plain, but never burnished. More than half of the sherds are slipped, usually a buff slip. In a few cases the slip covers both exterior and interior surfaces, but more often the slip occurs only on the outside if the outside is painted, or on the inside if the inside is painted. Thickness: generally more than 6 mm but less than one cm. Forms: wide mouth bowls with unmodified rims, as well as taller vessels of an unknown form. Base: in only one doubtful instance did painting seem to be on a vessel base so we have no idea as to the form of the bases. Decoration: painting is found on the interiors and exteriors of open bowls and on the exteriors of the taller vessels. It tends to be on upper portions of bowls and although painted lines must extend some distance downward on taller vessels, the bases apparently were left unpainted. The designs are consistently simple arrangements of very broad bands, sometimes parallel, sometimes intersecting.

Mashiz Plain. Paste: usually very hard, probably a true "stone ware" and brick-red in color. Temper: medium-size particles of grit. Can be white, black, red or other color.

The thicker sherds from larger vessels tend to show grit in greater abundance. Surface: more or less smoothed but never burnished. Buff or pink slips occur but the great majority of vessels were not slipped. Thickness: many sherds are less than one cm thick and are about the same range as the Aliabad types, i.e., thicker than most of the sherds of the Iblis types. There are some large vessels, however, with a wall thickness of 15 mm. Forms: appear to be principally wide mouth bowls with unmodified rims. Site L-5 showed two sherds with sharply everted rims. Base: flat bases and bases with foot rings, some of which are rather high.

Site L-3 (Pl.6). The first of these knolls was on the left hand side of the road 3 km SSW of Iblis. The surface was covered with stream worn pebbles, chips, spalls, and other litter suggesting lithic workshop activity. Lying among this debris were a great many sherds of Mashiz Plain. There were also a few grit tempered sherds of the type Chari River Plain (See Site B-2). Painted sherds were much less frequent but we picked up relatively more of them. The designs bear a considerable but inexact resemblance to Aliabad Painted of Iblis IV, and some of the forms of the plain pottery are indistinguishable from Aliabad Plain.

Site L-4 (Pls.7,8). Another small site was located 1.5 km SSW of L-3. The assemblage resembles that found at Site L-3 but there were many more sherds of Iblis IV. Occupation of this site evidently began earlier than most of the others. The site is bisected by the road bed and part of it has been gullied and eroded where water drained toward the ancient river bed. Several large scraper and knife-like implements were found. All chipped stone, spalls, and artifacts continued to be of dull black igneous rock noted at L-3. One or two partially spalled specimens still exhibited the original rind. These were worn pebbles originally, but no such pebbles could be found in the nearby river bed.

Site L-4A. This site was not recorded in the original reconnaissance and therefore not numbered at that time. It was noticed on a later visit and is perhaps an extension of L-4. occupancy. L-4A covers a 20 m long ridge located 50-60 m north of L-4. An old dried up creek or spring branch separates the two sites. There were 3 alabaster sherds among the pottery. Three faceted flake blades imply a possible earlier occupation although the ceramics showed no significant change. A greater than usual number of stream-worn cobbles littered the site. Their use in house construction might explain this.

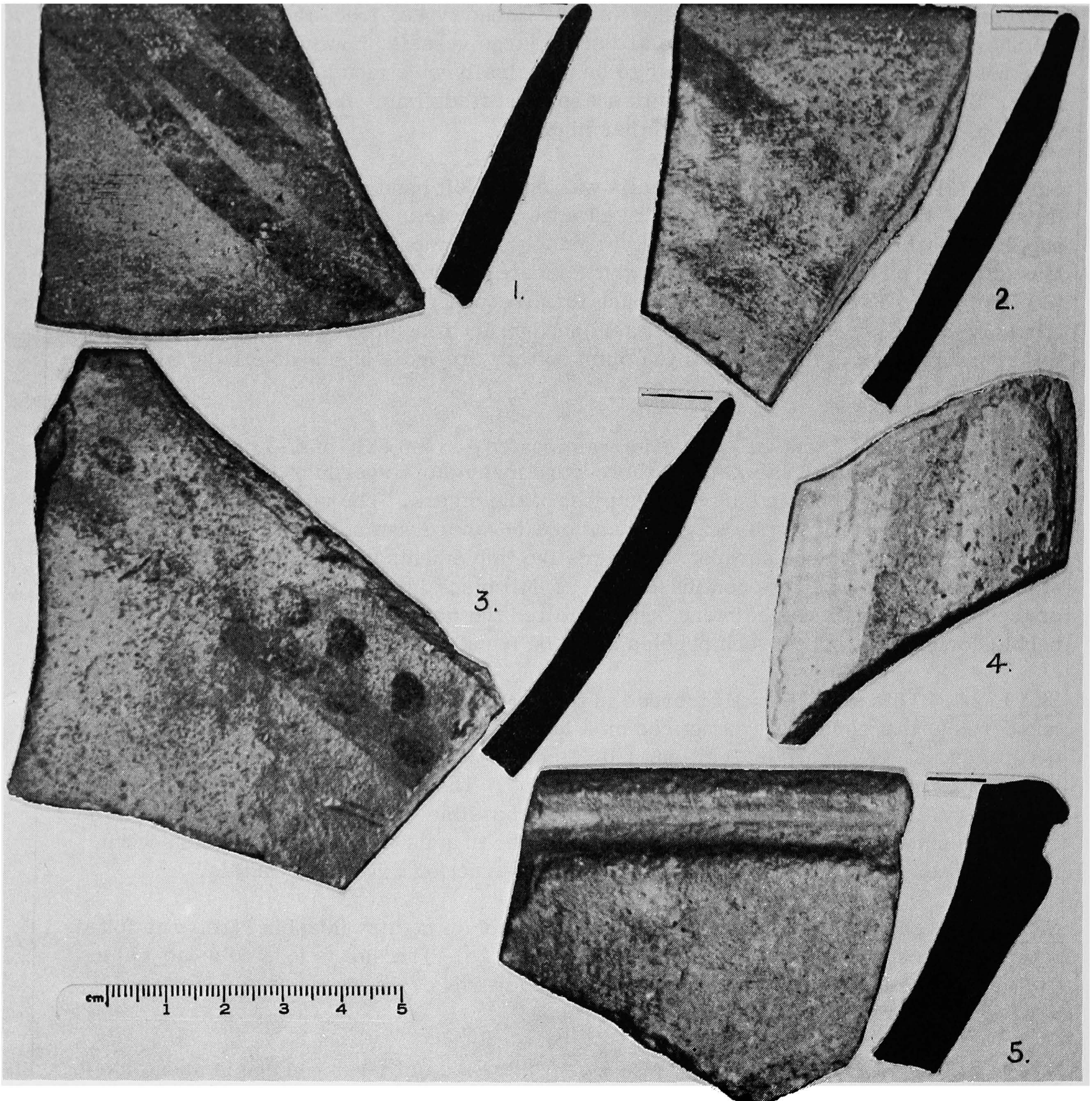
Site L-5. Again, the same association of reddish plain pottery (Mashiz Plain) was found together with cobbles and spalled black igneous rocks. The site is located some 150 m west of the road and almost 200 m from the old river bed. A fragment of a copper artifact -- possibly a projectile point, was found.

Site L-6. This site crowns a slight rise overlooking the old river bed and is about 300 m southwest of Site L-5. It is about 50 m in diameter with an impressive scattering of chipped stone. Below and parallel to the escarpment are four one meter concentrations of cobbles in a linear arrangement. The ceramics of this site is either of Period V or a mixture of IV and V.

Sites near Mashiz (Bard Sir)

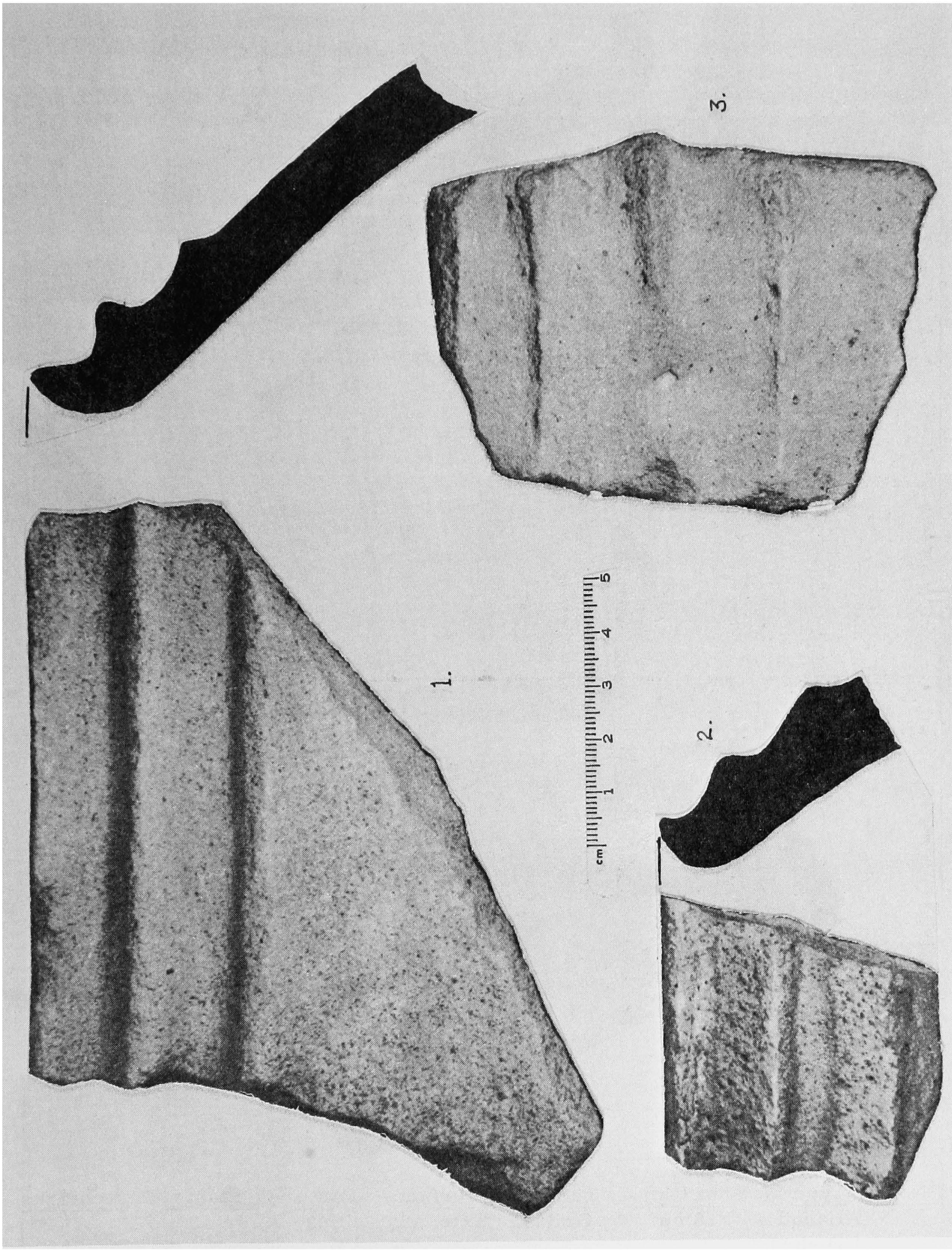
M-1 Site on West Bank of Lalehzar River near Mashiz. Close by a high point along the first terrace of the Lalehzar River on the west bank, and about 3 km southeast of the sugar refinery at Bardsir, was located what appeared to be a small late Islamic site. Many sherds of unglazed stoneware, and glazed sherds of the blue and white, and blue figures outlined in black were found. Also, nine sherds of Lalehzar Coarse ware, characteristic of Iblis I or earlier, were found on the surface.

PLATE 6 L-3 SSW OF IBLIS



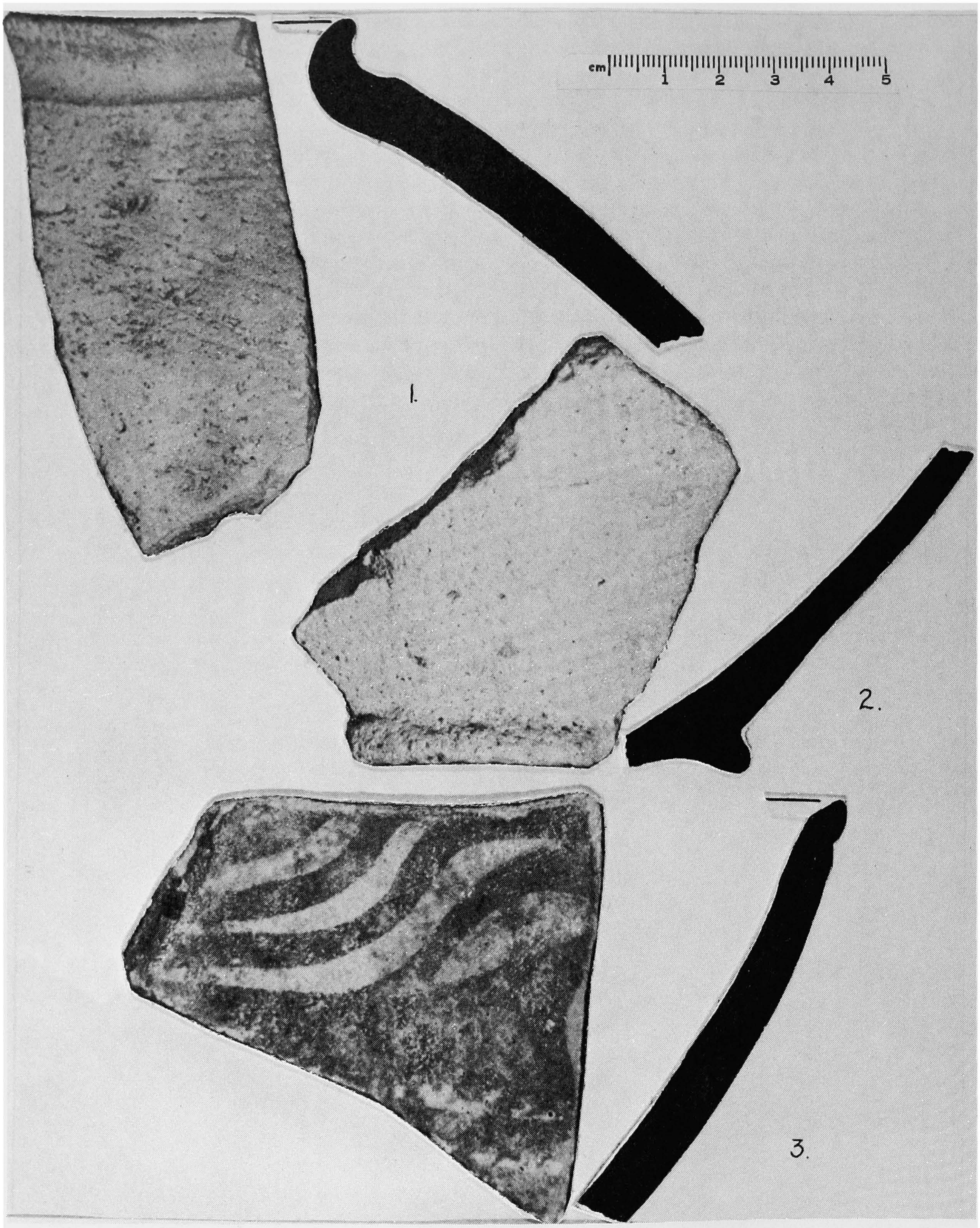
No.	Type	Diameter of Rim	Temper	Surface	Paste	Color of Paint
1	Aliabad Painted ?	20	Grit	Interior Buff Slip	Red-brown	Black
2	Aliabad Painted ?	22	Grit	Interior Buff Slip	Red-brown	Black
3	Aliabad Painted ?	--	Grit	No Slip	Brick-red	Black
4	Aliabad Painted ?	--	Grit	Exterior Buff Slip	Brick-red	Black
5	Mashiz Plain or Aliabad Ridged	60	Grit	No Slip	Brick-Red	

PLATE 7 L-4 SW OF IBLIS, ALIABAD RIDGED



1 Dia. 50 cm, grit tempered, no slip, red-brown paste.
2 Grit tempered, buff slip, gray paste.
3 Grit tempered, no slip, red-brown paste.

PLATE 8 L-4 SSW OF IBLIS



No.	Type	of Rim	Temper	Surface	Paste	Paint	Remarks
1	Aliabad Brushed ?	18 cm	Grit	Exterior Buff Slip	Pink		
2	Mashiz Plain	of base 8 cm	Grit	No Slip	Red-brown		
3	Mashiz Painted	--	Grit	Buff Slip	Pink	Brown	

M-2 Site on South Bank of Lalehzar River (at a point beyond where river turns west and where Bard Sir-Haidarabad road fords the Lalehzar River). This site was indicated by a few small mounds -- presumably remnants of sun-dried brick dwellings. Surface collections recovered included:

Gray unglazed stoneware:	12 (2 incised)
Glazed blue and white:	2

This site was probably a small, late, Islamic settlement.

M-3 Small Site South of Haidarabad. Haidarabad (Kheyrabad in Fig.1) is a small village about halfway between Tal-i-Iblis and Mashiz. The site is about 200 m south of the edge of the village and borders the dirt road leading southward toward Dashkar. The site is on a slight rise surrounded by low flat fields which are cultivated when water is available. Surface collections indicated habitation in later Islamic times -- probably between the 14th and the 16th Centuries A.D. Artifacts recovered from the surface were as follows:

Non-glazed ware:	3 (1 incised)
Monochrome blue or green:	6
Blue and white glazed:	6
Blue and black outline glazed:	7
Imitation celadon:	2

During the month of October 1966, the personnel of the Tal-i-Iblis project were visited by members of the Minnesota-Bampur Project directed by Mr. Gary Hume. During their stay in Bard Sir, both Mr. Hume and Mr. Zebidollah Ramatian, Iranian Archaeological Service representative attached to the Bampur project, conducted reconnaissance in the Lalehzar River valley and adjacent regions. The following sites were explored by Mr. Ramatian in the Lalehzar Valley north and west of Bard Sir.

M-4 Abdollahabad. This site is described as being"on the north side of the Lahlezar River on the road to Rafsanjan." Specimen containers from various areas of the Abdollahabad site were separately numbered.

Container No. 4(?):	Unglazed stoneware:	8
	Thick sherds, monochrome glaze:	4
	Underglazed painted:	1
	Seljuq fine glazed:	3
	Glazed black with blue:	1
	Glass bottle fragments:	2

Early, Medieval and later Islamic levels may be indicated. Some sherds are Seljuq, Timurid and early Safavid.

Container No. 5:	Gray stoneware, unglazed:	12
	Unglazed redware, plain:	21
	Unglazed redware, incised:	4
	Painted underglaze blue:	1

This area is probably Pre-Islamic with a medieval Islamic component.

Container No. 6:	Thick stoneware sherds including handle fragments:	12
	Plain unglazed redware:	6

This area may be Pre-Islamic.

Container No. 7:	Cranial fragments, ribs, scapula, 4 lumbar vertebrae and portion of aveolar structure - pre-adolescent child.	
Container No. 8:	Gray stoneware, unglazed sherds:	3
	Partially restorable handled unglazed vessel:	1

M-5 Site West of Mahmudabad. A short distance west of Mahmudabad Mr. Ramatian noticed Islamic sherds which appeared similar to some he collected from Abdollahabad (M-4). He then turned south to a village called Ali Abad on the south side of Kamalabad but found nothing.

M-6 Site near Kamalabad. Near Kamalabad on the Rafsanjan road in an area near the Lalehzar River were Islamic and possibly Late Sassanian sherds.

M-7 The Site of Mileh Hajim. Located south of Kimalabad on a very sharp point of a mound.

Possible flake artifact:	1
Red grit tempered unglazed sherds:	5
Red unglazed stoneware:	1

This material is insufficient for identification.

Sites West of Bard Sir Near the Sorkh River

The first two sites were reported by Mr. Garry Hume of the Minnesota-Iranian Project. His reconnaissance took place October 12, 1966. Information on these sites is based on his notes.

S-1 Sirjan Road. This site may be near an old mine, possibly Islamic. It was located on a high terrace among hill formations west of the Bard Sir area. The collection included 12 objects, several lumps of chert, several stoneware unglazed sherds and one blue glazed late Islamic sherd.

S-2 Sorkh Cave Site. Located in a hill range west of Bard Sir, this cave appears to be natural. Exploration by Mr. Hume uncovered the following specimens:

Malachite:	4
Glazed and Unglazed sherds of probable Islamic origin:	6

(Collection included one Seljuq fine-glazed sherd)

This site may be close by a copper mine of Islamic time.

S-3 Qaleh on the Bandar Abbas Road. This site is described as being 15 km west or southwest of Bard Sir on the Bandar Abbas road. It occupies a high river terrace on the west bank of an old stream which has nearly dried up. The walls of the qaleh are nearly intact on all four sides except for considerable erosional damage to the west wall. The rooms and a rampway on the south side are filled with sand and rubble from the crumbling upper structure. The corner bastions are still discernable on the northeast and northwest corners. Nothing definitive was found within the walls, the pottery consisting of about 30 specimens entirely of a thick, unglazed plain or broadly incised type. Dr. Fehérvári believes the structure may be Sassanian.

S-4 Qaleh-i-Minar Site near Jazu. This large and impressive qaleh is located on the north side of the Bard Sir - Bandar Abbas road some 22 km west of Bard Sir and near the small village of Jazu (Fig.4). The walls and main gateway are intact for the most part, with the upper structures showing considerable weathering. One corner tower (northwest) contains a small room -- in excellent state of preservation. Sherds gathered from the area inside the walls include both glazed and unglazed types. Underglaze painted specimens were among those identifiable. The site appears to date from as early as the fourteenth to the fifteenth century A.D. Several blue on white glazed sherds imply continued usage of the site through more recent Islamic times.

The structure covers a large portion of a ridge with the gate opening toward the south. The ridge overlooks a small stream which flows roughly east and west through the village of Jazu. Exposed surfaces in the village area were examined for ceramic specimens but none were found which would be contemporaneous with the qaleh itself.

Sites in the Vicinity of Negar

N-1 Qaleh-i-Negar. Negar lies some 80 km southwest of Kerman and about 22 km east of Bard Sir. Negar must have been a very important place in early and medieval Islamic times and the ruins of a Seljuq castle stand there. There is also a Seljuq mosque of which only part of the sanctuary and minaret survive (Pl.9:1). The rest has been altered and restored. The upper part of the minaret is missing, but the surviving lower section has a wide horizontal field decorated with faience tiles in turquoise-blue bearing a plaited-Kufic inscription. Unfortunately most of the tiles have already disappeared. The rest of the minaret discloses a lozenge design in the hazarbaf technique with glazed brick in the center of each lozenge.[1]

To the north of the village of Negar are the ruins of a fortress. It is rectangular in form with the ruins of corner towers. Of these towers one (on the southwestern corner (Pl.9:2) still exists. There was a moat 15 m deep around the citadel. On the surface were a great number of sherds, including unglazed fragments decorated with stamped, incised, molded or relief designs. Seljuq white wares were also noted. Splashed wares with green painting of the 9th and 10th centuries were found together with slip-painted wares of the 10th and 11th centuries. Underglaze-painted pottery was represented with black painting under turquoise glaze. Later Islamic wares were represented by blue on white sherds of the Kerman type suggesting a 15th century date.

N-2 Tal-i-Menegar. This site is known to the townspeople of Negar as being an ancient ruin but all are uncertain of its age. Located on the western edge of the village of Negar, it appears as a very large hemispherical knoll which the townspeople refer to as a "tal." Examination of the hill disclosed that it is probably a natural rise in the floodplain of the Lalehzar rather than a succession of ruined superimposed sites. It must be said, however, that an impressive amount of pottery may be observed on the surface of the knoll, mainly on its lower slopes and those parts which tend to level off. Nearly all the sherds were of heavy thick grey or reddish stoneware of the unglazed variety (Pl.10). Some appeared to have had spouts. Decorations were of the incised variety -- often a multiple line or "comb" type. A few were punctated or exhibited punctates in combination with incised motifs. Only two glazed sherds were found, both a pale dull blue. Fehérvári suspects these may be Sassanian. The almost complete absence of glazed sherds on a site with

1 The Seljuq castle and the mosque were mentioned by Arthur U. Pope in Survey of Persian Art, Vol. II, A. U. Pope and P. Akerman (ed.), London, pp. 998, 1024, 1033, 6 vol., 1938. He also referred to a Seljuq bath which we were unable to find.

FIGURE 4 QALEH-i-MINAR

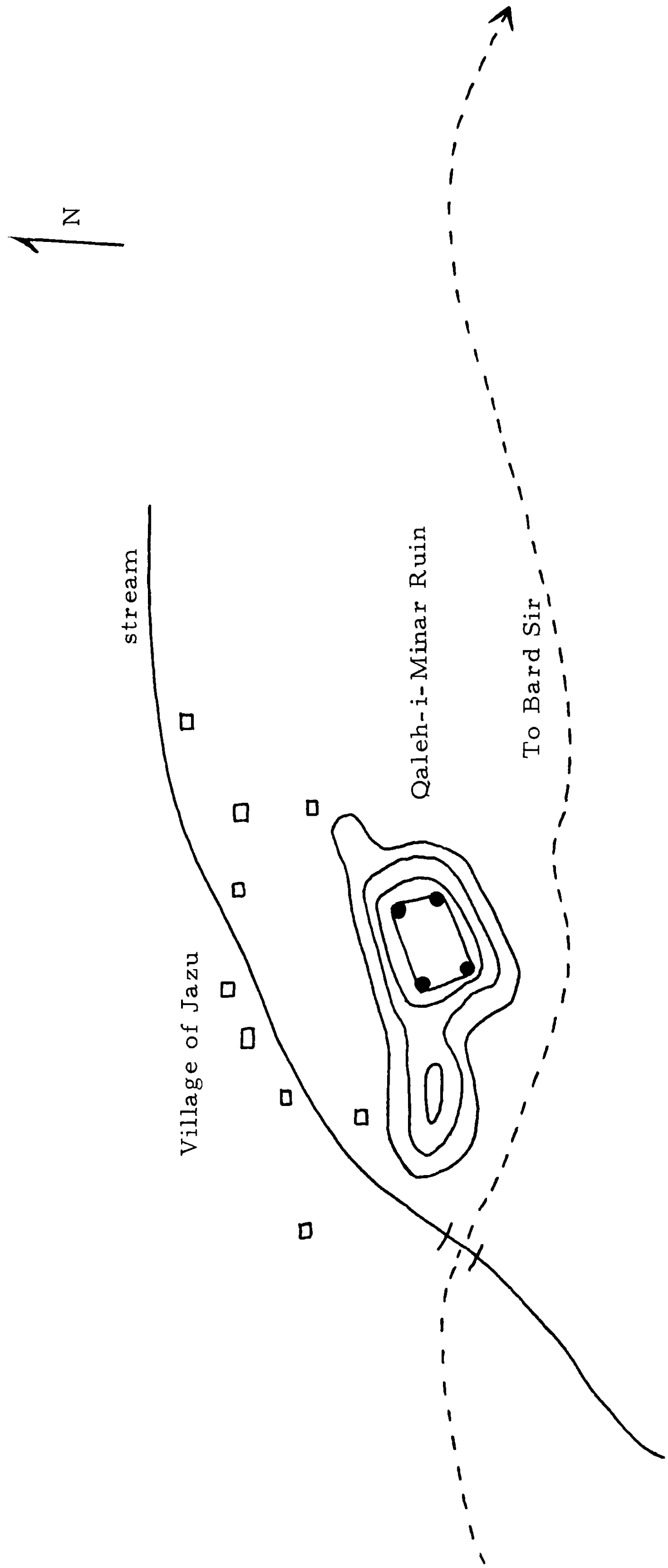


FIGURE 5 - QALEH NEGAR AND TAL MENEGAR

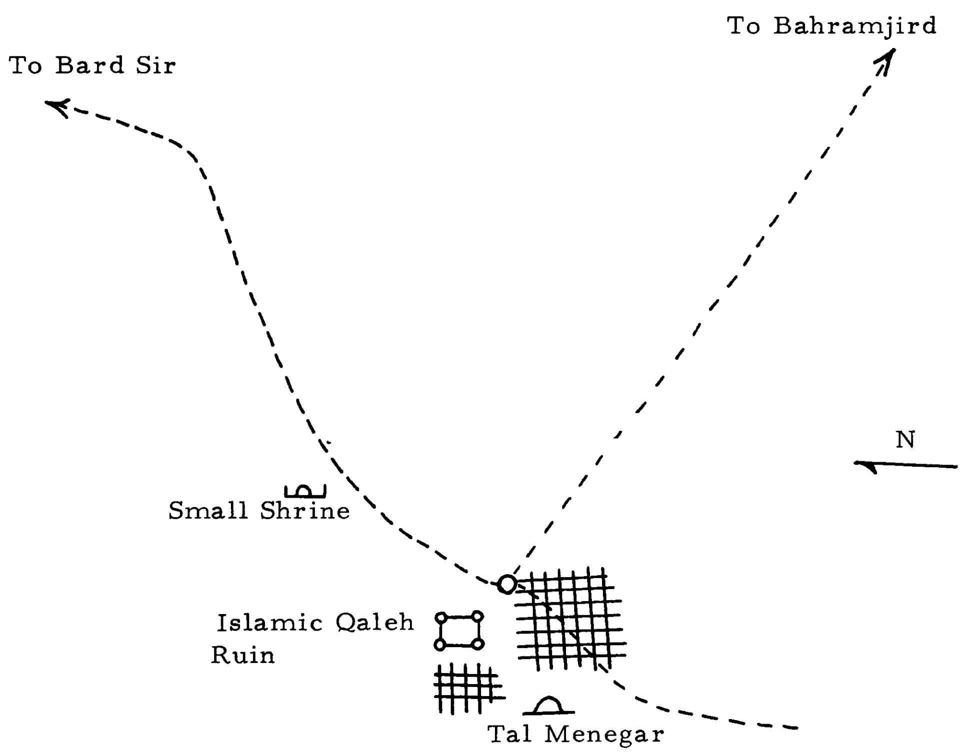
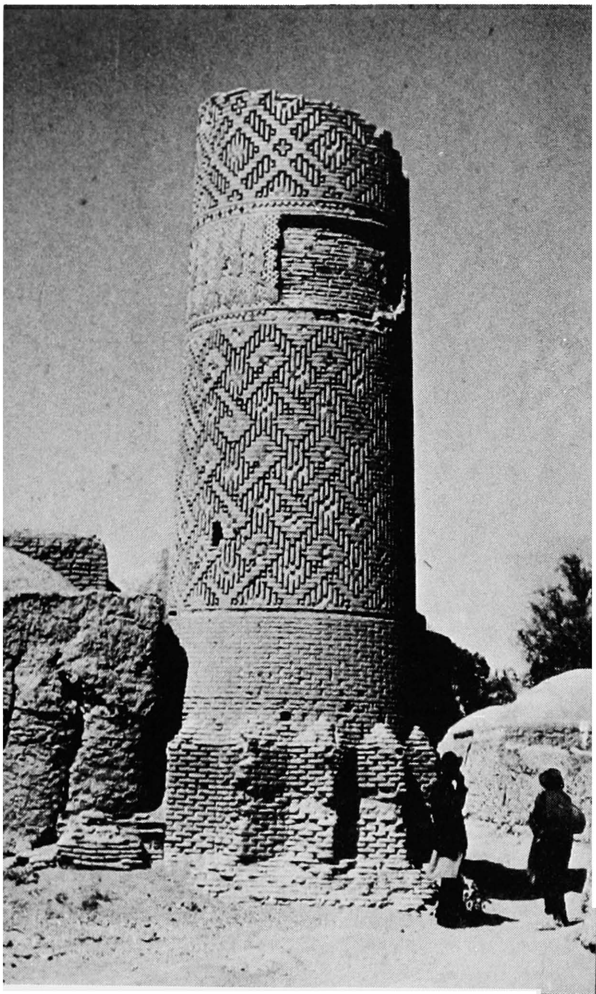
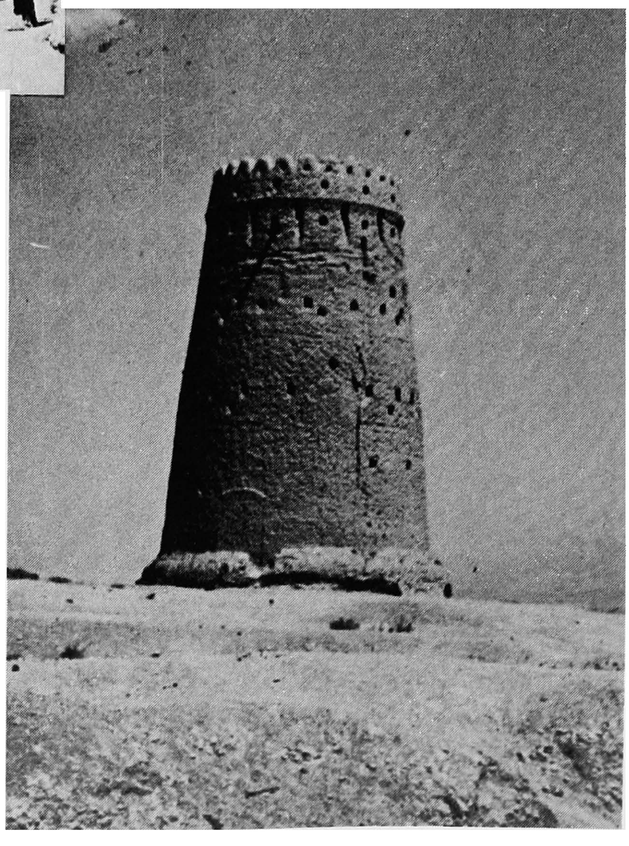


PLATE 9 - NEGAR

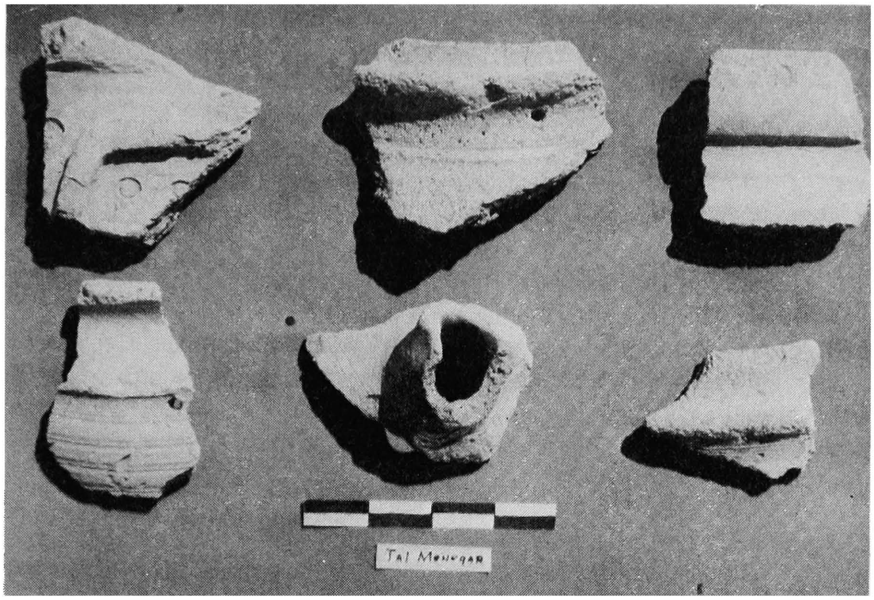


rt of ruined Seljuq Mosque
Negar.

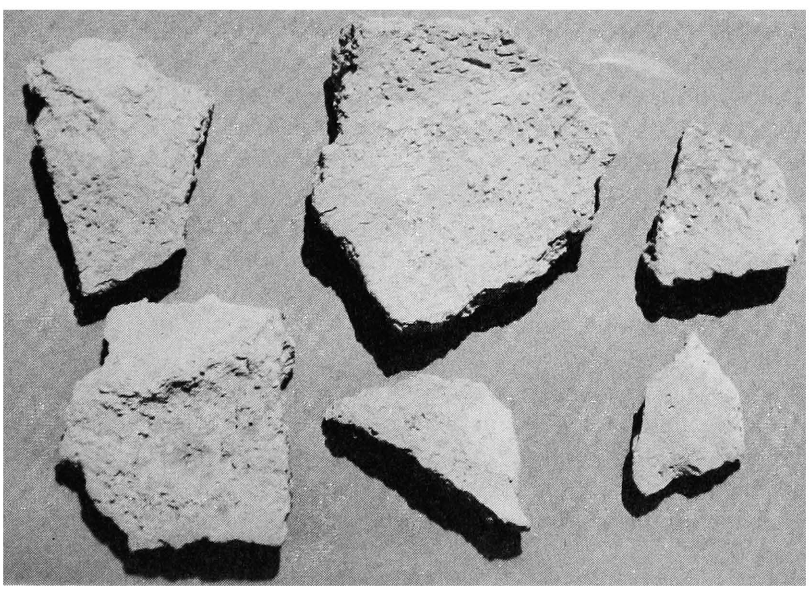


Northwest tower of Fortress
at Negar.

PLATE 10 - TAL MENEGAR AND SITE B-2



Tal Menegar: Gray Stoneware



Site B-2, Chari River Plain

such a large concentration of pottery implies a pre-Islamic site. Villagers informed us that the old name for "Negar" was "Menegar." This, if true, poses the need to determine the place name for Nigar in either early Islamic or Sassanian times as a clue to the identity of the ruin.

Artifacts gathered during the reconnaissance from the Menegar site are as follows:

Chahri River Plain:	1
Rough surfaced red ware:	5
Gray stoneware:	15 (incl. 1 reed punctated; 2 other type punctated; 6 comb incised and 6 plain - one with handle, one spout).

The Chari River Sites

The sites which are to be described were initially explored during the first week of October 1966. The Qaleh-i-Ghubeyra site was visited on three separate occasions; first with Geza Fehervari and again with Fehervari and Cyril Smith. These sites are clustered in that part of the Chari River valley which passes through the modern village of Bahramjird, and are identified numerically.

The Chari River appears to be a perennial stream which is fed by snow melt and springs originating among the high mountains of the Lahlezar group which lie to the southwest of Tal-i-Iblis. It meanders through a broad valley bordered by distinct terraces cut into gravel beds of probably recent geological origin. A main tributary, the Ghubeyra River joins the Chari at a point some 11 km west of the Bahramjird village. Another small community just beyond this point on the north bank of the Chari River is Qariat-al-Arab (Village of the Arabs). The Arabic name is somewhat of an anomaly in this area and of interest because of its proximity to the Qaleh-i-Ghubeyra site which will be described shortly. Bahramjird is located about 17 km east of the town of Negar.

Site B-1 (Fig.6). On the eastern outskirts of Bahramjird and extending along the second terrace above the Chari River a large concentration of pottery was seen. Most sherds were of Islamic times; however, on the slopes of a small knoll at the easternmost extension of the site, a wide scattering of plain grit tempered sherds was found (6 specimens collected) which are probably pre-Islamic. These sherds are as follows:

Seljuq fine:	1	Grit tempered red plain:	6	Chari River Plain:	5
Tin glazed:	1	Red slipped incised:	1	Incised grayware:	5
Underglaze-painted:	2	Plain red slipped	1	Plain handled:	1
Blue on white gl.:	2	Simple stamped (?):	1	Monochrome blue glaze:	1

The unglazed wares are types similar to those of the Qaleh-i-Dukhtar of Kerman and Qaleh-i-Negar. A great number of monochrome-glazed wares, mainly of greenish or turquoise glaze, represent different periods, perhaps pre-Islamic (Sassanian?). The other glazed wares belong to the tin-glazed green painted group of the 9th - 10th centuries; underglaze-painted pottery of the 12th - 13th centuries and some Kerman blue on white were found.

Site B-2 (Fig.7)

This site is located on the north bank of the Chari River on the second terrace. Concentrations of pottery cover two large knolls and to a lesser extent, a lower gulley between them. The bulk of the pottery gathered was a gray unglazed stoneware, some plain and

FIGURE 6 SITE B-1

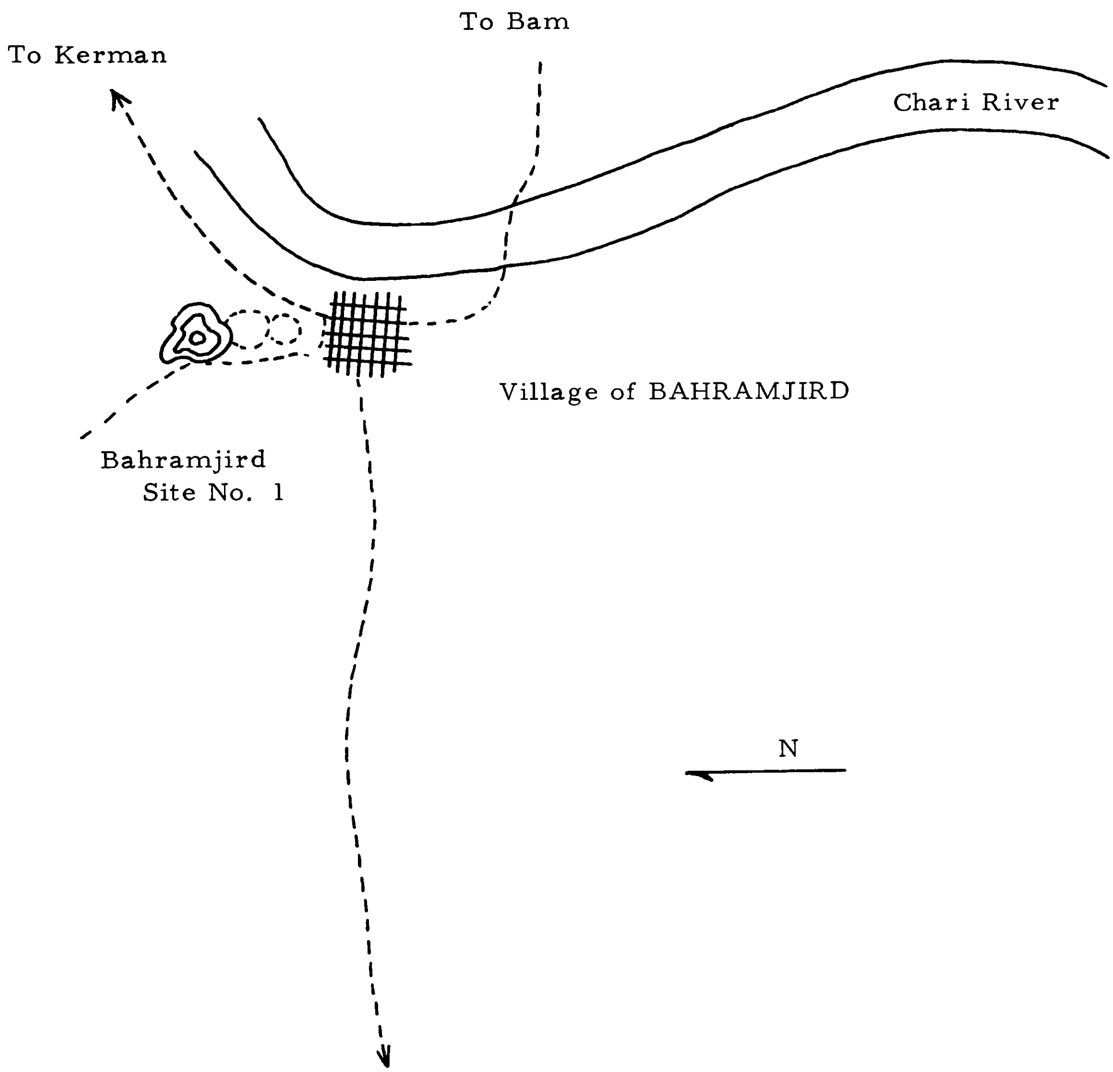


FIGURE 7 - SITES B-2 AND B-3

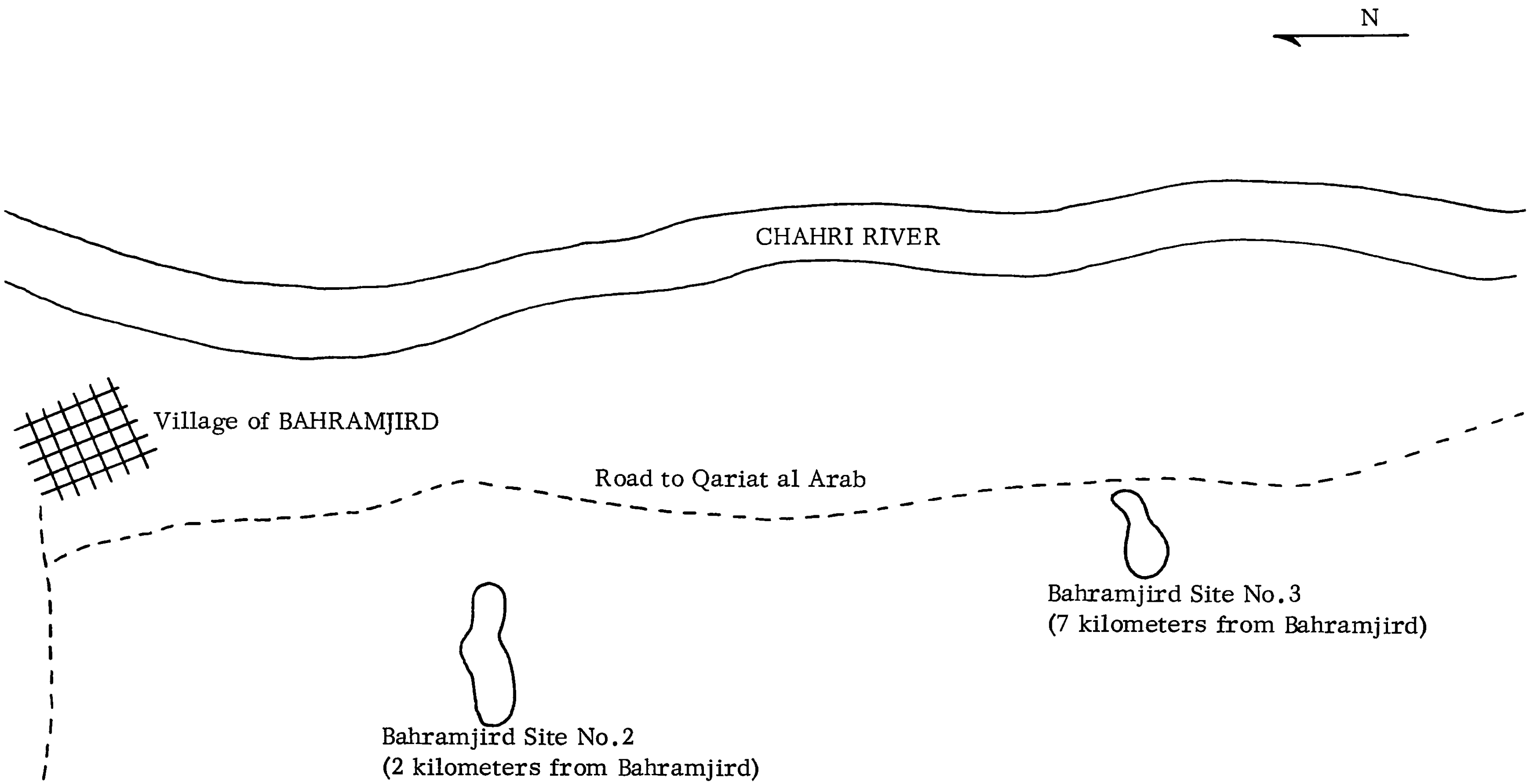
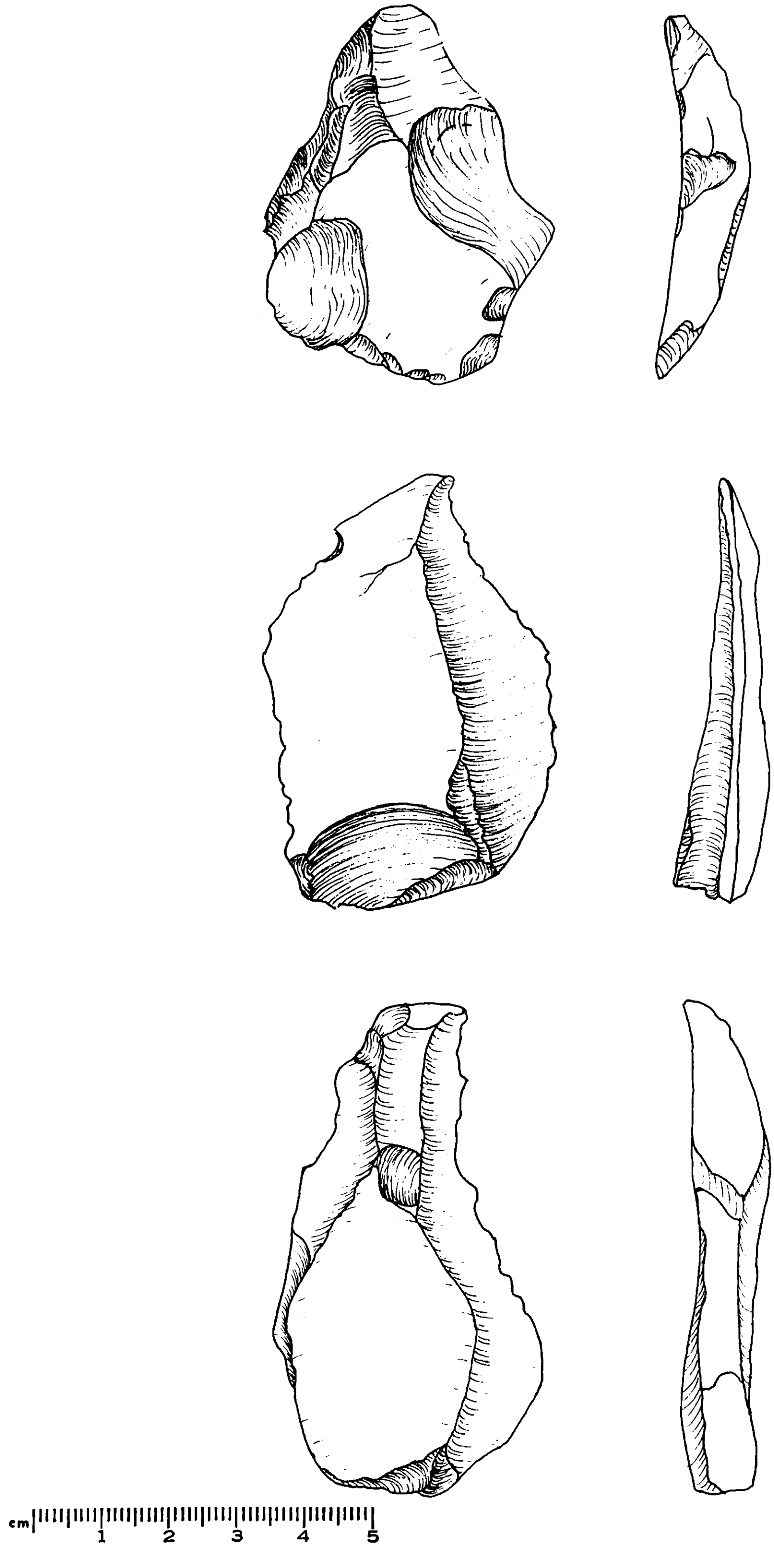


FIGURE 8 POSSIBLE MOUSTERIAN ARTIFACTS FROM SITE B-3



These were redrawn from pencil sketches and probably are not absolutely correct.

some incised, with an equally large number of hard red (Mashiz Plain) sherds like that found on the surface at Tal-i-Iblis and the nearby knolls along the abandoned channel of the Lalehzar River (sites L-3 through L-6). A third pottery type (Pl.10:2), not nearly as abundant on the surface but clearly different from the gray and red ware already noted, was found along the slopes toward the southern edge of the site. This ware, a somewhat soft and grit tempered plain type was represented by 22 gathered examples plus several large sherds which proved to be about one third of a pottery vessel. This vessel appeared to be globular with a sharply everted rim having a rounded lip with one loop handle extended from lip to shoulder. Other sherds found exhibited lip notches. For reference purposes and because it appeared that we were dealing with a type of pottery as yet undefined in this area, this ware was given the name "Chari River Plain." This type is referred to by this name elsewhere in this report and in the report dealing with work at Tal-i-Iblis. Other objects found at B-2 were listed as:

Open spout:	1
Smooth plain yellow ware:	1
Smooth incised yellow ware:	3
Blue glaze monochrome:	1
Comb incised grayware:	4
Incised red stoneware:	18
Comb incised red ware:	5
Chari River Plain:	22 plus one partially restorable vessel

This site may be entirely pre-Islamic with several components. Further investigation is to be recommended.

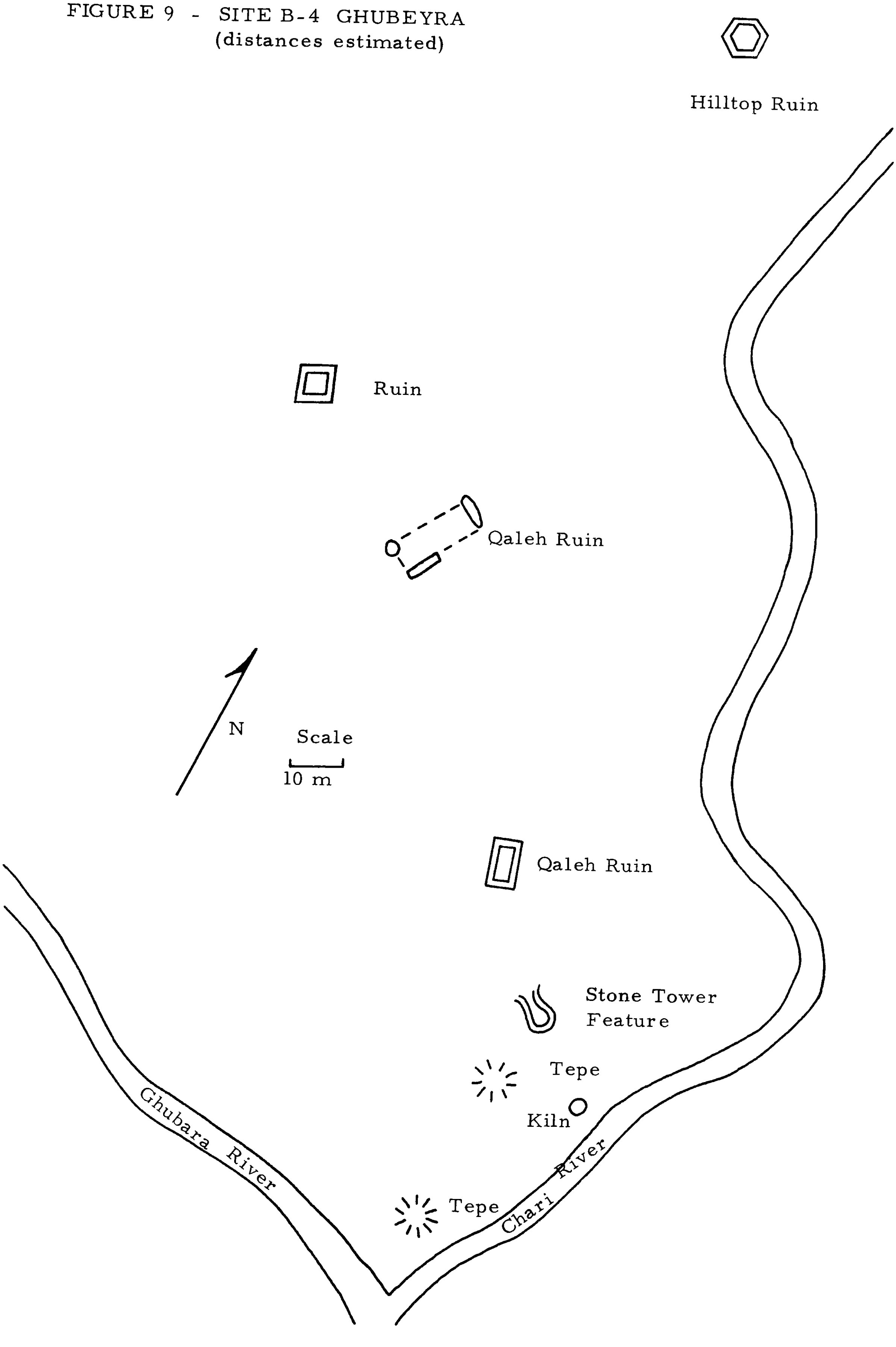
Site B-3 (Fig.8).

This site is located 7 km west of Bahramjird village on the north bank of the Chari River on a very high third terrace. Landmarks on the site consist of one or two small clay piles -- probably remnants of mudbrick dwellings which may or may not be very old. Ceramics were found well back from the edge of the terrace which had a very gravelly surface. Four flints were found which appeared to have been shaped by hammering or percussion. One had been retouched along a concave edge giving it a "spokeshave scraper" appearance. These objects were later examined by Mr. Gary Hume who was of the opinion that they were true artifacts, and strongly resembled certain Mousterian types he has seen. The inventory of this site included the following types:

Incised unglazed stoneware:	6
Splashware:	5
Early luster:	1
Underglaze-painted:	2
Slip painted:	4
Blue on white:	2
Sgraffiato:	1
Monochrome blue:	1

The site appears to have had a long term occupation area in Islamic times possibly from as early as the tenth century A.D. The presence of flint artifacts on the site is interesting but more work would have to be done there to establish it as an important paleolithic site (see Hume, this volume). On a survey map, published by the British War Office and Air Ministry in 1961 (Saidabad, Series 1404, Sheet 443-D) the name Kuveira is shown as the location of site "3". The medieval Islamic city of Ghubeyra was found about 5 km further south on the eastern bank of the Chari river.

FIGURE 9 - SITE B-4 GHUBEYRA
(distances estimated)



Site B-4 (Fig. 9)

Of all of the sites found in this general area, this was the largest and most prolific. Located 11 km west of Bahramjird, the ruins and surface evidence are concentrated at the junction formed by the Chari and Ghubeyra Rivers. The latter enters the Chari from the south and at the time of our reconnaissance, it was quite dry. The principal ruins are visible for a distance down the river valley. The largest of these is a qaleh which had been built on the top of a prominant hill like two others in the vicinity. In extent, the site can be traced for nearly a kilometer from the mouth of the Ghubeyra upriver along the Chari. There are two ruined saints' tombs, two qaleh type high wall rectangular structures, the base of a stone tower whose function could not be determined, and two small tepes which appeared to be associated with a scattering of Aliabad or Iblis IV pottery. In addition, a small kiln close to the bank of the Chari was superficially investigated by Fehervari and Smith.

Close to the junction of the two rivers pre-historic painted pottery was found, while further south pottery which might be Sassanian was discovered. Otherwise the pottery found on the surface was of Islamic times. A great number of unglazed sherds were found, all of white, closely-grained paste, some with relief decoration showing Kufic inscription and one piece showing a fish. Glazed wares were mainly of the Nishapur and Samanid slip-painted types indicating a date of the 10th or early 11th century. Simple sgraffito wares with brownish-yellow and green glazes were found, one showing the head of a bird under brownish-yellow glaze. These sgraffito wares occurred on the northern part of the site. It was here that we found the pottery kiln. The outlines of the kiln show a rectangular form of 300 by 180 cm with a fire-hole of 42 cm (Pl.11). Part of the kiln walls showed remnants of greenish glaze on the inner surface.

PLATE 11 SUPERFICIAL EXPOSURE OF POTTERY KILN AT B-4 (Ghubeyra).

Monochrome glazed and underglaze-painted sherds were also found, probably of the 13th - 14th centuries. Two or three pieces of Kerman polychrome ware and others of blue on white were also collected. In general, however, the Islamic pottery suggested an occupation before the end of the 15th Century.

The presence of thick stoneware sherds of the unglazed type, many of which were red slipped, together with the prehistoric ceramics already mentioned indicate the long history of the site. At one point along the Ghubeyra River bank, a large number of flint spalls and what appeared to be workshop debris were found. None, however, could be regarded as diagnostic.

A listing of the non-Islamic artifacts is as follows:

Stone:	Perforated heavy stone ring:	1
	End scraper, chert:	1
	End-side scraper combination:	1
	Chert core:	1
	Flake blades:	2
	Alabaster fragment:	1
	Alabaster sherds:	2
	Small knife, red jasper:	1
	Ovate end scraper:	1
	Large trianguloid end scraper:	1
Pottery:	Chari River Plain:	1
	Burnished red slipped, red ware:	6
	Grit tempered (Chari type) red slipped:	1
	Aliabad Painted (Iblis IV):	72
	Closed spout:	1
	Buff Plain (Aliabad?):	17

That this site is in need of further investigation goes without saying. Collateral investigation of the pre-Islamic components of the site is also imperative. Evidence recovered during our reconnaissance suggests a possible continuing occupation of the site from as early as 3500 B.C. and possibly earlier.

Arabic and Persian geographers give us some information on Ghubeyra. It is mentioned by Istakhri in the Masalik wa Mamalik, which was written in A.H. 5th - 6th Century (A.D. second half of the 10th Century).[1] It describes the road from Sirjan to Bam. The cities or stations shown between the above places are as follows: Sirjan - Shamat - Ghar (or Bahar) - Khannab - Ghubeyra - Kughun - Rayin - Sarvestan - Darchin and Bam.

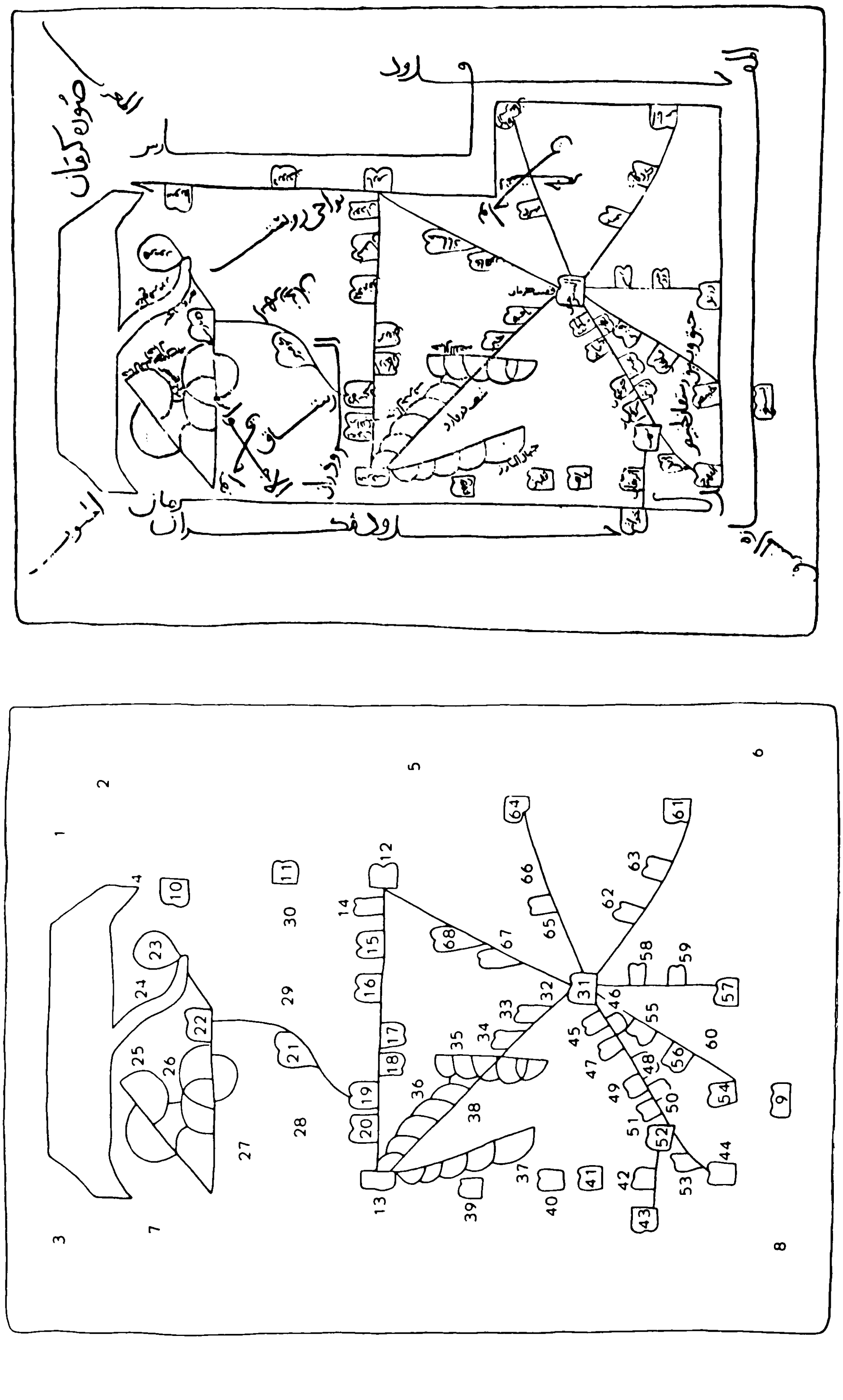
The same road is described in Ibn Hawqal in the Kitab Surat al-Ard.[2] The map of the Kerman region (Pl.12) showing the above route is on p. 304, no.13.[3] Ibn Hawqal is more specific than Istakhri, giving the distances. The same distances are given by Ibn

1 Teheran edition, 1961, p.140 and map facing p.139.

2 Brill, Leyden, 1939, vol. 2, p.407.

3 Pl.12 was taken from the French edition of Ibn Hawqal (Kramers and Wiet, Configuration de la Terre, Tome II, ed. G.T.Maissannlewe and Laroff, Paris.

PLATE 12 - MAP OF KERMAN REGION ACCORDING TO IBN HAWQAL.



Khurdadbih in his Kitabu 'l-Masalik wa-'l-Mamalik,[1] which is the oldest geographical work in Arabic. He writes that the distance from Sirjan to Shamat is four parasangs, then to Quhistan six parasangs, to Qaratah six parasangs, to Rustaf six parasangs, to the town of Khannab four parasangs, to Ghubeyra five parasangs, to Khan Juzan five parasangs, to Khan Khukh six parasangs, then to Sarvestan seven parasangs.

The Hudud ul-Alam describes the route the same way as it appears in Istakhri and Ibn Hawqal, and informs us that these cities "belong to the cold zone, have a good climate, and are prosperous and very pleasant. They have running waters and a numerous population."[2]

It is probably Muqaddasi who gives the most precise description of Ghubeyra.[3] "It is a small town surrounded by villages (B-3 must have been one of these villages), with a fortress in its midst, while outside was the market recently built by the Governor Ibn Ilyas. Both this place and Kughun have fine mosques and the water comes from qanats."

The ruins of a fortress (Pl.13:1) and a palace are still visible today. There are also two ruined octagonal imamzadeh (saints' tombs) on two distant hill tops (Pl.13:1, 2), one of them with still standing pointed arches. There is no sign either of the mosque or of the Bazaar. The name of Ibn Ilyas, who according to Muqaddasi built the market, is mentioned a number of times by Guy Le Strange[4] who refers to him as a Buyid governor of Kerman province. In fact he was the Samanid governor of Kerman Province who tried to keep away the Buyids from the region.[5]

At that time the capital of the province was Sirjan and it was only under Ibn Ilyas that the capital was moved to Kerman city. In Abbasid times the main route from Sirjan to Bam was south of Kerman on the route as it is described by Arab and Persian geographers of the 9th and 10th centuries. (This route has been shown by Guy Le Strange, op.cit. map VI facing p.249). It has also been mentioned in two recent studies of the economic situation of Kerman Province.[6]

When one tries to reconstruct this ancient route on modern maps, it seems to be an easier task to start from Bam. Using the already mentioned British War Office and Air Ministry maps of 1961 (Series 1404, Sheets 443-C and D, Bam and Saidabad, scale 1:500,000) one easily finds Darzin (Darchin according to Istakhri and Ibn Hawqal) some 20 km northwest of Bam along the modern Kerman - Bam road. The next station,

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1 Leyden, 1889, p.49.

2 Gibb Memorial Volume, p.125.

3 Bibl. Geogr. Arab, Leyden, 1870-77, 462, 463.

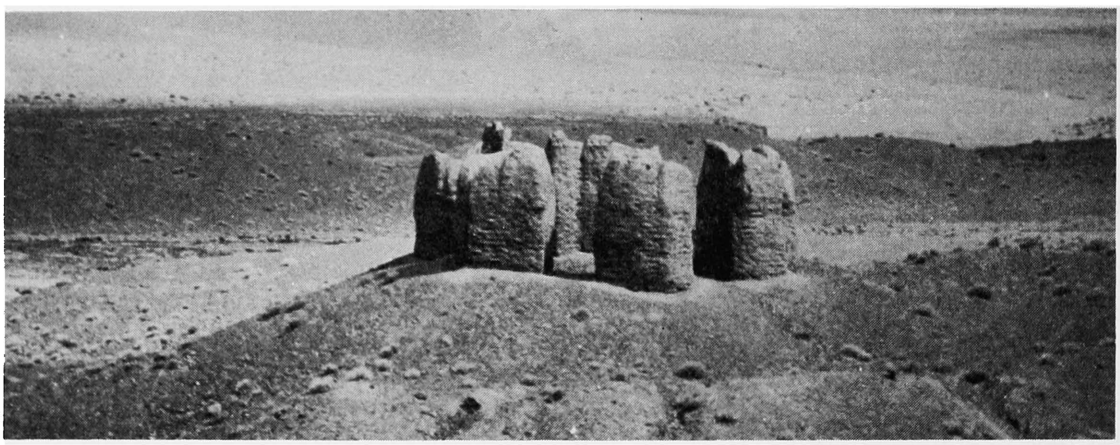
4 The Lands of the Eastern Caliphate, 1905.

5 A. Hautum - Schindler, "Notes on Marco Polo's Itinerary in Southern Persia," Journal of the Royal Asiatic Society, 13, 1881, pp. 490-497.

6 Philip Beckett, "The City of Kerman, Iran," Erdkunde, Archiv fur wissentschaftliche Geographie, Band XX, 2, 1966, pp. 120-125, fig. 1; Paul Ward English, City and Village in Iran; Settlement and Economy in the Kerman Basin, The University of Wisconsin Press, Madison, p. 25, 1966.

PLATE 13 - GHUBEYRA

The Citadel



Octagonal Imamzadeh

Detail of the other octagonal imamzadeh

Sarvestan, is 30 km away to the northwest from Darzin and about 8 km west of the modern road. Rayin, the next stop also exists today and is a rather large and important place. The distance here, however, is much greater being about 56 km north of Sarvestan. Kughun is not known today but judging from the distance that Ibn Hawqal mentions (p.407) it should be somewhere around the village of Qariat-Al-Arab. Ghubeyra is only 8 or 9 km distant from this point.

The road from Ghubeyra turns right to the south and then towards the west. Khannab, which according to Ibn Khurdadbih was five parasangs, should have been around a place called today Baghabad. The next place is supposed to be Ghar or Bahar. There is a small place some 35 km west from Baghabad called Gughar, which is probably identical with Ghar or Bahar. There is a north - south route today which goes from Bard Sir in the north to Baft in the south. The location of Shamat is not known, but it must have been somewhere halfway between Ghar and Sirjan, the latter of which is about 75 km from Ghubeyra. An archaeological survey of this route and the excavation of Ghubeyra are planned for the autumn of 1968.

The central position of Ghubeyra offers favorable opportunities for archaeological reconnaissance. It should be possible to identify major stations on the converging route, all named by the geographers, some of considerable importance, though unlocated in modern times. Such sites are Kughun, said to be only one farsakh from the main site; and Hormuz al-Malik, a mountain settlement near Jiroft which Idrisi claims to have been the capital under the early Sassanians. Visits to Sirjan, and Shahr-i-Daqianus should both be possible, as well as the more distant Shahr-i-Babak, none of which have been described in detail by modern visitors.

There is little material at present for a history of the Kerman province in pre-Islamic times. It is mentioned in the context of the campaigns of Alexander, and was a famous stronghold of Zoroastrianism under the Sassanians. Their influence in the area is attested by such place-names as Bardasir and Narmashir (going back to Ardashir I, if we may discount the etymology proposals by Sykes for the latter), or Bahramjird, relating to Bahram IV Kermanshah. Excavations at Ghubeyra may be expected to yield a type series of pottery and minor objects valuable for establishing the chronology of these and other neighboring sites. At the same time they should throw light on the disused communication systems which intersect at this point. If the finds include the familiar Sassanian bullae these may throw light on the topography and early place-names of the province. If only half the supposed potential results of the proposed excavation of Ghubeyra is in fact realized, a great body of information, economic, political and archaeological will be added to the small store now available from Kerman Province.

IX

COMMENTS ON THE GEOLOGY AND ARCHAEOLOGY OF THE BARD SIR VALLEY

Gary W. Hume

The University of Minnesota Archaeological Project field team completed a short survey in the Bard Sir Valley near Kerman at the request of Dr. Joseph R. Caldwell, Director of the Kerman Project. Dr. Caldwell had extended an invitation to visit his excavations at Tal-i-Iblis and to examine its geological setting as well as other geological features in the valley. Though we did not reach Mashiz until October 9, due to a serious intestinal virus incurred by one of us, it was decided to extend the survey near Mashiz for five days to explore more fully the potential for Palaeolithic sites in this area. Members of the Kerman Project have found Mousterian implements of Late Pleistocene age on the upper terrace of the Chari River east of Mashiz.[1] These represent the nearest Middle Palaeolithic finds to Baluchistan, with the exception of Carlton Coon's excavation of the Kunik rock shelter near Birjand in 1949. The importance of these terraces and artifacts required an investigation by the Minnesota team because the geological, climatological, and archaeological information which can be obtained from this area could be used in the interpretation of the inter-regional relationships of Baluchistan.

In the course of the five day survey the Minnestoa team established the following:

✓ Tal-i-Iblis lies on the bank of a former channel of the Ab-i-Lalehzar. Though the channel can only be traced definitely for seven km before it is lost in a sea ✓ of sand hills at either end, the general orientation and gradient of the abandoned channel seems to follow that of the present Lalehzar. Southwest of Tal-i-Iblis the channel follows a line approximately 45° east of north; it gradually curves to 5° east of north just northeast beyond the mound. There, where it becomes obscured by more recent erosion, the channel seems to be following a general curve toward the lower gradient of the valley, just as the present river curves to the northwest.

A lithic industry found on small knolls along the abandoned channel above Tal-i-Iblis, previously thought to be possibly Middle Paleolithic, is an industry

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1 See Chase, Fehérvári and Caldwell, this volume.

directly associated with a red ceramic ware of the Mashiz complex (Iblis Period V)[1] found on the sites. The lithic material occurs nowhere alone, only with pottery. This industry is represented by surface finds at Tal-i-Iblis and seems to be one of latest occupations at that site. During the course of the survey one new site of this kind was found, bringing the total of such sites to six, all within four km of Tal-i-Iblis. All are located on or near the abandoned channel of the Lalehzar.

Definite evidence of climatic changes of great magnitude has been found in the form of terraces and fossil spring deposits. Pleistocene and recent terraces were located on the Chari River, a tributary of the Rudkhaneh-i-Surkh, and the Rudkhaneh-i-Surkh. Mousterian implements have been found on the upper terrace of the Chari River, though none were found on our survey. Pottery and nondescript lithic material was collected from the tributary of the Rudkhaneh and given to the Kerman Project. No artifacts were found on the section of the impressive terraces along the Rudkhaneh-i-Surkh. These terraces, the highest of which is probably 300 feet above the present river level, represent a process of valley-erosion having been interrupted by intervals of aggradation.

Even more reliable as an indicator of greater rainfall in the Kerman region are the calcareous tufa deposits formed by extinct springs. Four massive deposits were formed on the escarpment of one of the high terraces of the Rudkhaneh-i-Surkh. Such deposits require much greater rainfall than is presently available.

Though the investigation of these geological features was limited in time and scope, it provides an excellent base for further Pleistocene research in this area. Climatic changes of great magnitude occurred, but the sequence of these changes must be worked out by a geologist in a subsequent field session.

The potential for Paleolithic sites in the Mashiz area is great. Terraces, spring deposits, and caves represent potential sites. No artifacts were found in or near the deposits of the spring we examined; however, numerous springs are to be found in the mountains and, I feel confident that a systematic examination of these springs would yield Paleolithic sites. One small rock shelter was found and there are references to some caves in the area. However, the large number of solution cavities in the limestone deposits in the mountains indicate a potential for many more caves and shelters.

References to Caves

1. Take the Sirjan Road; at 35.6 km (see Map No. 1) turn right and cross the Rudkhaneh-i-Surkh; cave is at the crest of the ridge.

2. "Cave Kamar"; no directions were given for this cave, but we learned of its existence from an old man who lives at the top of the springs on Terrace 4 at Stop 2 (see Map).

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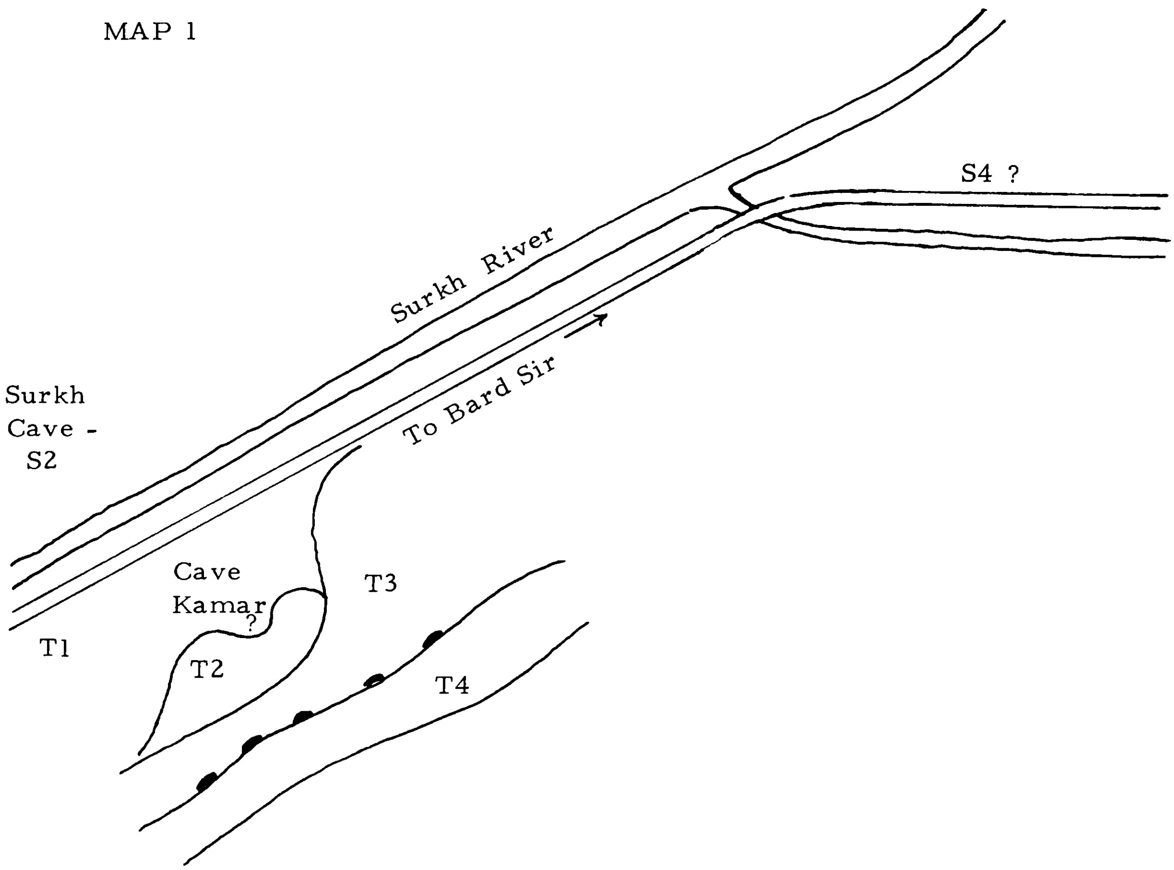
1 Iblis V is still undated. The characteristic pottery, called the Mashiz Complex, apparently follows the Aliabad (Iblis IV) Period at about the end of the 3rd millenium B.C., see Fehérvári, Chase, and Caldwell, this volume (Ed.).

3. "Our Spring Cave"; this can be located on the Rayin Map near Rayin.

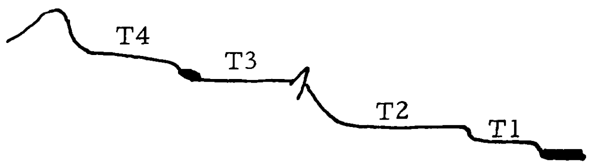
4. "Kote Shah Paraki Cave"
   a. Golmabad to Arreh to Takht-i-boneh.
   b. Sirjan to Balavard passing through Bandehon Mine to Takht-i-Boneh.

5. Chah-i-Chaghot, against Gendarmerie Post on a yellow hill near the rustic house at Kal Gholamhossein.

MAP 1



Surkh Terraces



Spring

X

THE IBLIS SEQUENCE AND THE EXPLORATION OF EXCAVATION AREAS A, C, AND E

David W. Chase, Joseph R. Caldwell and Iren Fehérvári

The three excavations described in the present paper were undertaken to clarify the stratigraphic situation at Tal-i-Iblis. The Caldwell party in 1964 had extracted pottery and charcoal samples from the profile of a mound remnant, but the samples were small.[1] Hence, a thoroughgoing stratigraphic excavation was in order. Because of a difference in excavation methods the data obtained in the 1966 season does not altogether supplant that obtained in 1964 and therefore this paper includes Caldwell's results as well. A considerable part of the new work was done by arbitrary levels which, judging from the appearance of the profiles, did not sharply separate those levels which looked like zones of actual occupation from intervening levels,which looked like fills. The result is reflected in the pottery counts. These show gradually shifting proportions of pottery types "phasing in" and "phasing out" of the sequences. Normally, we should expect material culture changes to be gradual but our pottery counts are not necessarily to be regarded as a demonstration of this, for slowly shifting proportions of pottery types are also a characteristic of digging by arbitrary levels. This method will often include older and later sherds in the same bag and obscure evidence of interruptions in continuity. While both methods gave essentially the same sequence, the advantage of the 1966 work was to provide a large sample of pottery while the advantage of the 1964 sampling was to give us nearly pure assemblages, relatively unmixed with earlier or later materials. In this paper we will try to balance the respective results against each other.

Area A, section A was a deep probe in the floor of the excavation left by the fertilizer diggers (Fig.1). Area A, section B was a northward extension of this to obtain a larger body of material. Area A, section C, was dug adjacent to section A where the profile extended upward on a mound remnant close to that recorded by the Caldwell party in 1964. All sections of Area A were excavated by Mr. Chase.

Area C, investigated by Mrs. Fehérvári, was behind the profile of the mound remnant close to Area A. In Caldwell's Level V, our Level IV, was what appeared to be a large mass of burned bricks, and we wished to learn more about it. A secondary purpose was to continue downward to get a larger exposure of the early levels where the Caldwell party had found several crucible fragments, to obtain more of these and to discover if possible the kind of situation in which the crucibles occurred. Area C yielded so many thousands of sherds that we were simply unable to classify and count them in the field. This was an

1 Joseph R. Caldwell and Sadegh Malek Shahmirzadi, "Tal-i-Iblis, The Kerman Range and the Beginning of Smelting." Illinois State Museum Preliminary Reports, Number 7, Illinois State Museum Society, Springfield, Illinois, 1966.

error which can be remedied in the next season with a larger staff. Instead we could only make detailed studies of particular levels and samplings of pottery counts. The discussion, however, does include the registered artifacts from Area C.

Area E, also investigated by Chase, was an early trash dump well northwest of the mound. This was subdivided into sections, A through G, for stratigraphic examination.

The highlights of the 1966 work include the discovery of the new Iblis I period, which had not been recognized by Caldwell. It has since, however, turned out to be the period with the greatest amount of deposits still remaining. Area E, described in the present paper seems to have belonged mostly to the later part of Iblis I, while houses D, F, and G, described by Evett in this volume, and the houses in area B described by Caldwell and Sarraf probably belong to the earlier part of Iblis I. Table I lists the mound levels as originally defined by Caldwell and our revisions of his sequence.

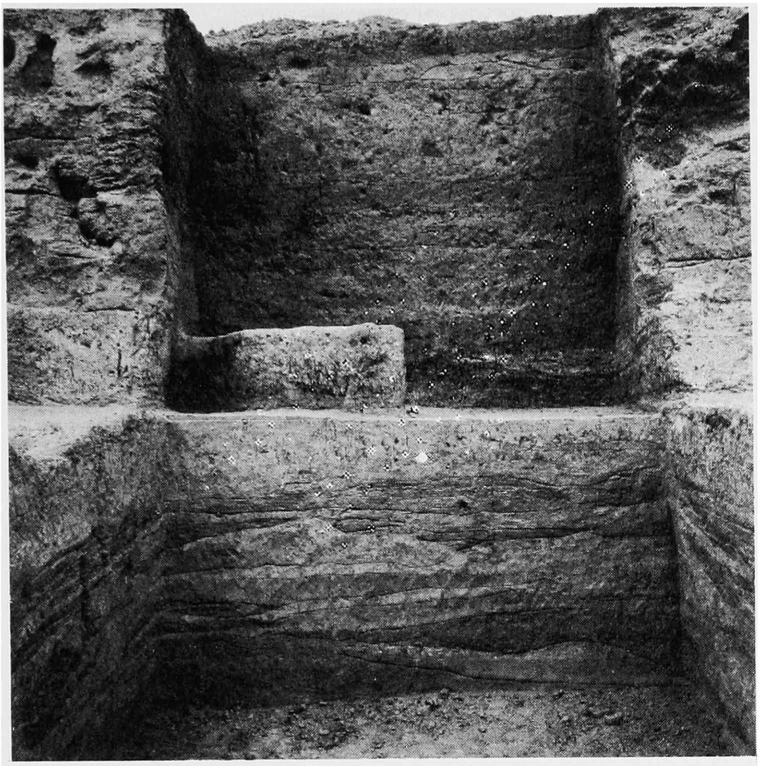
Table I

Original Sequence	Revised Sequence	Pottery Complexes
	VII	Haidarabad Complex
	Hiatus	
	VI	Najaferabad Complex
VI	V	Mashiz Complex
IV and V	IV	Aliabad Complex
III	III	Dashkar Complex
I and II	II	Iblis types and some Lalehzar Coarse ware.
O	I Late Early	Bard Sir types and Lalehzar Coarse ware.
	O	Lalehzar Coarse ware.

Mrs. Fehérvári's excavation in section C suggested that that area had been used as a dump throughout most of its history. The aforementioned mass of bricks, as viewed from Area C looked like burned brick debris and other trash, including a multitude of potsherds,lying on a steep slope. Our exposure was insufficient to determine whether the bricky material had belonged to a particular construction. Aside from poorly preserved mud brick walls near the surface in the east corner of the excavation (and which we did not pursue beyond the excavation) no structural features were encountered except for the aforesaid mass of brick debris. Much of the fill in the excavation looked like drift sand, but it did contain quantities of potsherds. Perhaps the most important result of the work here was to show that both beveled rim bowls and wheel made pottery were associated in Iblis IV with Aliabad pottery, which is usually hand made.

From this excavation in Area C, from Chase's excavation in Area A, section C, and from a gypsum burning kiln which Caldwell exposed in an adjacent profile (and is described in this paper) we also obtained our first good sample of the pottery of Iblis III.

PLATE 1 - EXCAVATION AREA A, SECTIONS A AND C, AND EXCAVATION AREA C.



Background, Area A, Section C.

Foreground, Excavation Area C, Section A.

Excavation Area C. Right, Mrs. Fehérvári inspecting slope of burned earth and tumbled bricks of Iblis IV. Area at lower right was later excavated down to Iblis II. Upper left, brick wall of Iblis IV, not followed outside the excavation.

Table II.-Artifact Distribution: Area "A", Section A

	0-40cm	40-60cm	60-80cm	80-100cm	100-130cm	130-170cm
POTTERY:						
Iblis Plain	49	3				
Iblis Painted	8	1				
Bard Sir Red Slipped	5					
Bard Sir Plain	36	9				
Bard Sir Painted	96	5				
Lalehzar Coarse	1444	1326	266	22		
STONE:						
Faceted Flake Blades	6	4	1			
Core	1	2				
Ground Slate Chisel	2	1				
Calcite Sherd	2					
BONE:						
Awl						
Animal (refuse)	134	17				
Turtle	3					
METAL INDUSTRY:						
Crucible Fragment	8					
Copper Pin (large head)	2	1				
Ore Fragment (copper)	11	4				
SHELL:						
Drilled Ornament	1					

Table III.-Artifact Distribution: Area "A", Section B

	IBLIS II and IBLIS I		IBLIS O ?	
POTTERY:	0-20cm	20-50cm	50-70cm	70-100cm
Iblis Plain	36	2		
Iblis Painted	5			
Bard Sir Red Slipped	36			
Bard Sir Plain	63	2		
Bard Sir Painted	41	1		
Lalehzar Coarse	4408	2206	226	30
STONE:				
Bead	2			
Whetstone	1			
Ground Sandstone knife	1	1		
Flake Blade	34	4	1	
Core	6	1		
Ground Slate Chisel	2			
Calcite sherd	2			
BONE:				
Awl	2	1		
Small knife	1			
Spatula	1			
CERAMIC:				
Spindle Weight	2			
Perforated Disk	1			
Cylindrical object	1			
SHELL:				
Bead	1			
METAL INDUSTRY:				
Copper pin	8			
Copper bead	2			
Copper ring	1			
Crucible fragment	2			
Ore fragment	1			

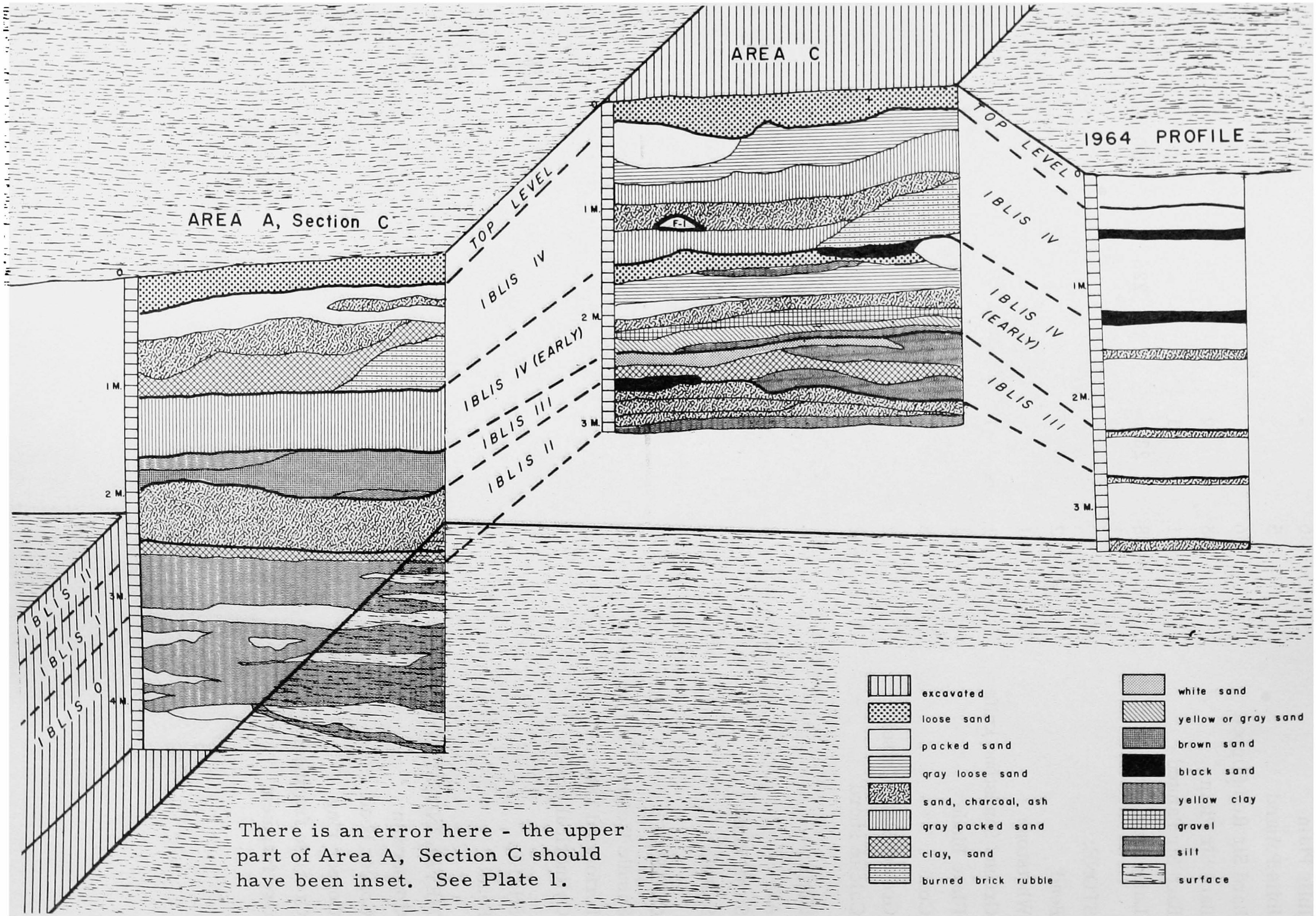


FIGURE 1 - PROFILES OF EXCAVATION AREA A, SECTION C; AREA C; AND THE PROFILE RECORDED IN 1964.

PLATE 2 - LALEHZAR COARSE WARE FROM 1964 INVESTIGATION - PROBABLY IBLIS II.

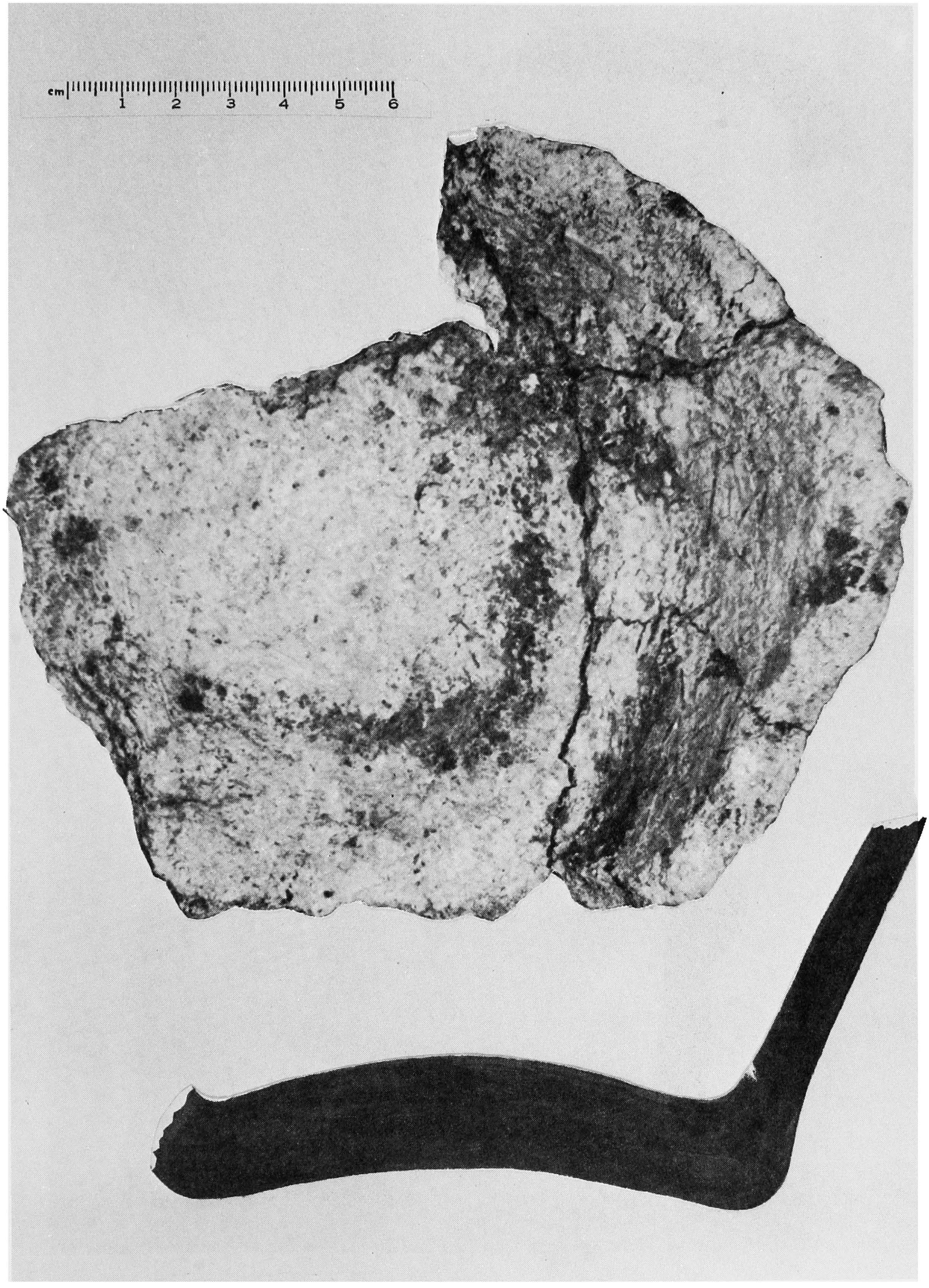


PLATE 3 - LALEHZAR COARSE WARE FROM 1964 INVESTIGATION - PROBABLY IBLIS II.

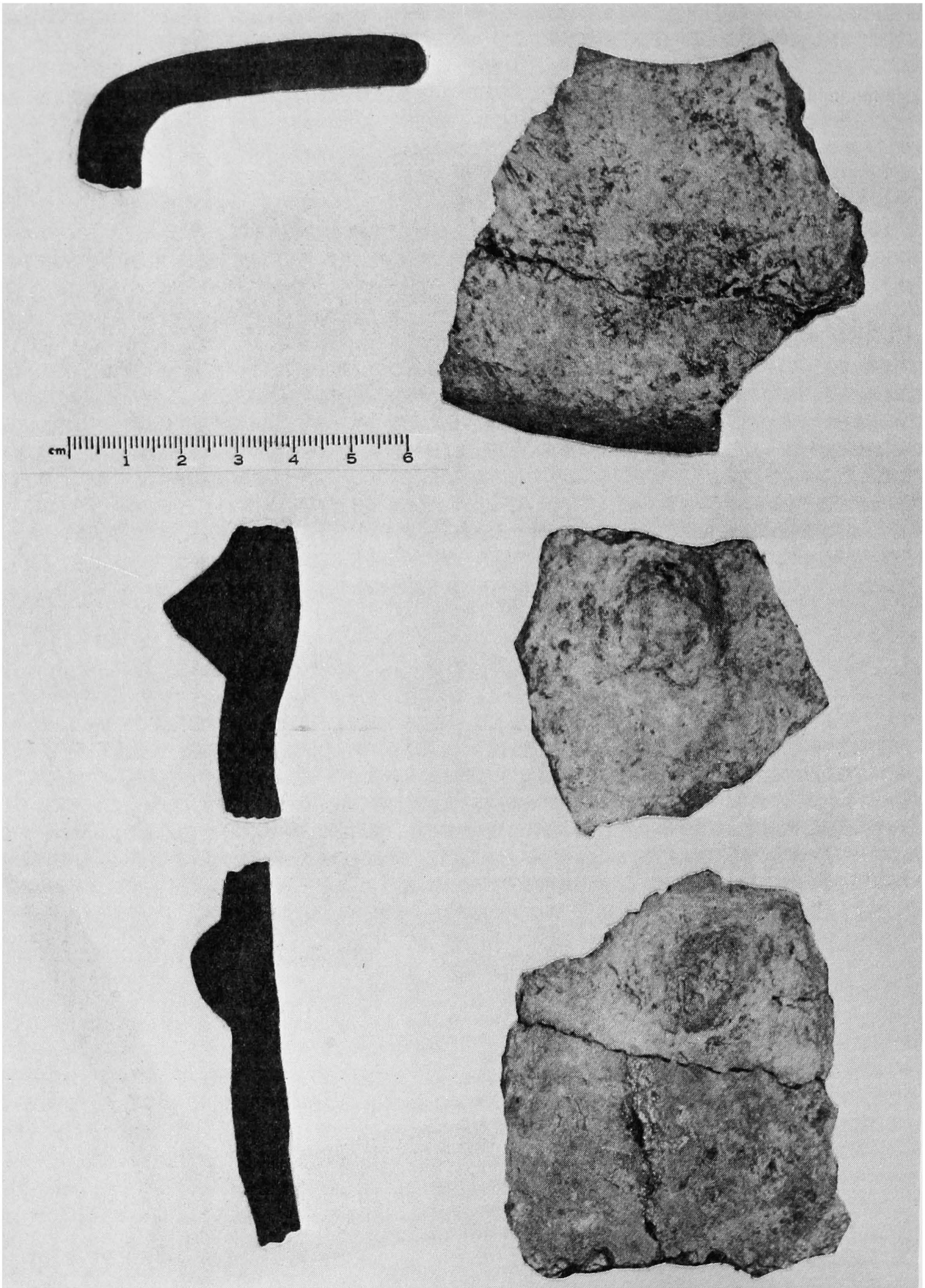
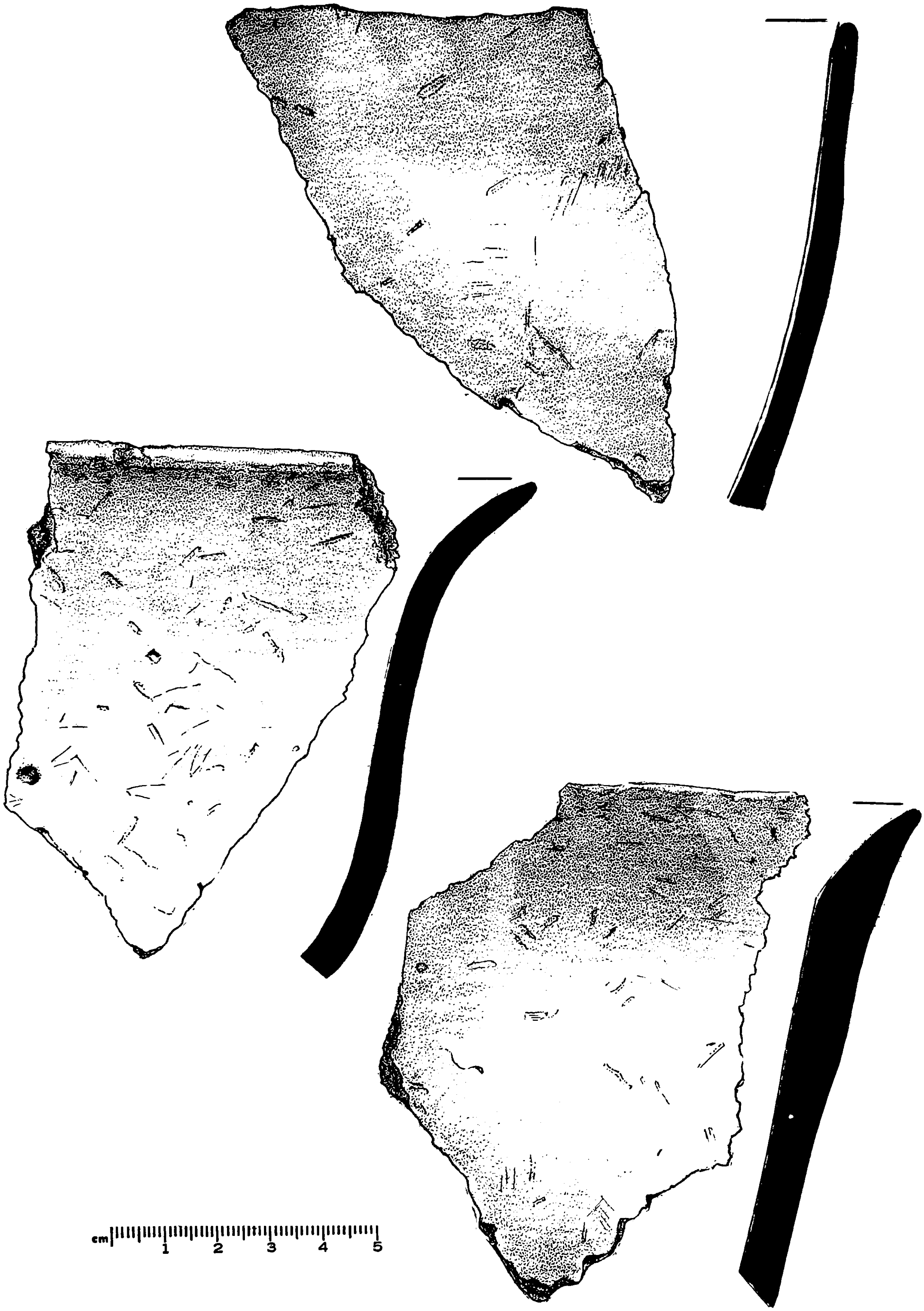
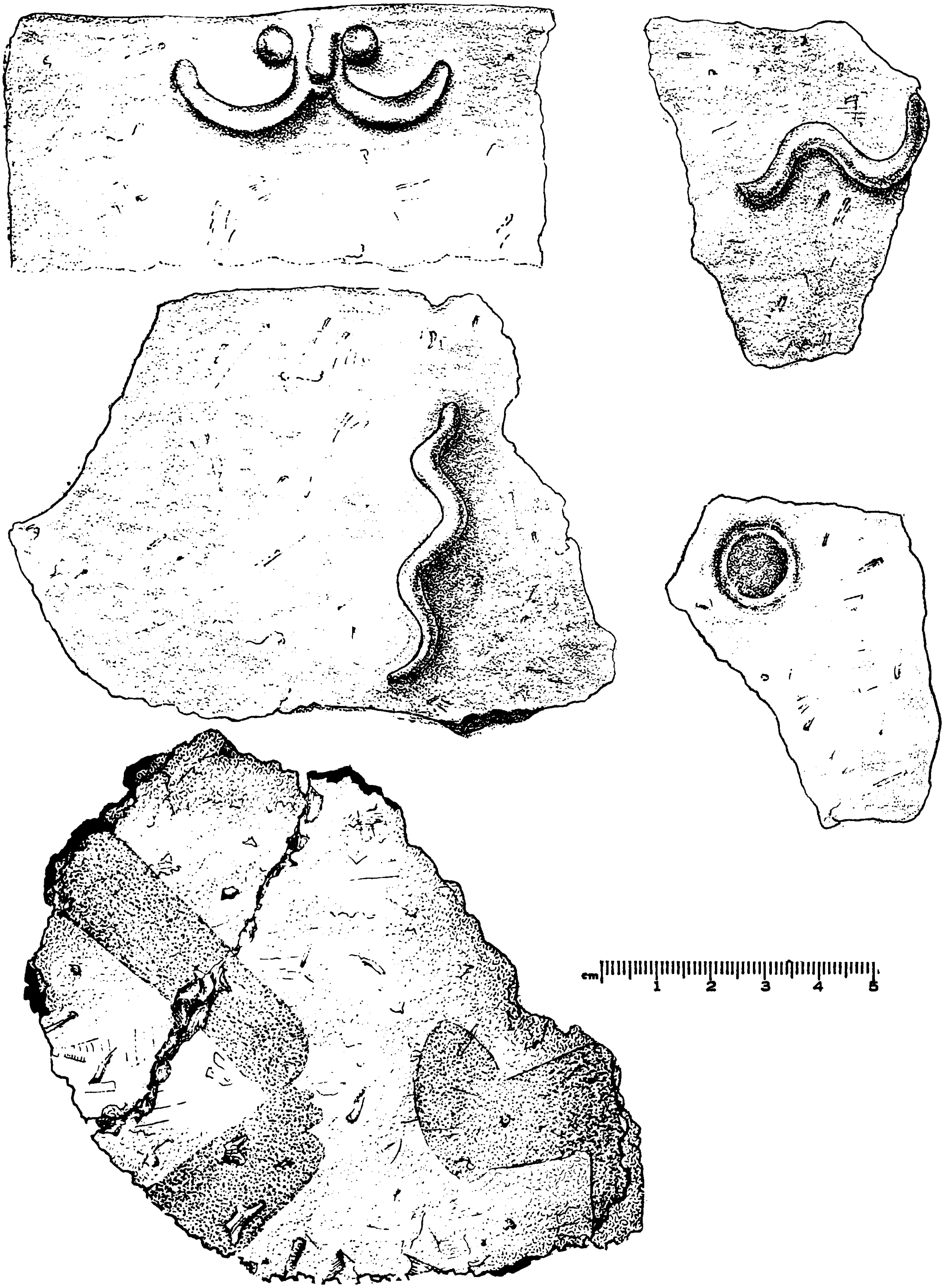


FIGURE 2 - LALEHZAR COARSE WARE FROM AREA E



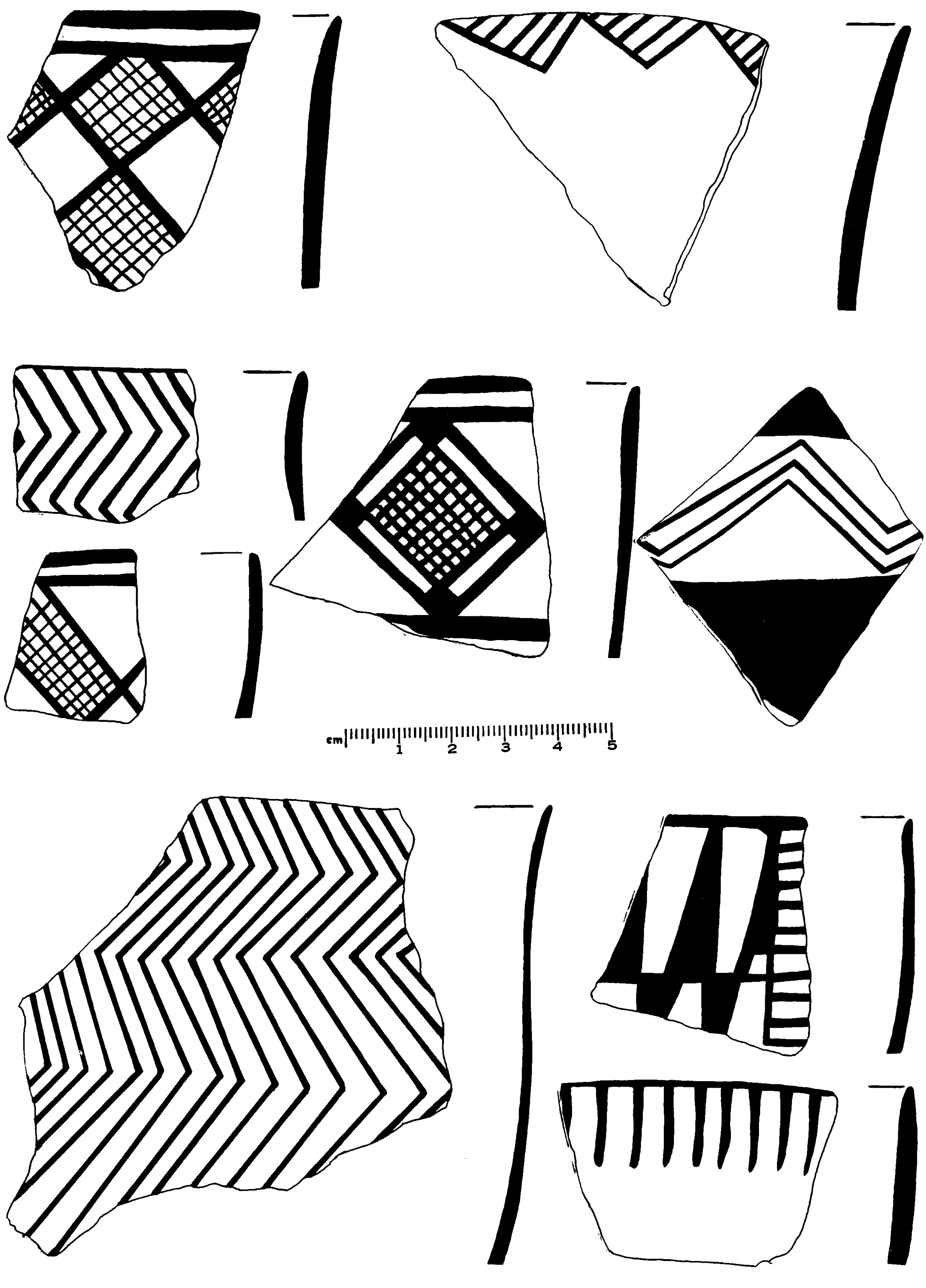
Section F - Level 4

FIGURE 3 - LALEHZAR COARSE WARE FROM AREA E



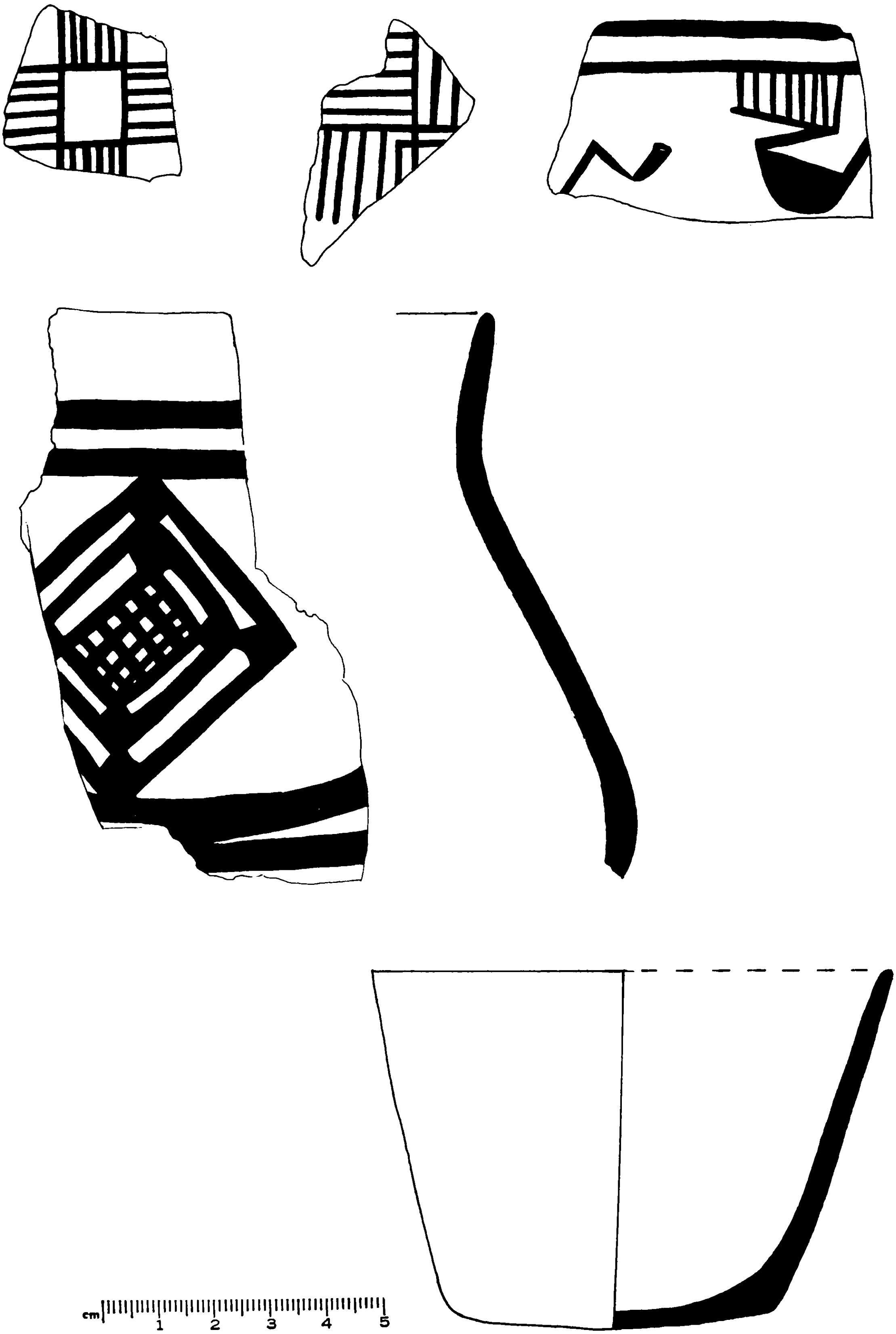
Top, Section F, level 4; Middle, Section G, level 2; Bottom, Painted sherd from Area B, Room 3.

FIGURE 4 - BARD SIR PAINTED, AREA E



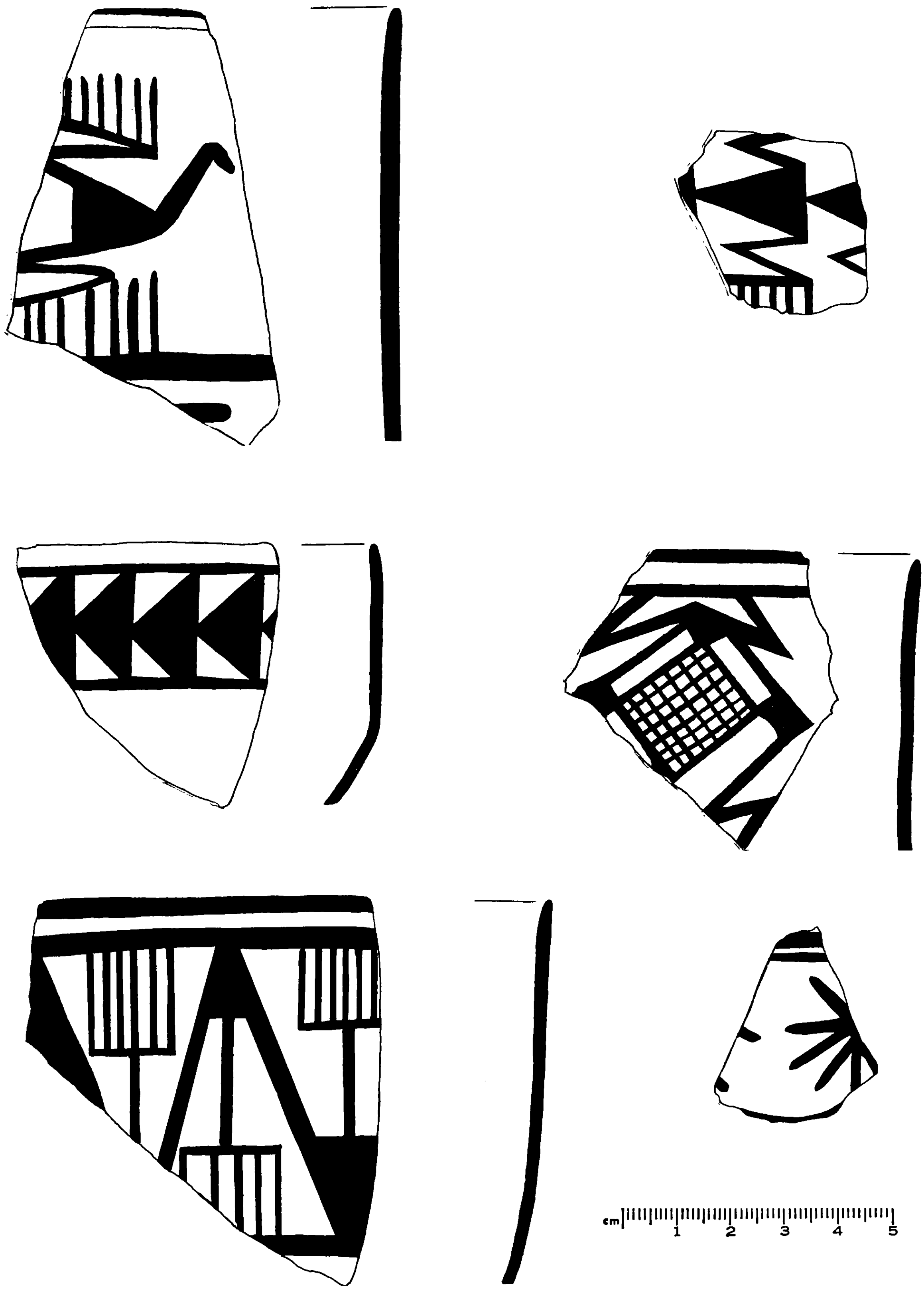
Top, Section A, level 1; Middle, Section A, level 2; Bottom, Section A, level 3

FIGURE 5 - BARD SIR PAINTED AND PLAIN, AREA E



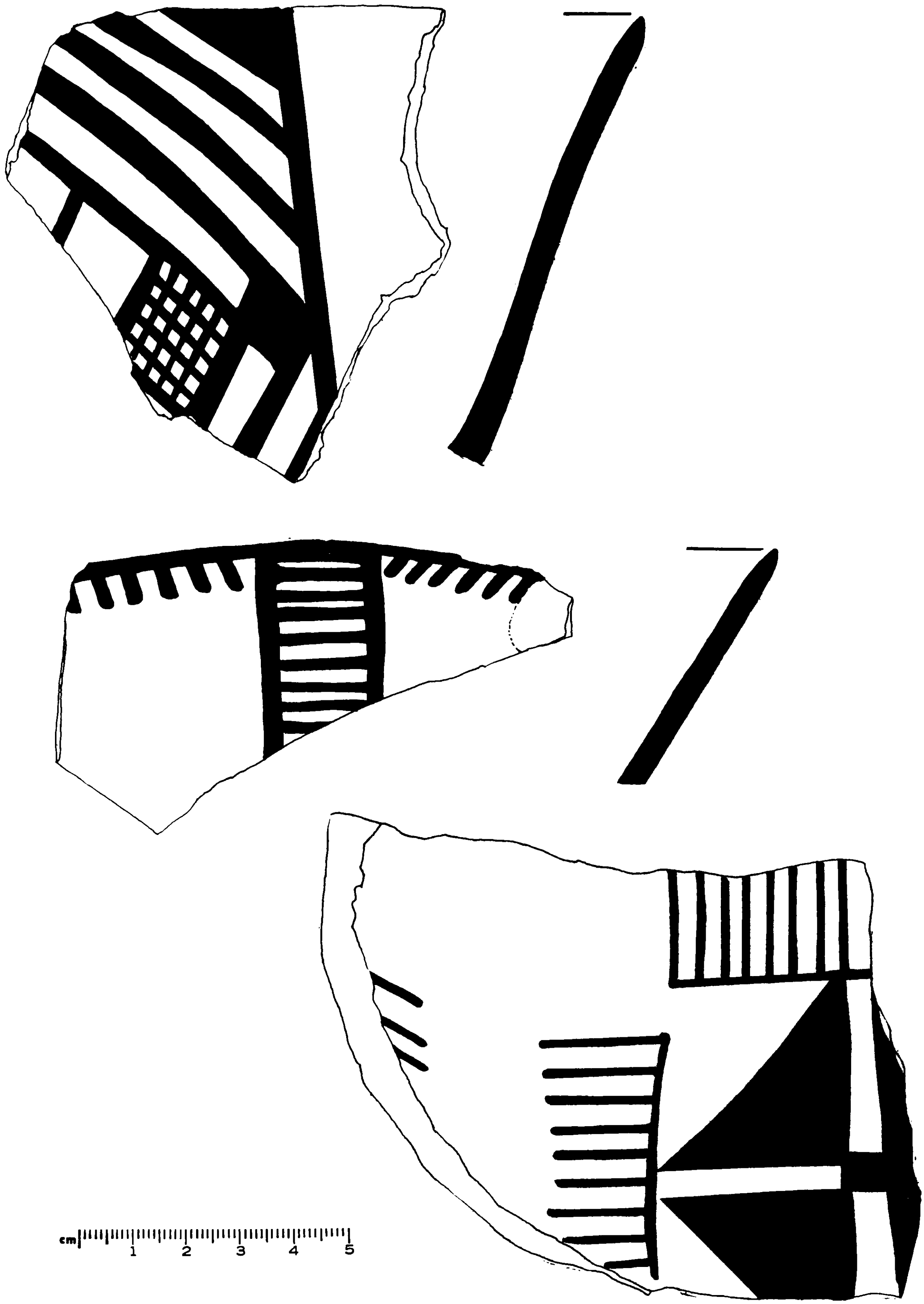
Upper row, Section B, level 1, 3 and 3; Middle, Section G, level 2; Lower, level 4

FIGURE 6 - BARD SIR PAINTED, AREA E



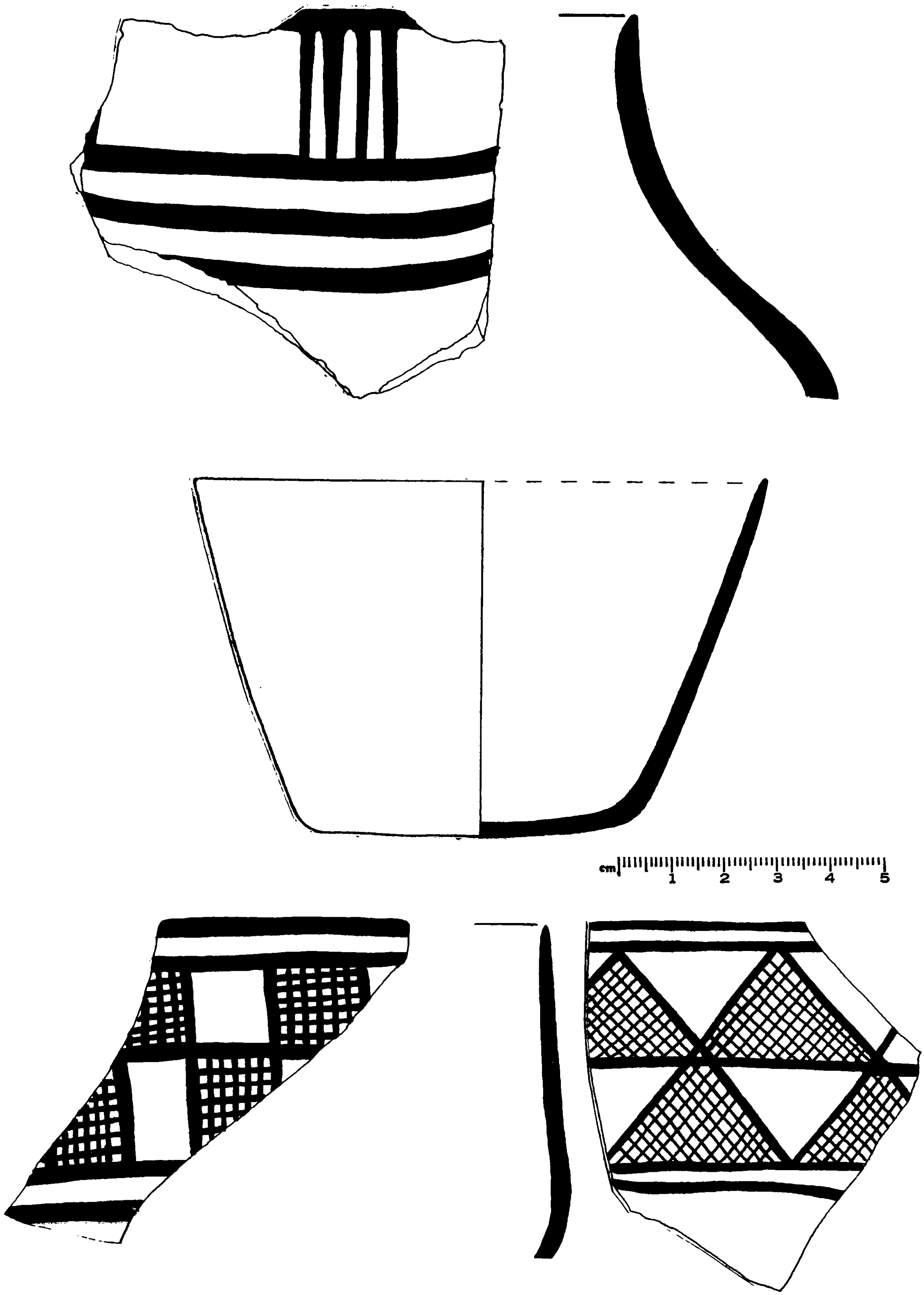
Section F - Level 2

FIGURE 7 - INTERIOR BARD SIR PAINTED, AREA E



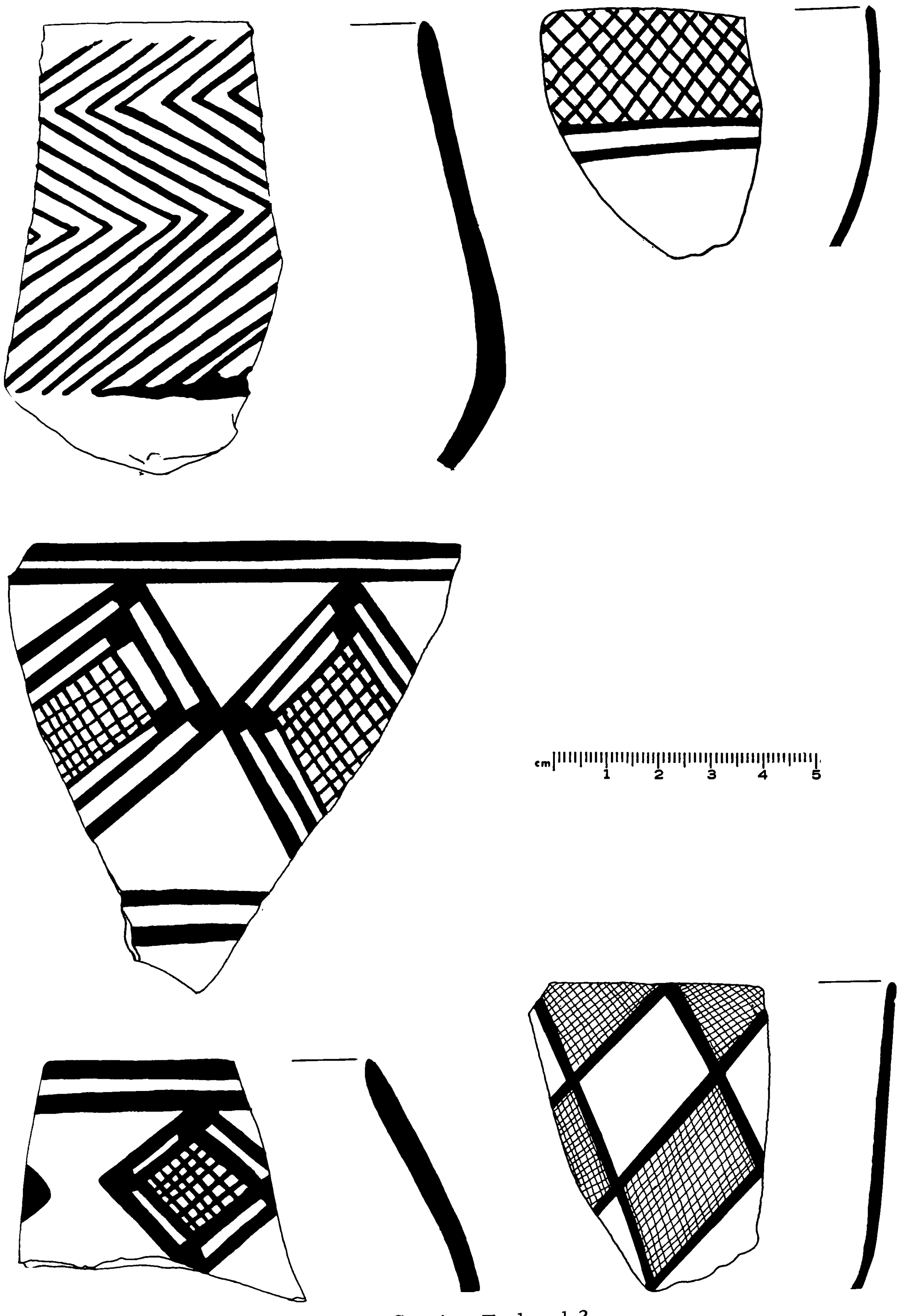
Section F - Level 2

FIGURE 8 - BARD SIR PAINTED AND PLAIN, AREA E



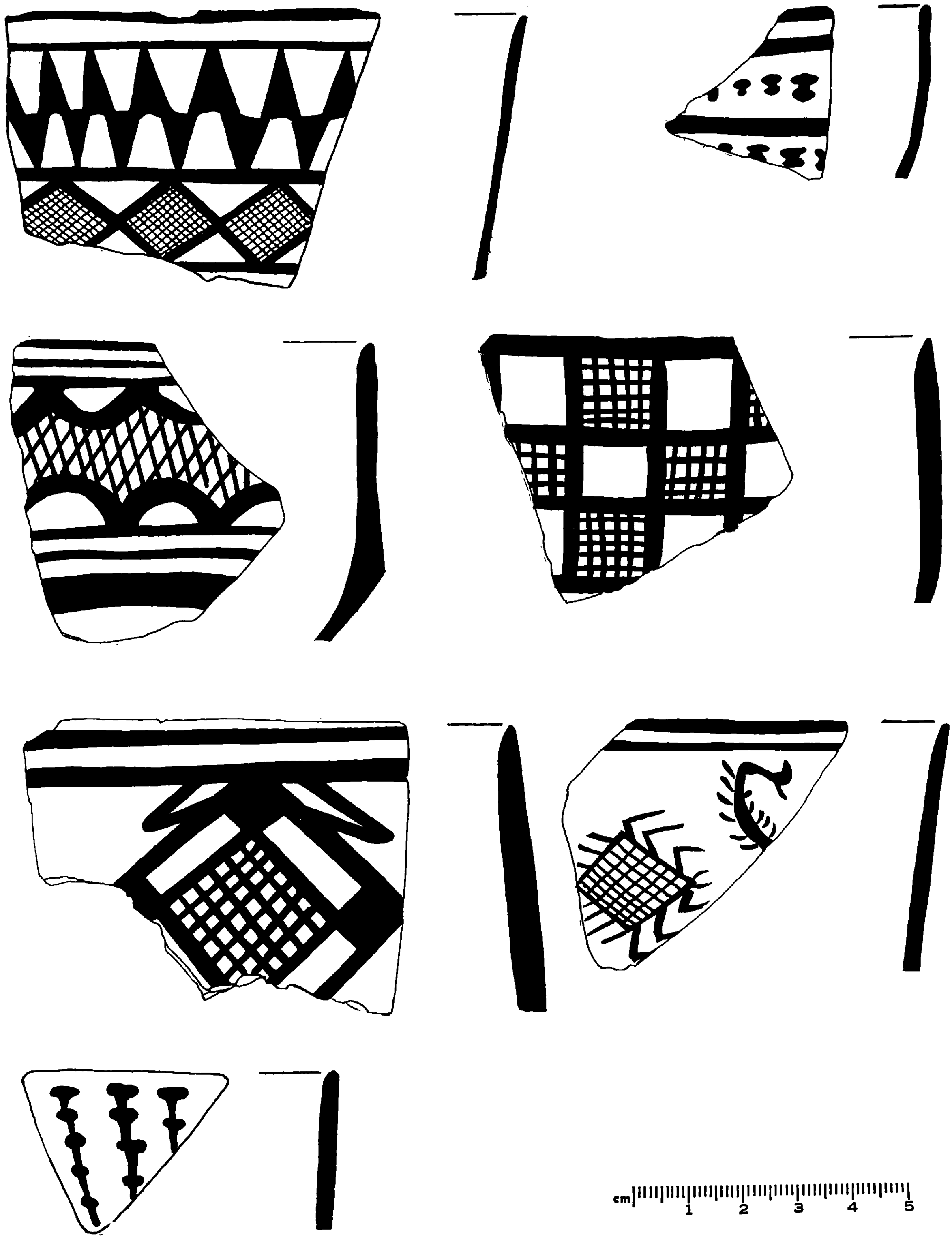
Top, Section F, level 3; Others, Section F, level 4

FIGURE 9 - BARD SIR PAINTED, AREA E



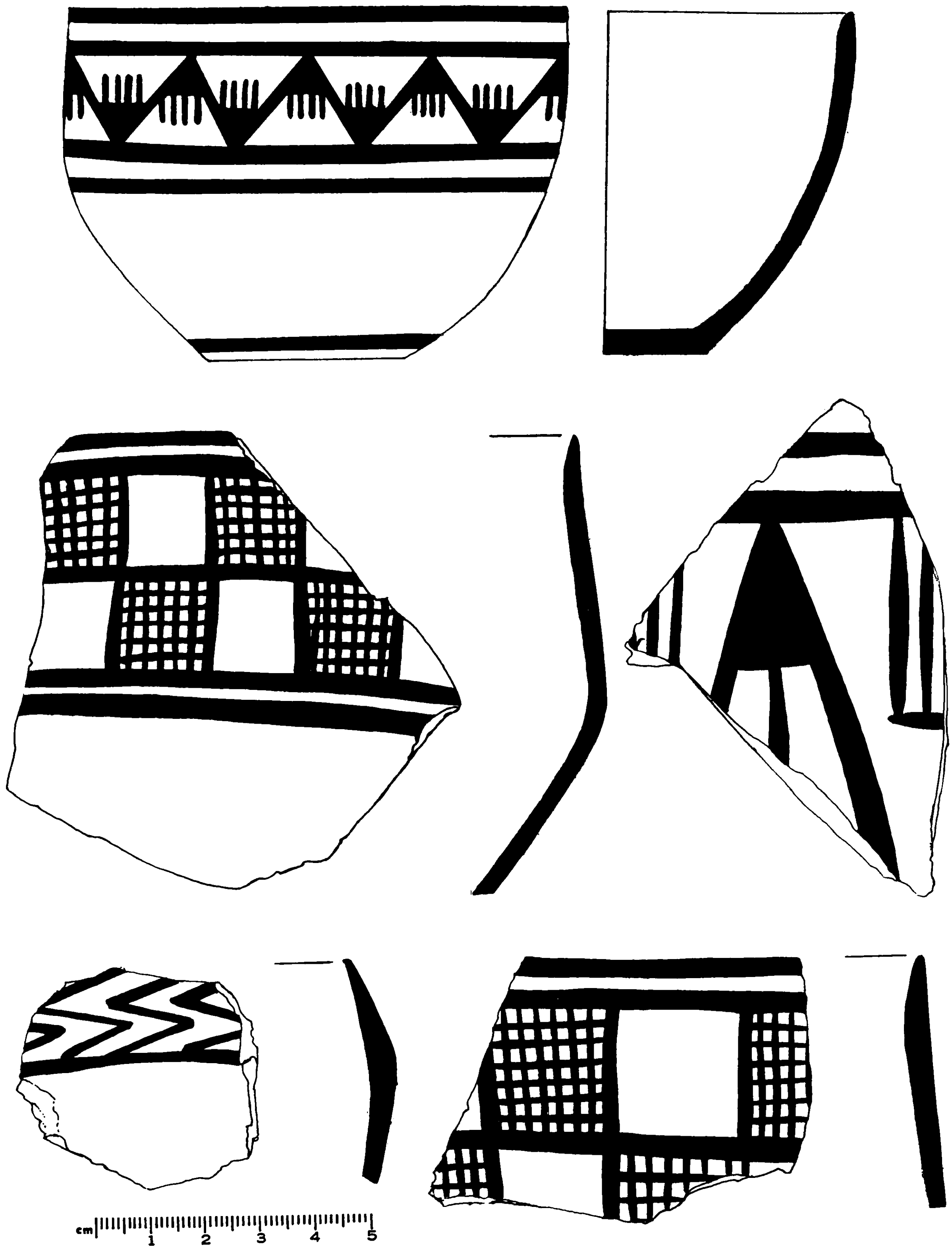
Section F, level 2

FIGURE 10 - BARD SIR PAINTED, AREA E



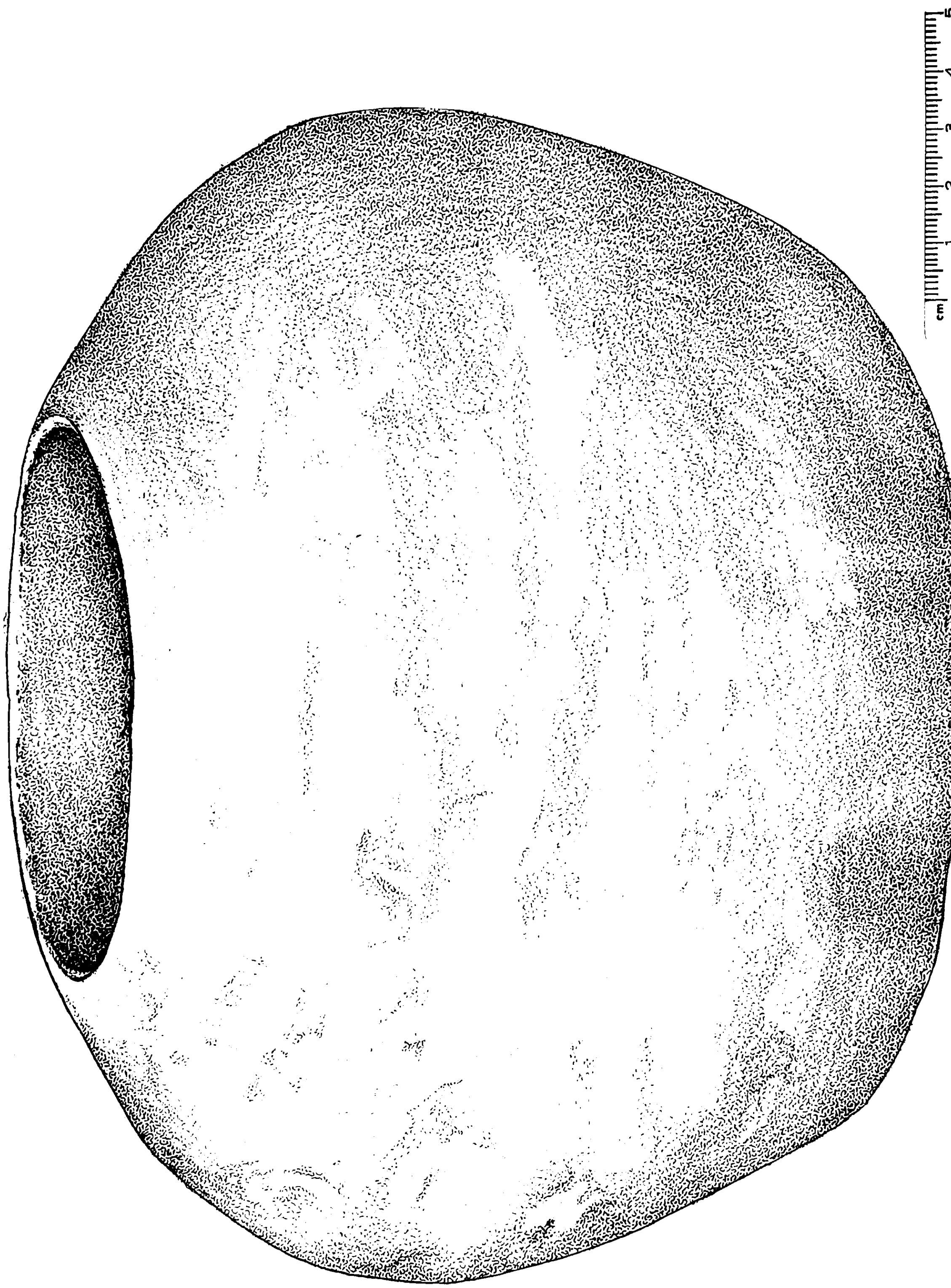
Section F, level 4

FIGURE 11 - BARD SIR PAINTED, AREA E



Section G, level 1

FIGURE 12 - IBLIS II, BARD SIR RED SLIPPED.



This is also a poor example of the pattern burnish technique. Area C, 2.40 - 3.10 m.

FIGURE 13 - IBLIS PAINTED, AREA C, 240 - 310 CM

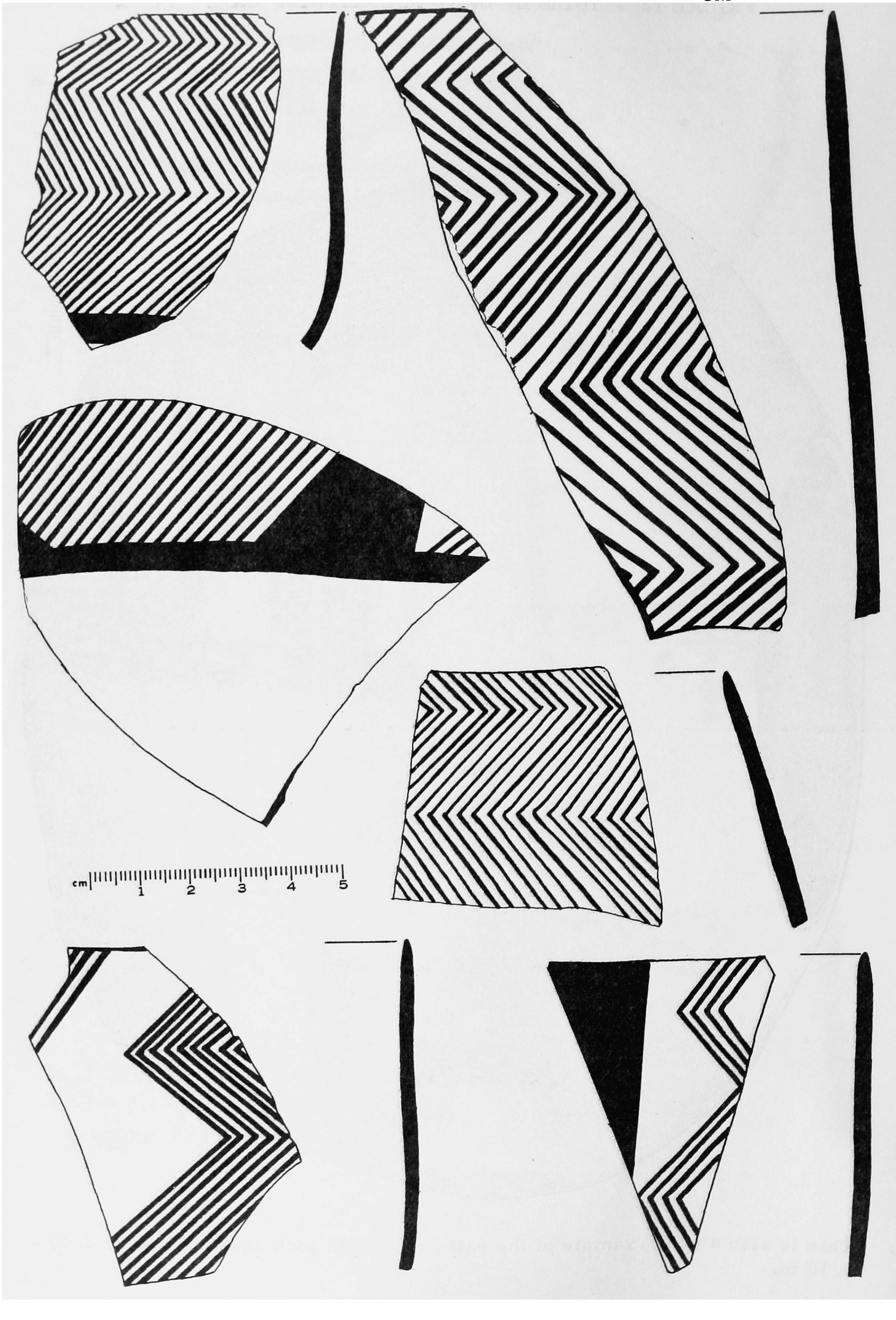


FIGURE 14 - IBLIS PAINTED, AREA C, 240 310 CM

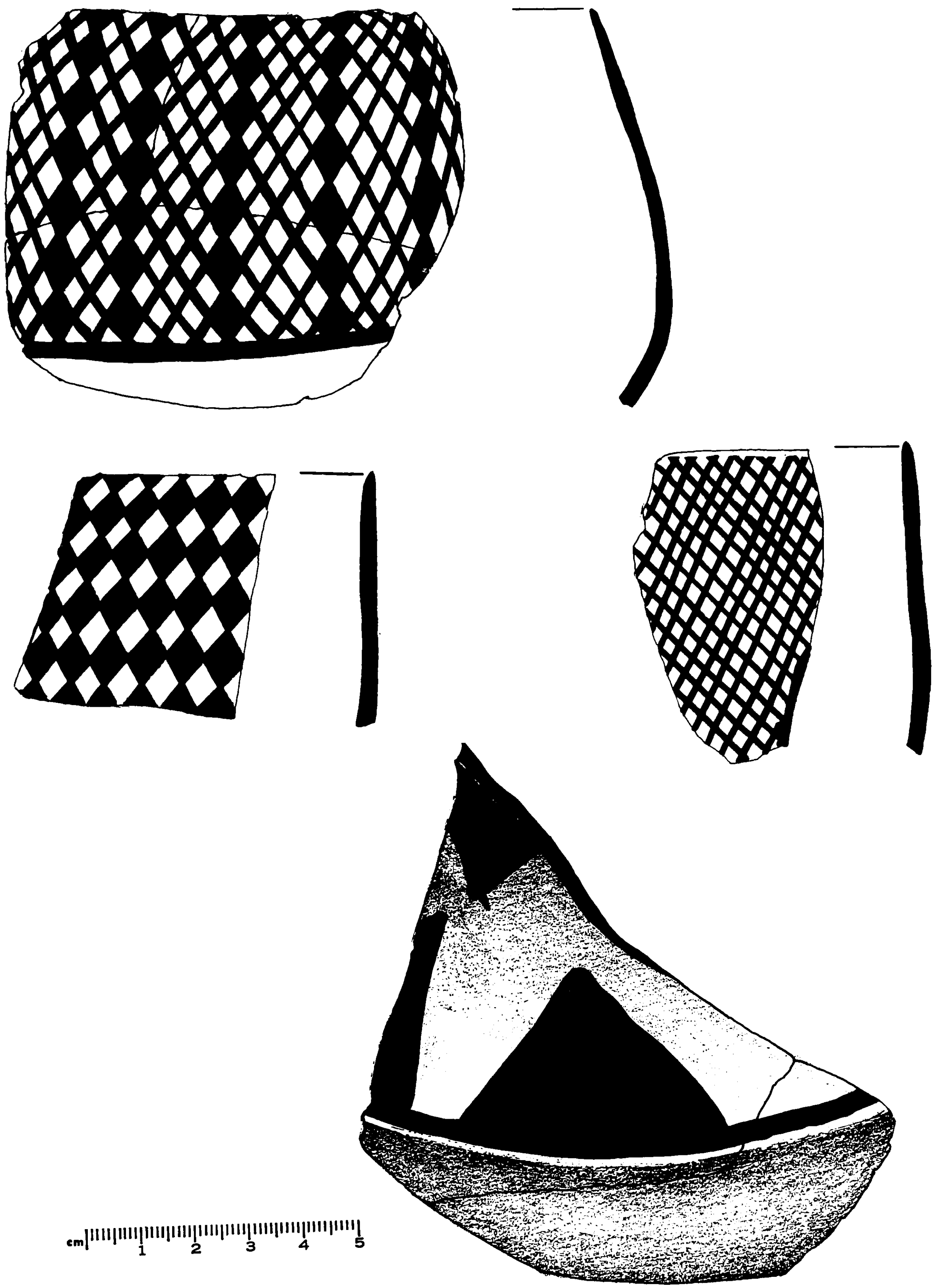
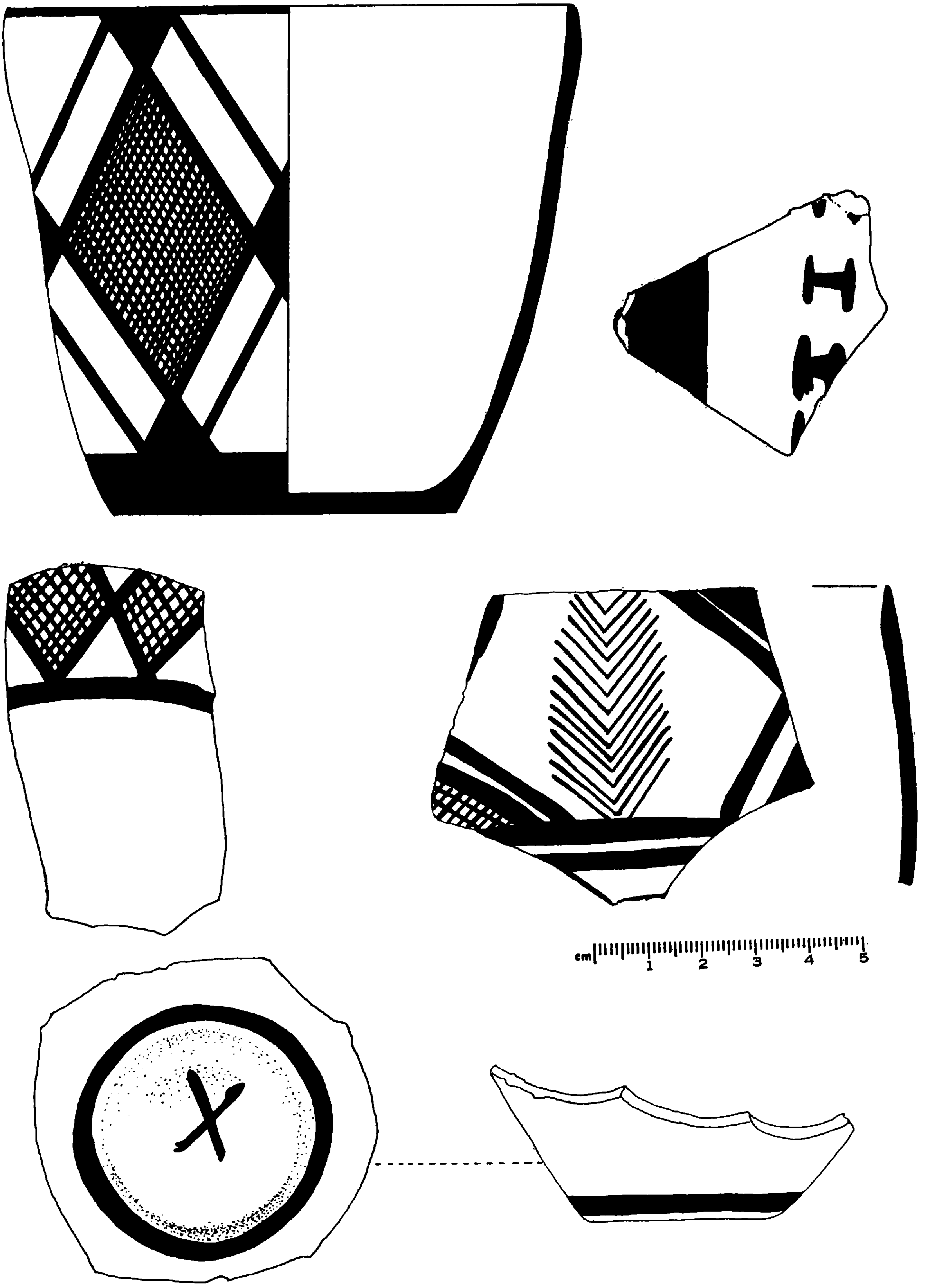


FIGURE 15 - IBLIS PAINTED, AREA C, 240 - 310 CM



Top left is from fertilizer diggings.

FIGURE 16 - IBLIS PAINTED, AREA C, 240 310 CM

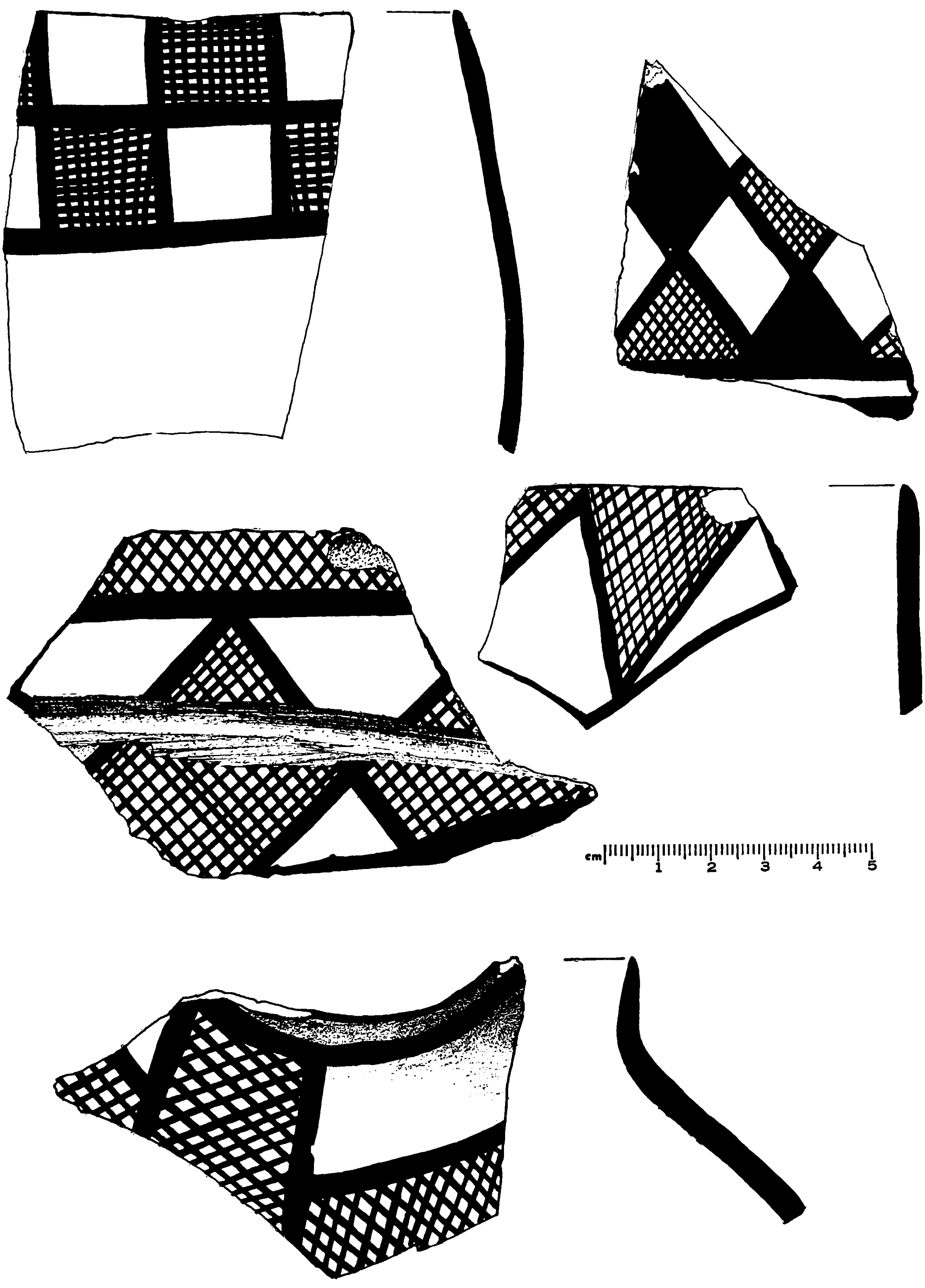


FIGURE 17 - INTERIORS OF IBLIS PAINTED SHERDS, AREA C, 240 - 310 CM

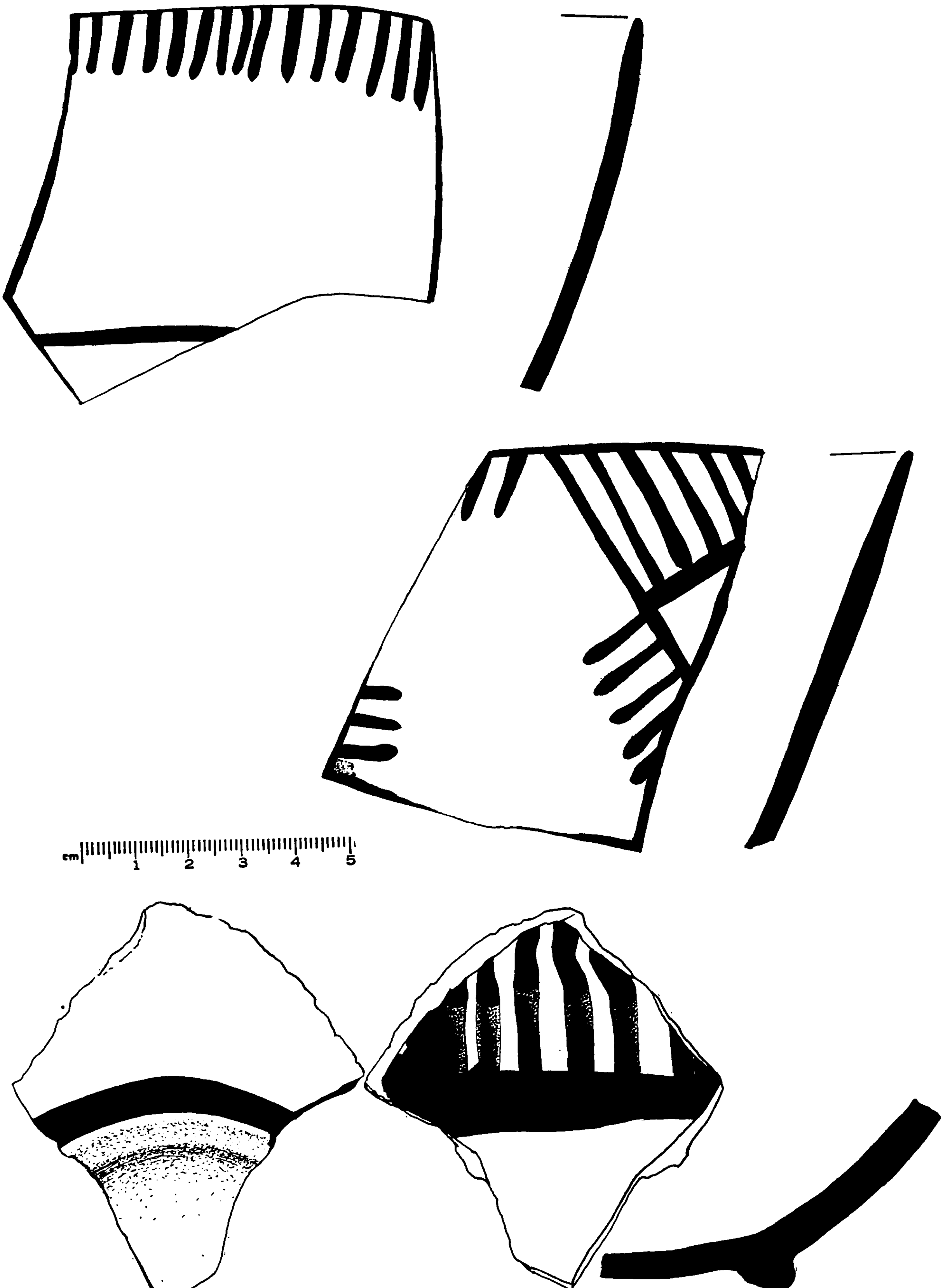


FIGURE 18 - IBLIS III - SHERDS FROM AREA A, SECTION C, 150 - 200 CM. COLOR OF PAINT IS PALE RED.

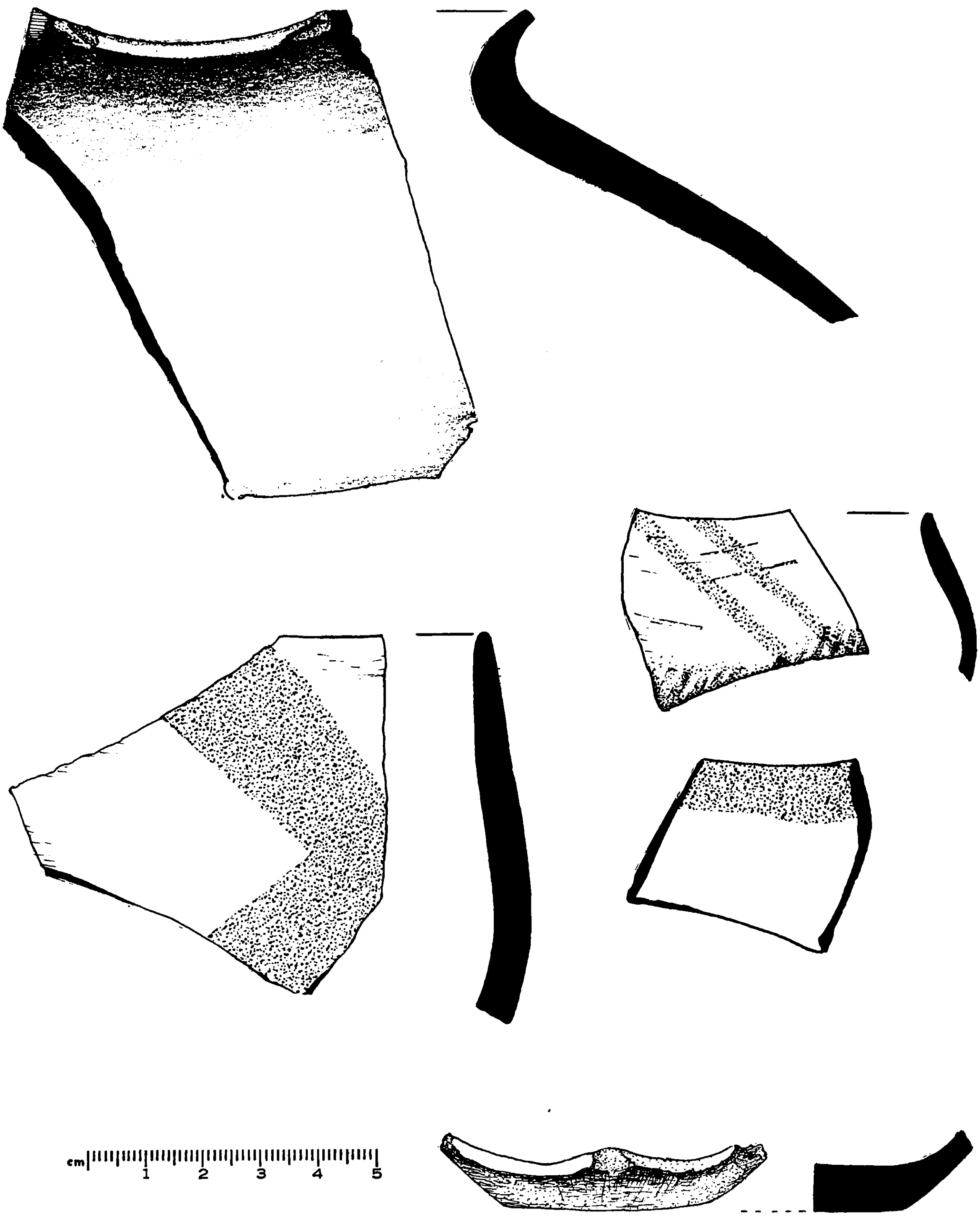


FIGURE 19 IBLIS III SHERDS FROM GYPSUM BURNING FURNACE

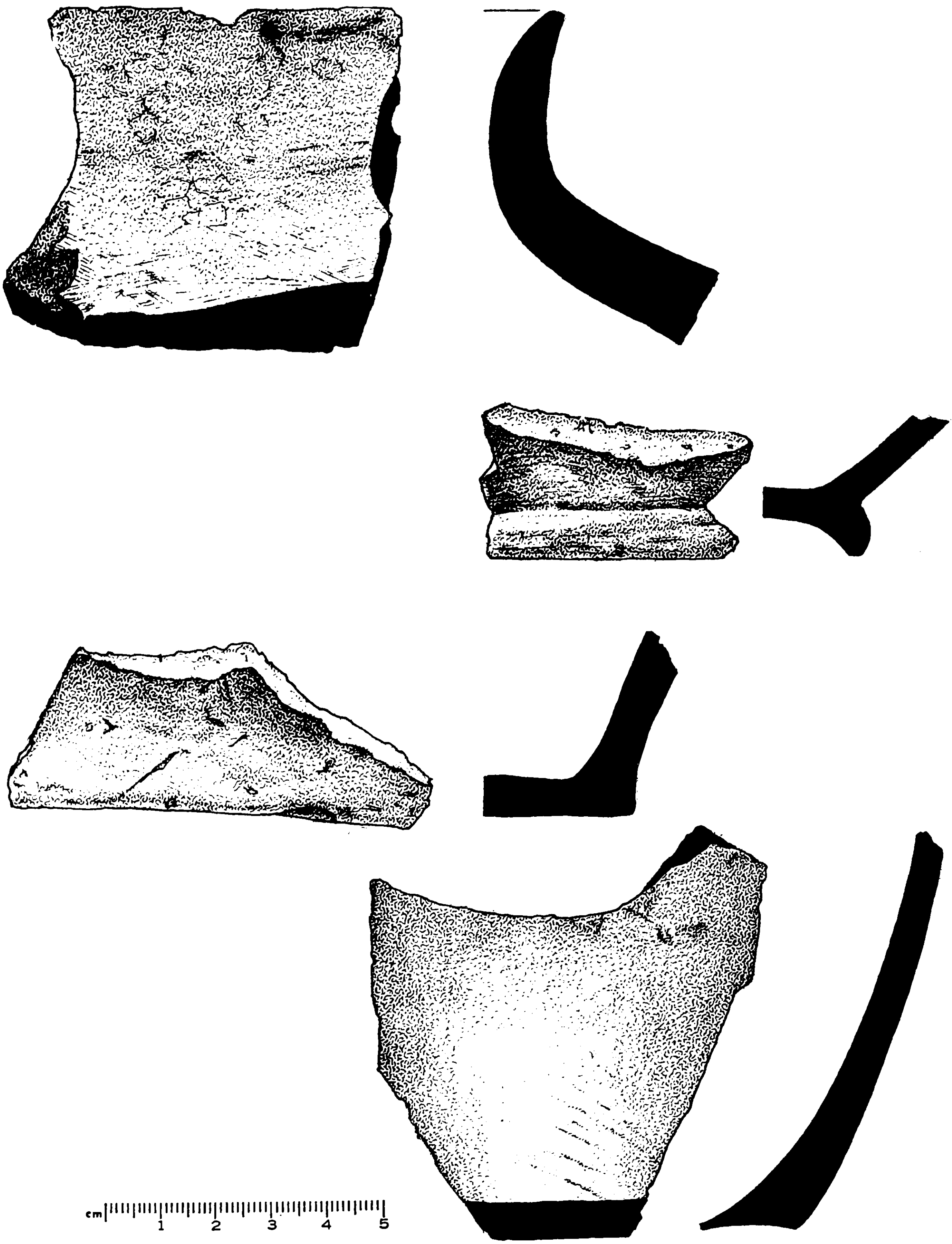


FIGURE 20 - IBLIS III SHERDS FROM GYPSUM BURNING FURNACE

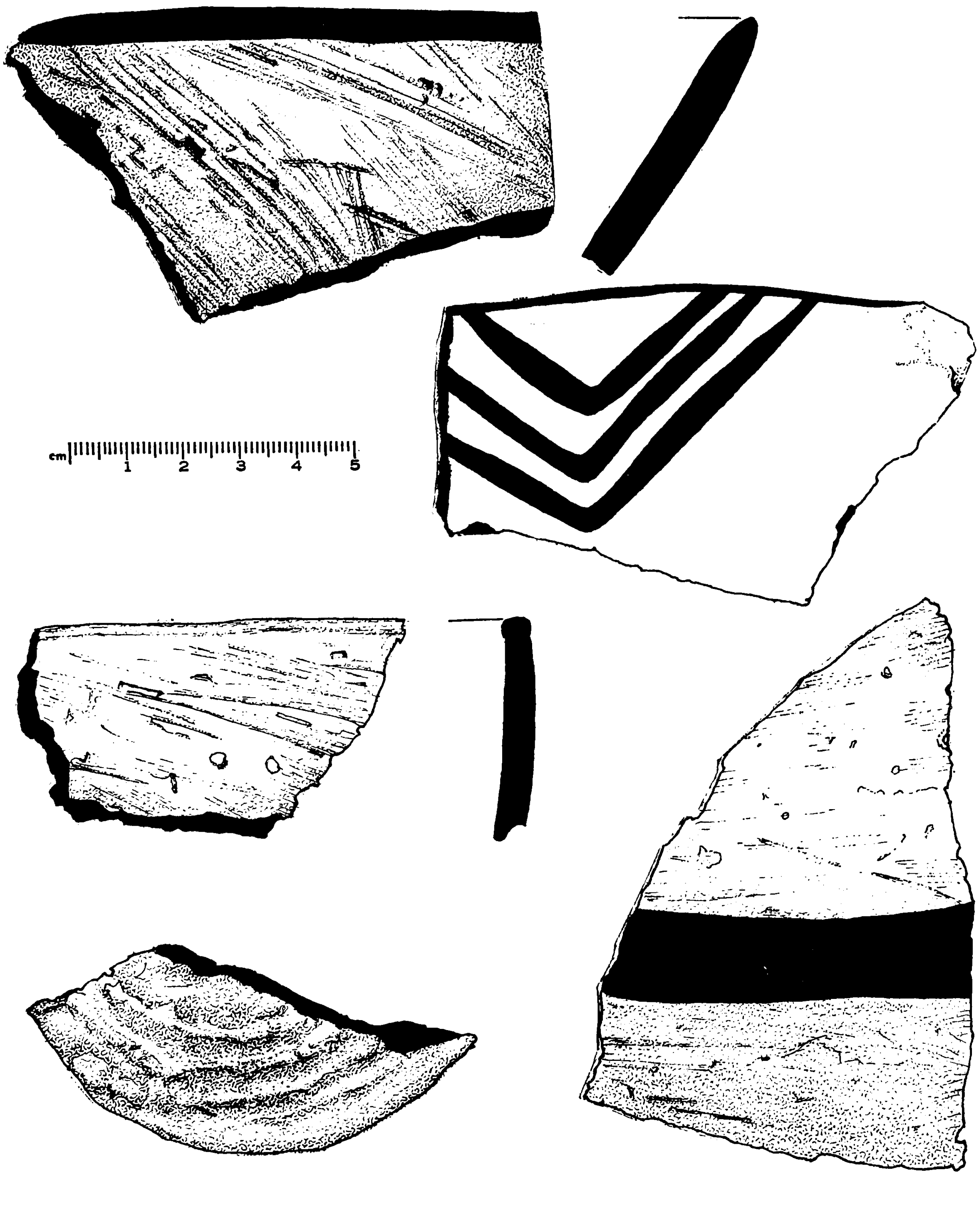


FIGURE 21 - AREA C, EARLY IBLIS IV, 150 - 230 CM

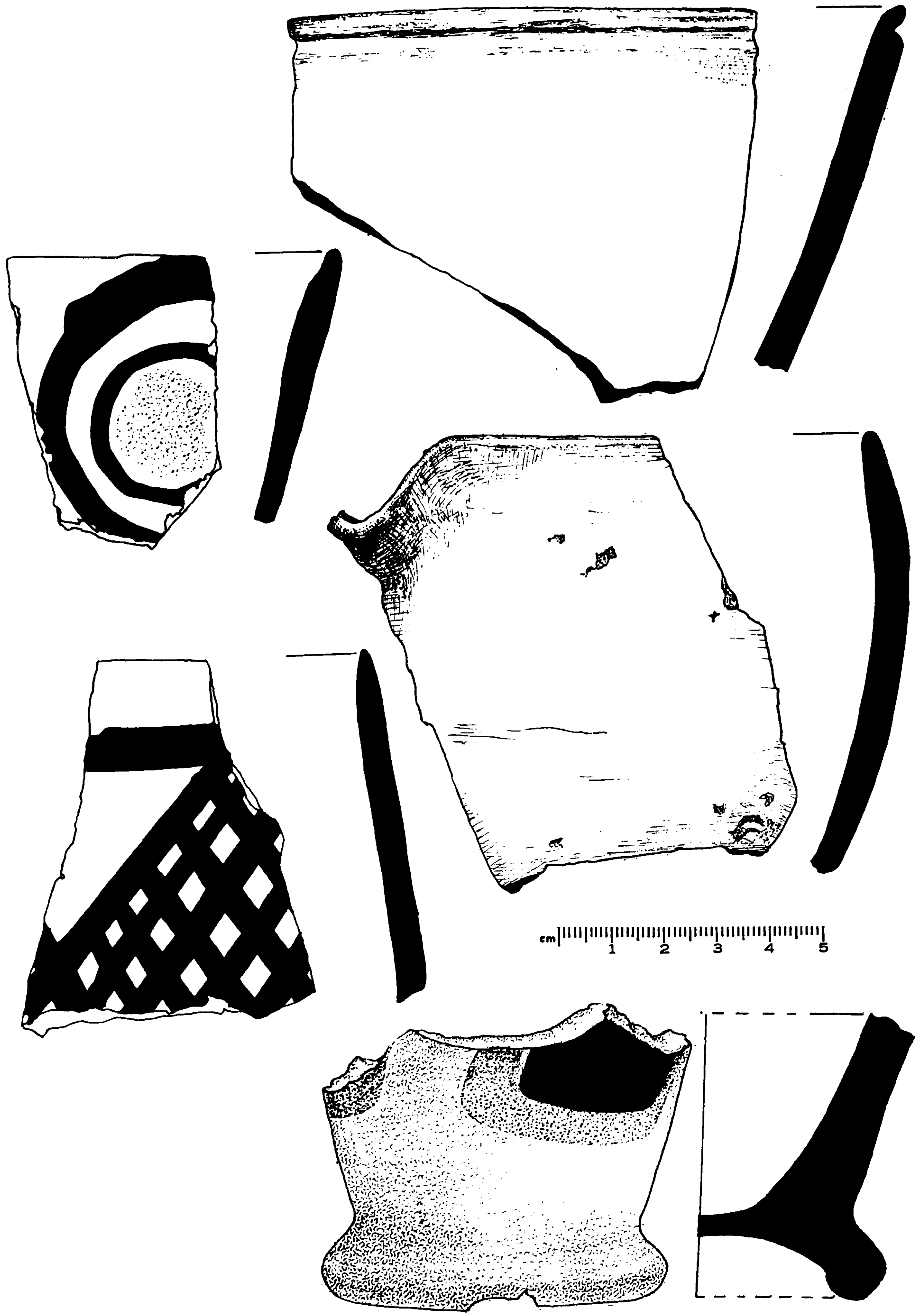


FIGURE 22 - AREA C, ALIABAD PAINTED FROM LOWER PART OF IBLIS IV AND UPPER PART OF EARLY IBLIS IV, 130-180 CM.

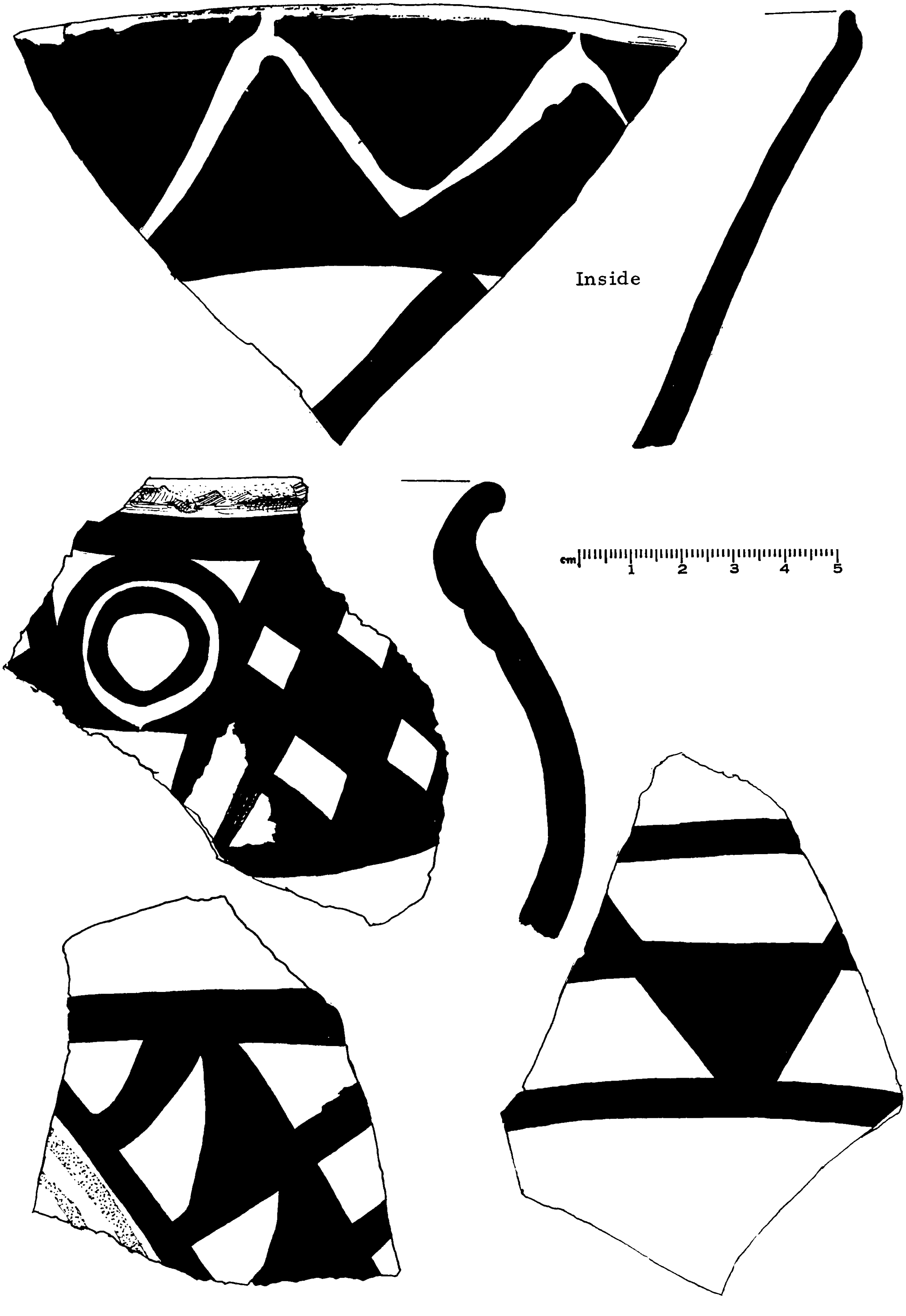


FIGURE 23 - ALIABAD PAINTED, BICHROME, AND PLAIN. AREA C, IBLIS IV, 130 - 150 CM

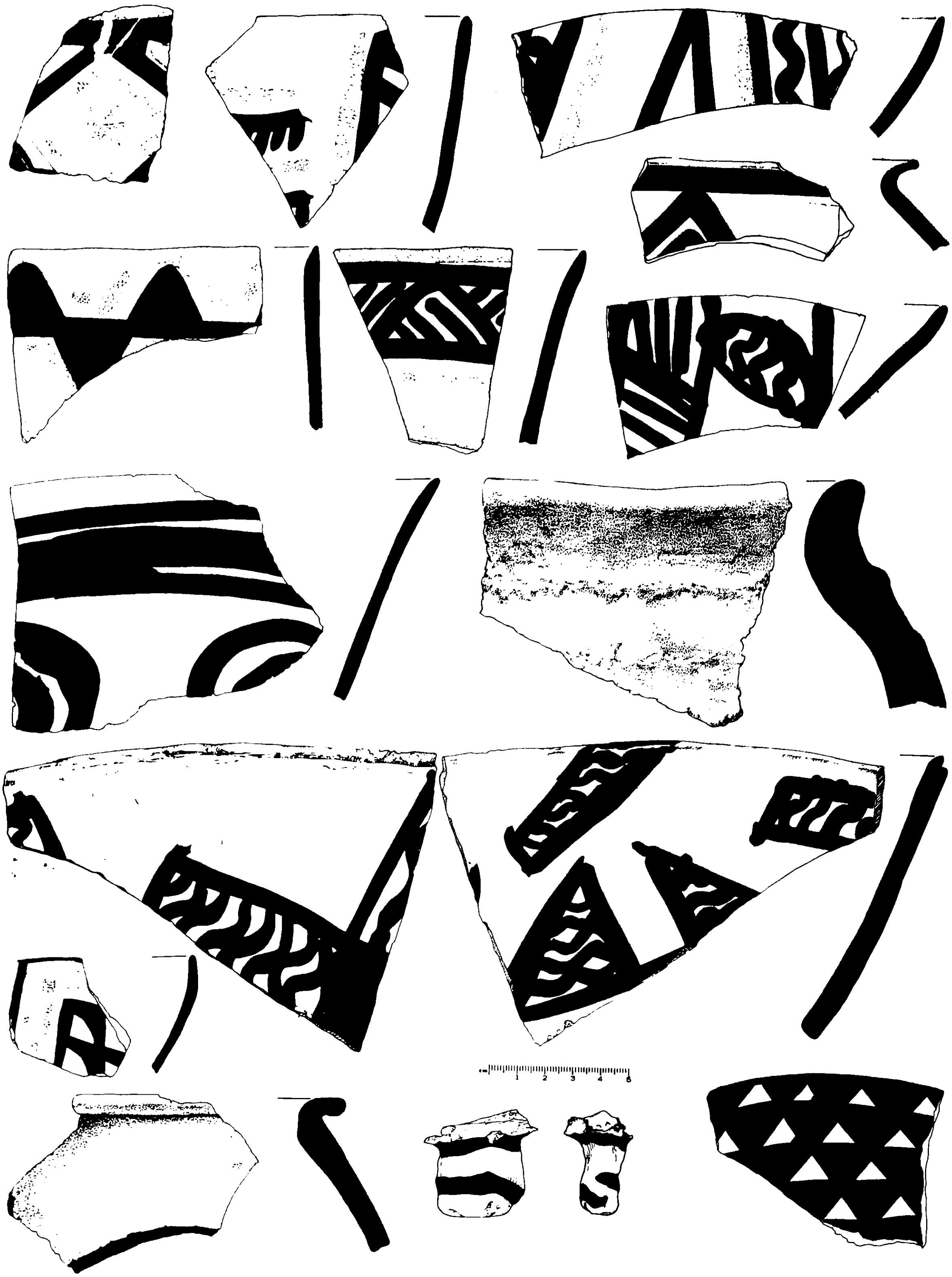


FIGURE 24 - AREA C, IBLIS IV, ALIABAD PAINTED, ALIABAD RIDGED, AND A' TRAY, 100 - 110 CM

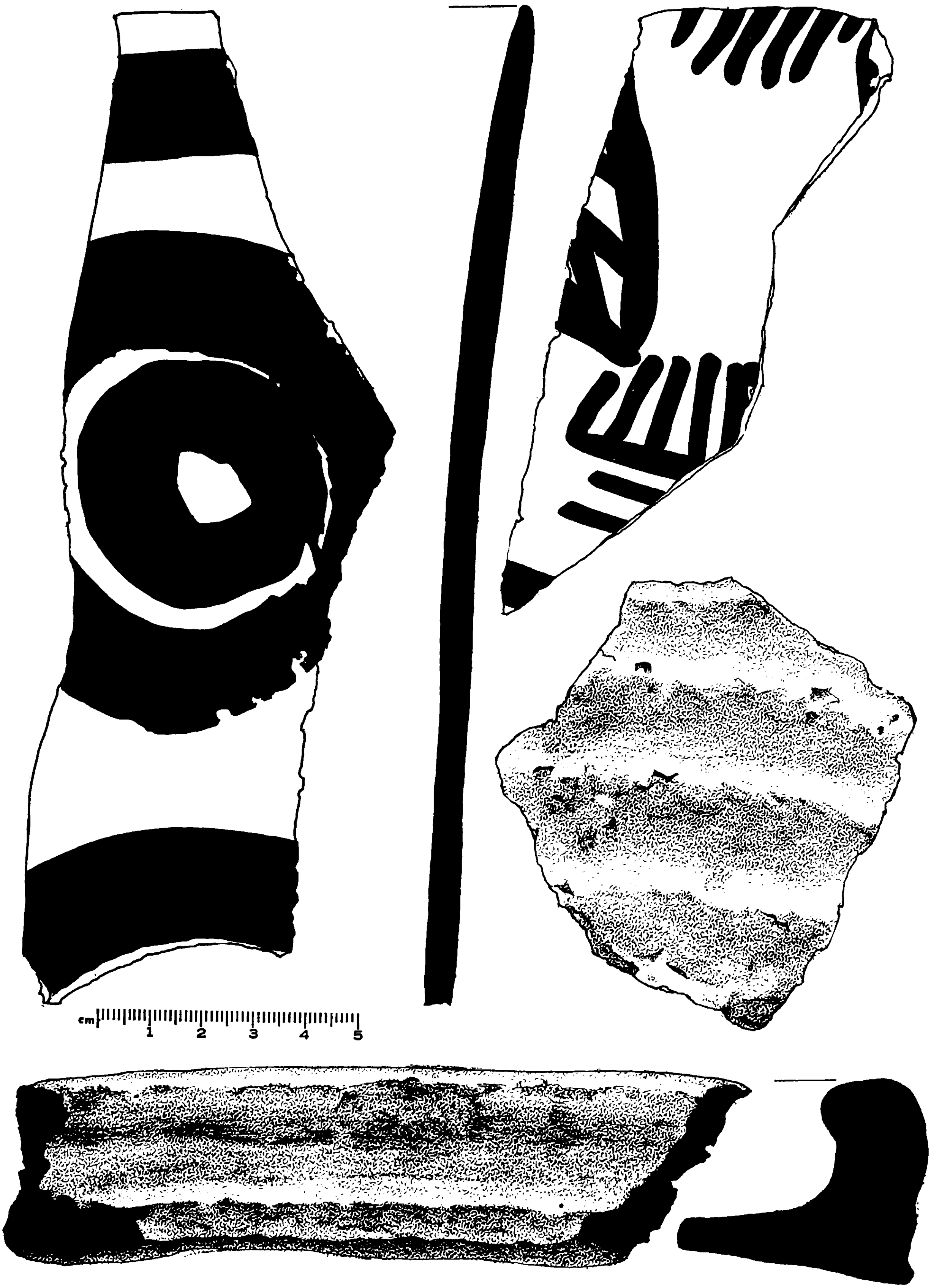


FIGURE 25 - ALIABAD PAINTED, BICHROME, BRUSHED AND RIM WITH INTERIOR LEDGE. AREA C, IBLIS IV, 70 - 130 CM

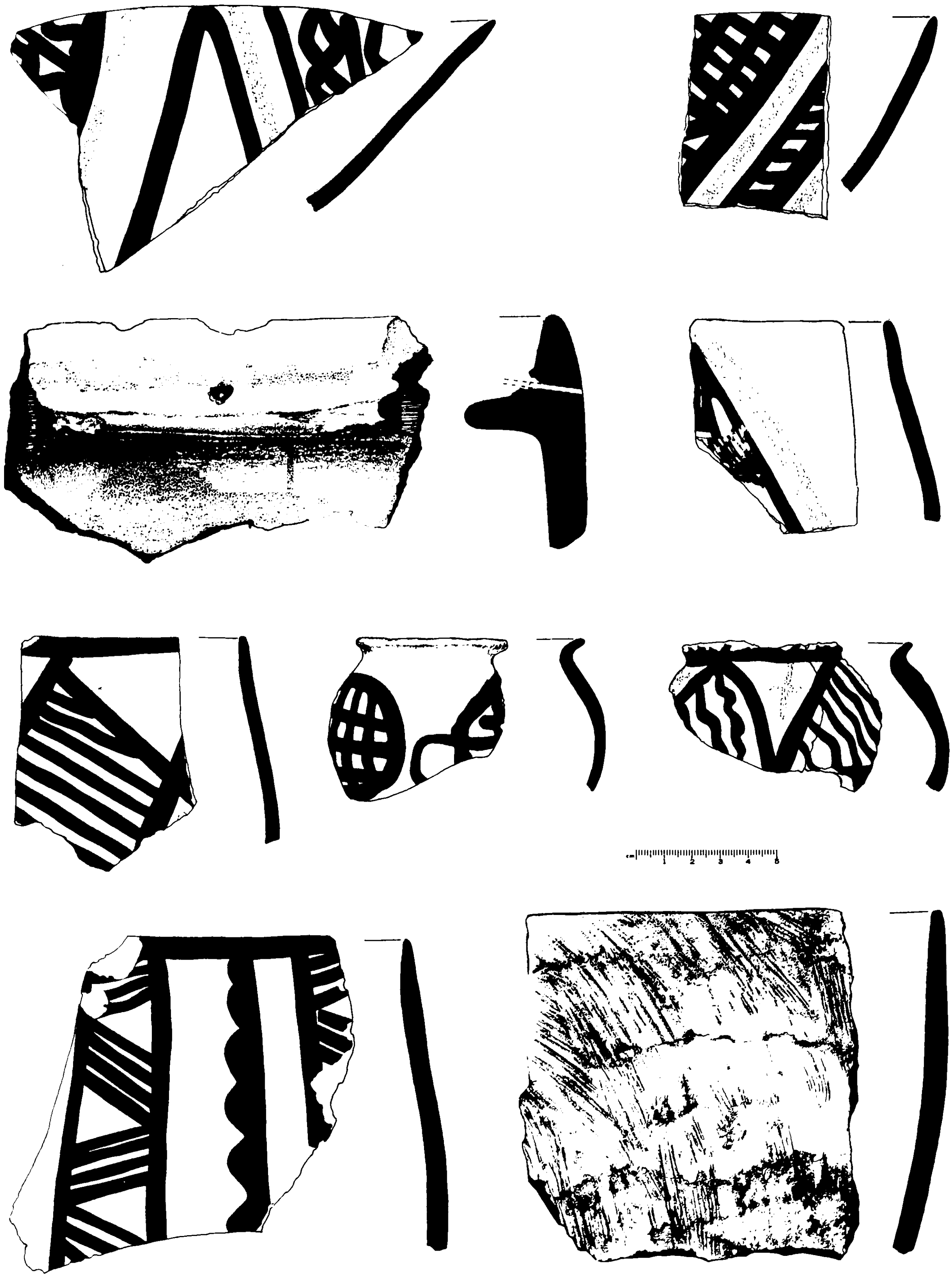


FIGURE 26 - ALIABAD PAINTED, BICHROME, PLAIN, BEVELED RIM BOWLS AND OTHER SHERDS. AREA C, IBLIS IV, 70 - 90 CM

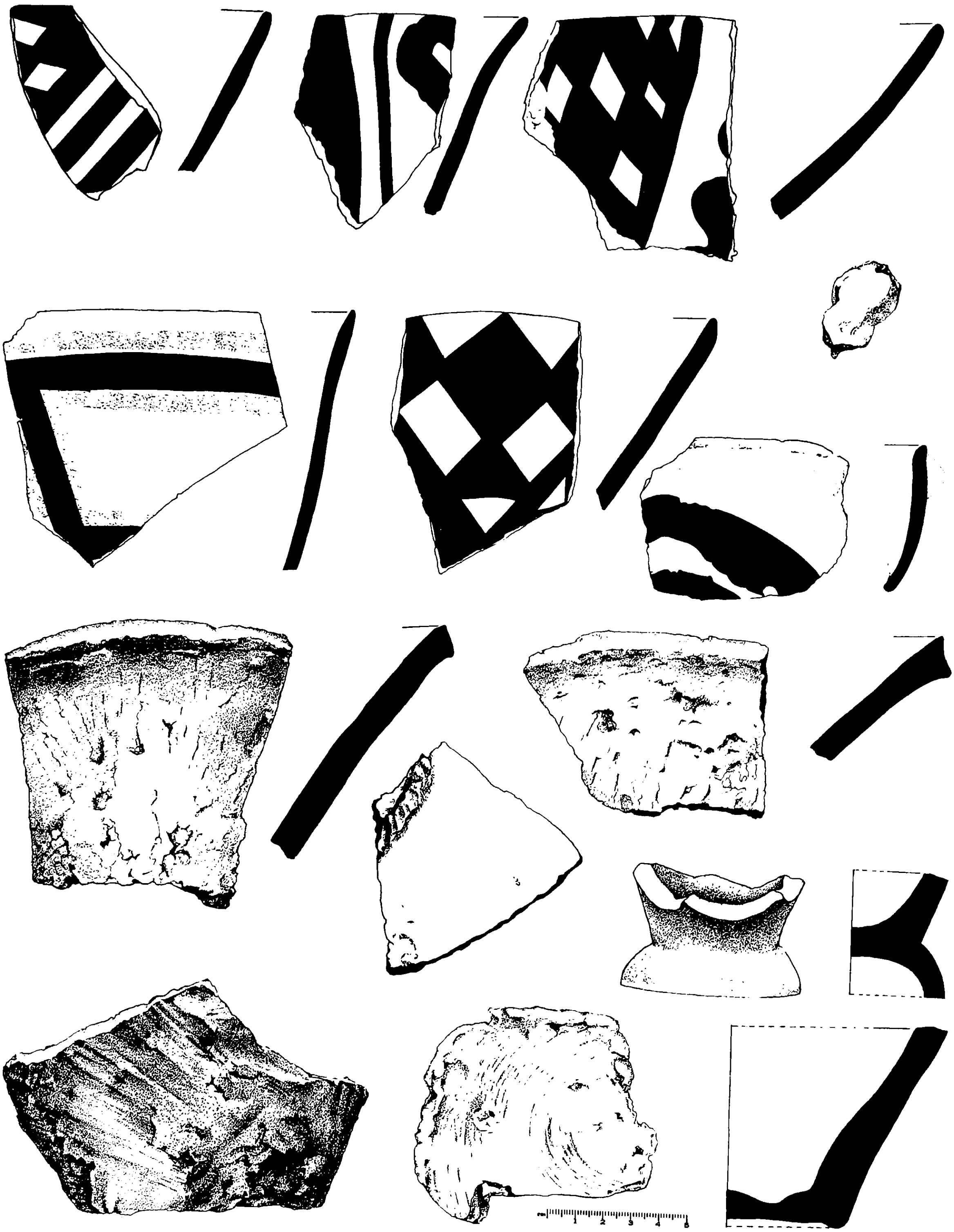


FIGURE 27 - ALIABAD BICHROME, AREA C, IBLIS IV, 70-90 CM

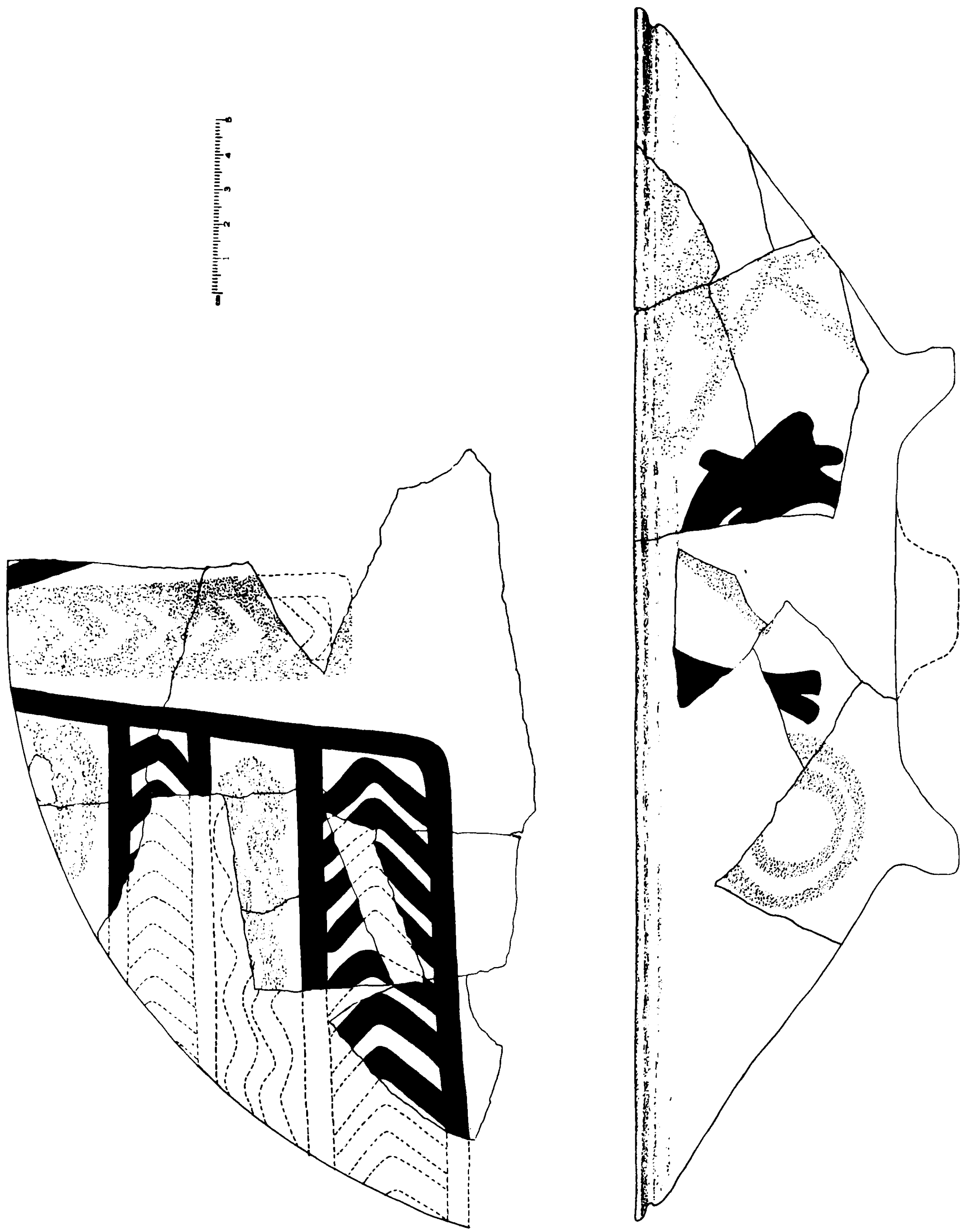


FIGURE 28 - ALIABAD BICHROME, AREA C, IBLIS IV 70-90 CM

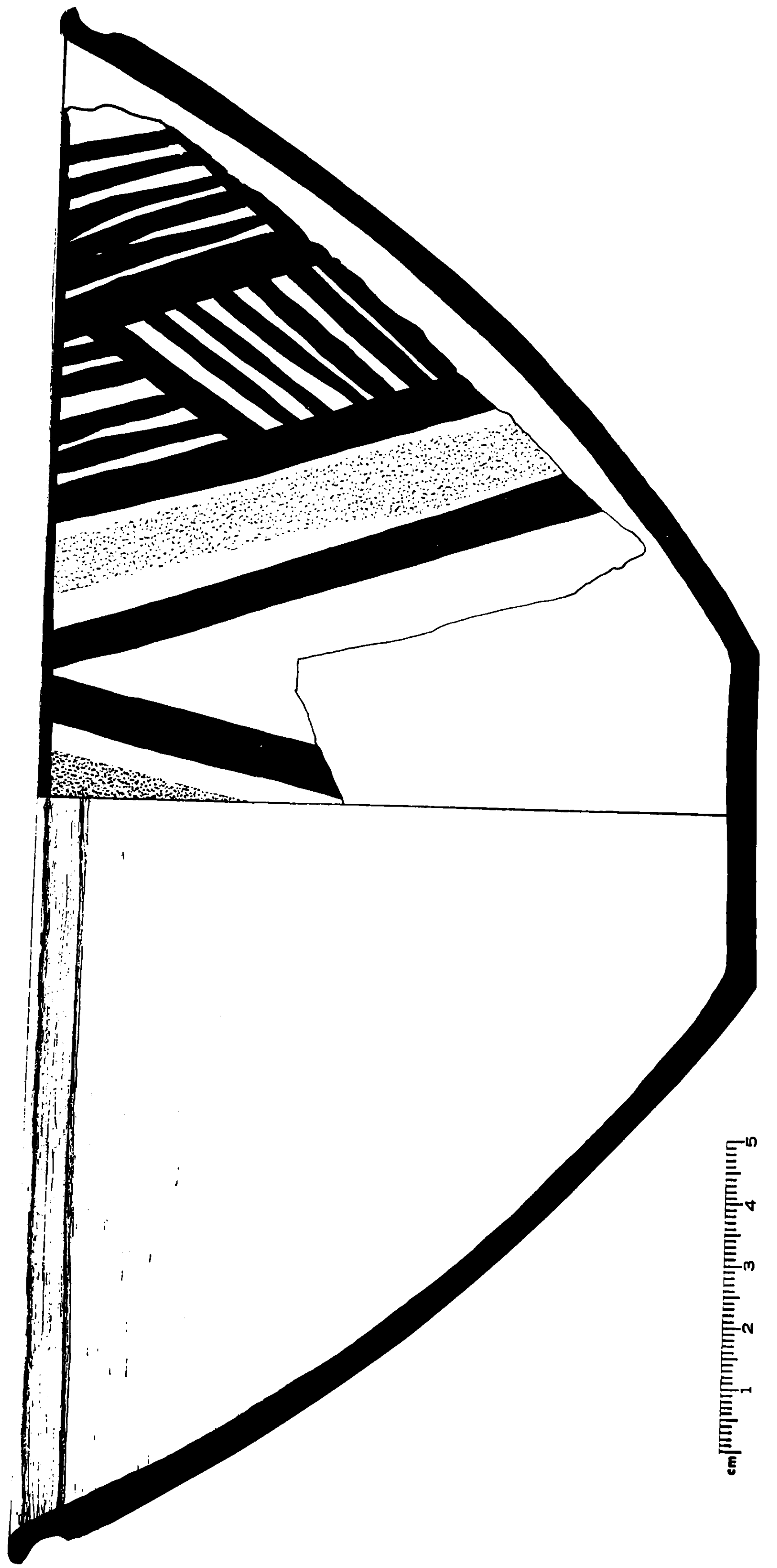


FIGURE 29 - AREA C, IBLIS IV AND PERHAPS LATER MATERIALS, 50 - 70 CM. UNUSUAL SHERDS.

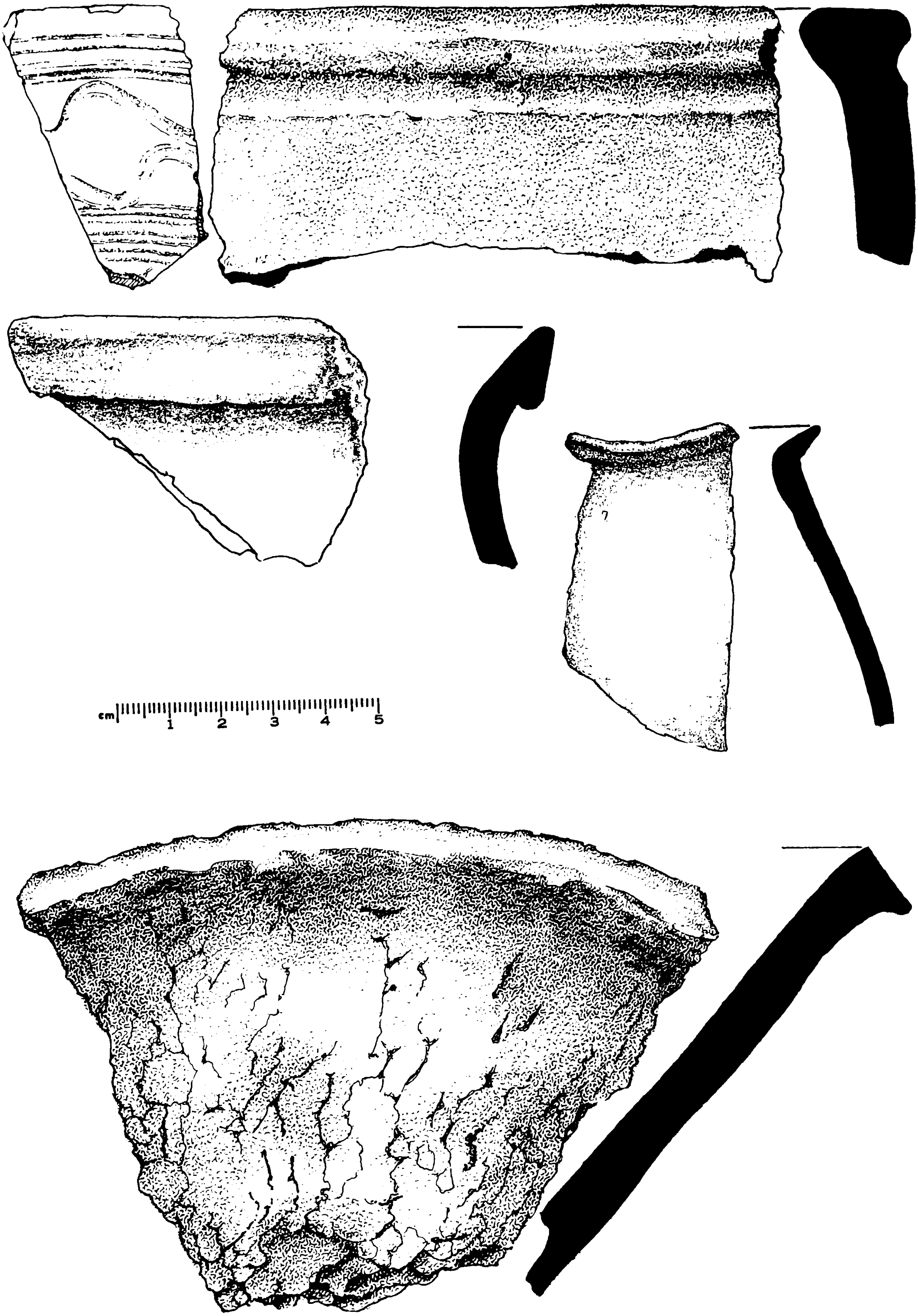


FIGURE 30 - AREA C, O - 20 CM

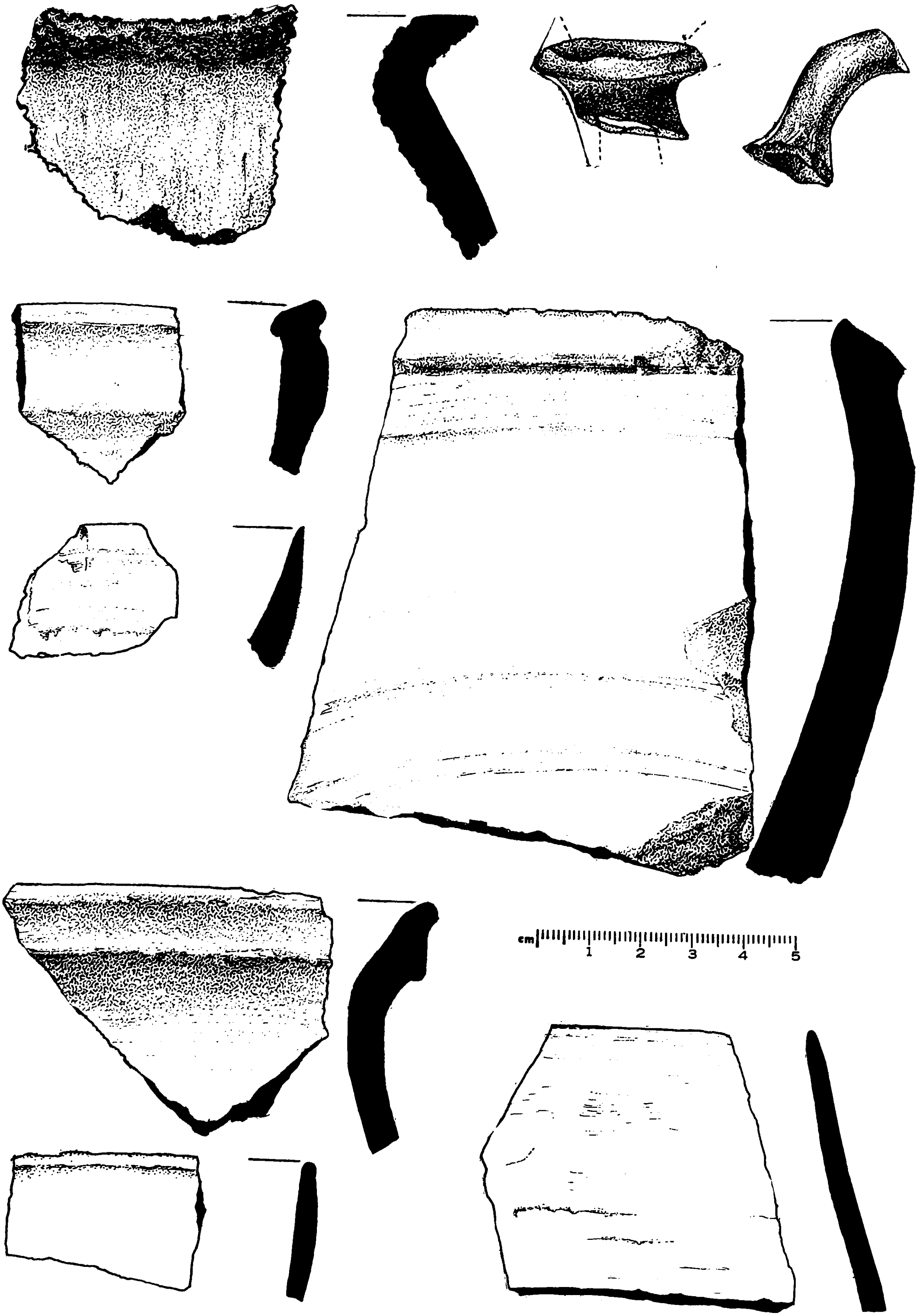
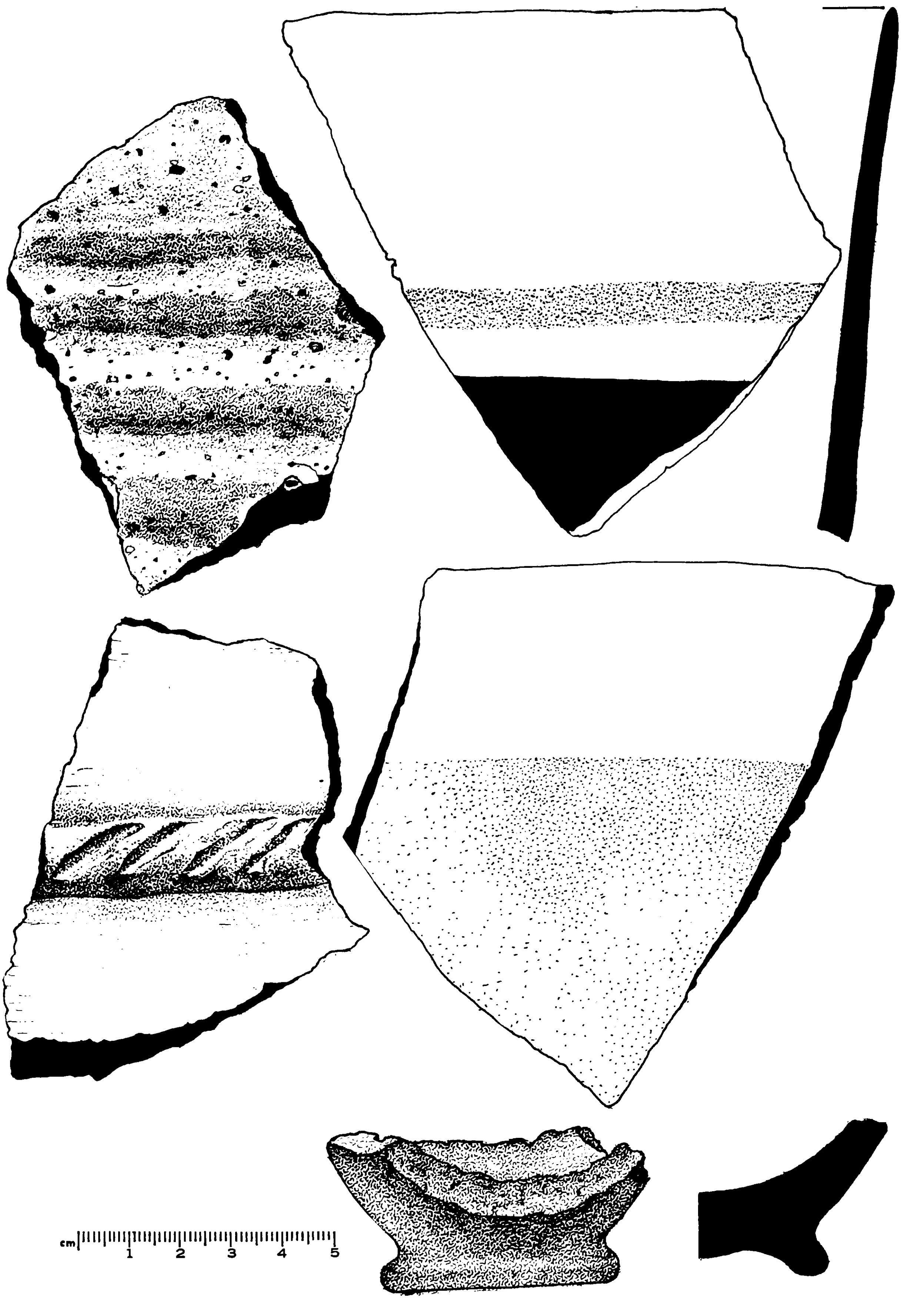


FIGURE 31 - AREA C, O - 20 CM



Possible Iblis O Period, Excavation Area A, Sections A and B

Area A, section A was a rectangular excavation 3.5 by 3.2 m opened tangent to the north profile of the south mound remnant. Its uppermost level equated with the floor level of the mound as left by the fertilizer diggers. Excavation was by levels in which the first was 40 cm (allowing an average 20 cm of wind blown dust and washed in debris to be removed), the next three were in 20 cm levels, the fifth, 30 cm and the sixth, 40 cm.

For the most part, the upper profile (Fig.1) structure of sections A and B was made up of rather hard packed yellow clay. This occasionally graded into other colors depending upon its content. That it was occupational soil was demonstrated by the presence of artifacts -- mostly pottery. Charcoal was present consistently throughout much of the upper fill but tended to become less as the excavation proceeded downward.

At 60 cm, alternate bands of sand and very fine clay were detected. These lenses occurred with greater frequency as the excavation was carried downward. The sand was medium to fine occurring in 'pockets' surrounded by a hard clay matrix. The clay also, but to a lesser extent seemed to lens or 'pocket' in larger strata of sand toward the very lowest levels. This clay was very fine -- a type which could be called colloidal and deposits of gypsum crystals occurred frequently along cleavage lines in the clay. These sand and clay bands and gypsum deposits suggest that water may have been the depositing agent -- moving water to transport the sand, and pooled or standing water from which the fine clay particles could settle. In a very tiny sounding made by the Caldwell party somewhat north of this area in 1964, there occurred a 5-10 cm layer of bluish clay with iron stains underlaid by reddish silt. It was thought at the time that the blue clay might have been a swamp deposit, but this stratum did not occur in Chase's excavation. At the moment, all these apparent water-laid deposits can only be the subject of speculation. That the situation was very localized, conceivably a result of overflow from the now abandoned channel of the Lalehzar River 120 m to the southwest, is suggested by sounding made in 1965 by the Archaeological Service of Iran at a point 80 m north of section A (See V, Fig. 3) which reached even deeper levels. Here there was no indication of water deposits. Instead the profile showed layer after layer of wind-blown sand interspersed with zones of tiny pebbles similar to those layering the arid desert around the mound today.

Artifact Distribution Area A, Sections A and B

To judge from the profile of section C adjacent, at least three meters of overburden had been removed by the fertilizer diggers prior to our excavation of sections A and B. We therefore intercepted one of the earlier levels at the outset. Examination of Tables II and III shows that the surface levels of these two sections intercepts the Iblis II period. Level O-40 cm in section A seems to be roughly equivalent to O-20 cm in section B. The next levels, 40-60 cm in Area A and 20-50 in Area B, show some mixture of Iblis I and II decorated types, but the proportion of Lalehzar Coarse ware is substantially higher. Below these only Lalehzar Coarse pottery is found, and the only artifacts were two flake blades.

Tables II and III show that Lalehzar Coarse ware is at least as early as any ceramic on the site. The deepest levels in Area A sections A and B contained no other pottery, and Chase believes that these levels represent a distinguishable period which he would call Iblis O. The reader should note that the levels called Iblis O by Chase are some centimeters lower than the level originally described by Caldwell and Shahmirzade[1] as

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1 *Op. cit.*

Iblis O. Caldwell's small sample from the latter level also contained only Lalehzar Coarse ware, but the 1966 excavations show clearly that had the sample been larger, some sherds of the Bard Sir complex, the concurrence of which with Lalehzar Coarse ware marks the inception of Iblis I, would have occurred. The proportion of Lalehzar Coarse ware on the floors of Iblis I houses excavated by Evett was never less than 95 percent and was as much as 99 percent. In Area B, structure 3-8, excavated by Caldwell and Sarraf, every sherd on the room floors were Lalehzar Coarse, but a thin midden below this building yielded 3 Bard Sir sherds. In essence, Lalezar Coarse represents the end of a long tradition of soft ware in eastern Iran, and Iblis I is the time when the first few buff ware vessels were being adopted. That Iblis O sites exist somewhere in the area can hardly be doubted, the question is whether Chase's sounding actually demonstrates the existence of an Iblis O period at Iblis itself.

Lalehzar Coarse is a crude, thick, soft ware, reddish or brown in color and heavily tempered with vegetable matter, probably wheat straw. Hardness is estimated at 1.5 - 3.0 (Moh). Many vessels were extremely large, some small-base jars exceeding 50 cm high and 35 cm in diameter. Sherd thicknesses range, depending on which parts of the vessels are measured, from .7 to 3.0 cm.

To Prof. Frederick R. Matson of Pennsylvania State University we sent two pottery fragments, one of Lalehzar Coarse from the level we now call Iblis I, and a similar fragment from Tall-i-Bakun B near Persepolis. According to recent radiocarbon determinations both are approximately the same age, [1] and both represent the end of the predominance of soft wares in their respective areas. In a letter of June 15, 1965, Professor Matson wrote:

"The two sherds have both been fired long enough to oxidize the organic materials that are normally in all clays. Thus they do not have black cores. The color of the fired clay, tan salmon, suggests that the firing temperature was in the range of 700° to 800° C. The distinctive aspect of both sherds, despite their differences in thickness (Bakun B-18 mm: Tal-i-Iblis 7-13 mm) is the nature of the tempering material included in them. It consists of stubby chaff in units of about 5 mm in length and 1 mm wide, the individual pieces, according to impressions left in the fired clay, were frequently at angles to each other, not uncommonly at approximately right angles. They are not aligned parallel to one another. This would suggest that once the chaff was added to the wet clay, doubtless to stiffen it so that it could be formed into vessels, the clay was not further worked or wedged to any great extent, nor were the vessel walls patted and shaped and scraped much once they had been formed. The lack of orientation of the chaff is interesting. The surfaces of both sherds are smoothed over with chaff-free clay, doubtless to produce a smooth surface. Finger striations can be seen in this surface layer, much of which has spalled off of the sherds thus exposing the chaff impressions inside....The Bakun rim sherd has a groove along its lower fracture edge showing the junction of two coils of clay that had been joined together."

Another pottery fragment from this level was sent for examination to Professor Hans Helbaek of the Danish National Museum, Copenhagen. Professor Helbaek wrote: "The tempering is mainly grass blades and bits of straw. That it could easily be cultivated grasses is suggested by the dimensional range of the fragments as also by the occurrence of a crushed palea of wheat (Emmer ?) and a few fragments of silica remains of awns, corresponding in dimensions and other characteristics to those of Emmer."

Vessel forms are apparently relatively few. In the earliest levels of Area A, sections A and B, Chase noticed only one form, a large straight-sided cylindrical vessel with a small base. Such vessels appear to have been made in two parts. The base section is flat or slightly concave and flares up and outward sometimes in an ogee curve to be

1 We now have two C14 determinations from Bakun B-I (P-438) 4220 ± 81 B.C. and (P-931). 4502 ± 72 B.C. Both 5730 half-life.

attached to the cylindrical upper part of the vessel. The basal section is generally low, constituting not more than one-fourth of the overall height (Evett, this volume, Fig.1,1; Caldwell and Sarraf, this volume, Figs. 6, 7, and Pl.2). Other forms which, according to Chase's observations, may come later are drum-shaped and pear-shaped vessels (Evett, Fig.1: 3,5). There are also simple bowls (Evett, Fig.1:2.) Painting in broad red bands and simple designs does occur on Lalehzar Coarse vessels of the Iblis I Period (Caldwell and Sarraf, Fig.6). Other Lalehzar Coarse sherds from Iblis I levels show modeled decoration.

A total of 52 Lalehzar Coarse sherds were found in the deepest level (80-100 cm) of both sections of Area A. Slightly higher was a considerable increase in the number of sherds: 226 in the 60-80 level of section A, and 226 in the roughly comparable level 50-80 cm in section B. Up to this point no other pottery type had occurred, and this is our evidence that a pure Lalehzar Coarse ware horizon may represent the oldest period at the site. This is what Chase would call Iblis O, despite Caldwell's reservations. Chase also notes that these apparently pure Lalehzar zones correlate with the alternate bands of sand and colloidal clay which may indicate alternate episodes of moving water and water standing in pools, possibly as a result of annual overflow from the nearby abandoned channel of the river.

Iblis I and II, Excavation Area A, Sections A and B

Lalehzar Coarse continues to increase in abundance upward through sections A and B, but in the 40-60 cm level of section A and the 20-50 cm level of section B, we find both Bard Sir and Iblis types intermingled with Lalehzar Coarse. It is possible that at this point the levels are telescoped, that the concurrence of Bard Sir and Iblis types is fortuitous. It is equally possible that this is a truly transitional zone. In other situations, however, the Bard Sir are earlier than the Iblis types. The floors of the houses excavated by Evett do not have the Iblis types, nor were any found in early houses excavated by Caldwell and Sarraf. However, Chase's excavations in Area E, show the Iblis types increasing in levels where Bard Sir types are decreasing.

In sum there is every reason to believe that there is a horizon at this site where Lalehzar Coarse and the Bard Sir fine wares represent the entire ceramic assemblage. We call this Iblis I. It is followed by Iblis II when pottery is predominantly of the Iblis types, and Lalehzar Coarse ware is becoming infrequent. The Bard Sir painted types may continue infrequently, but one type, Bard Sir Red Slipped, actually increases in popularity. The stratigraphic digging by Chase in Areas A and E, essentially dumping areas, suggests a gradual transition of relative frequencies from Bard Sir to Iblis types, i.e. Iblis I to Iblis II.

Iblis I

Following our possible Iblis O, which would have only Lalehzar Coarse ware, in Iblis I are added the types of the Bard Sir complex, a well-made, thin-walled buff ware with the firing well controlled, perhaps in a kiln. Tempering may be fine grit or finely divided vegetable matter or both. The addition of this new pottery to the soft crude Lalehzar Coarse must have been a very gradual affair. As previously mentioned it occurs very sparingly on the floors of those houses we have excavated, a fact which might be equally a function of time or a function of the particular purposes and tastes of the inhabitants using it. In any case it is sufficiently rare in houses D, F, and G, excavated by Evett, and in the houses of Area B, excavated by Caldwell and Sarraf, to suggest that it may be imported. If so, the direction from which it came was southwestern Iran, the "Buff Ware

Province" of McCown. Chase's excavationsin Area E, however, show a considerable increase in the Bard Sir types in proportion to Lalehzar Coarse. It is possible therefore that there is both an increase of the Bard Sir types and a beginning for Iblis Painted within the duration of Iblis I. We suspect that, by this time, fine pottery is being made locally. A radiocarbon determination from Area E of 4100 150 B.C. (GX865) is somewhat later than other determinations of Iblis I (although not as late as other data we have rejected, see Fig.2) and is just slightly earlier than our two determinations for the Iblis II period. If there actually is a late Iblis I interval during which the Bard Sir types have notably increased in number, this determination from Area E is our best intimation of when it may have occurred.

The types of the Bard Sir complex are Bard Sir Painted, Bard Sir Red Slipped, and Bard Sir Plain. In Bard Sir Painted the decoration is dark maroon or black but occasionally a faded or "fugitive" red. On shallow vessels it frequently occurs on the interior; on deep vessels it is confined to the upper part of the exterior. There is a very wide range of design motifs, much greater than in the succeeding type Iblis Painted,of the Iblis II period. Design elements are principally geometric, but there are rare animal representations. Cross hatched patterns with bordering embellishments are particularly common. Other designs include combinations of triangles, swasticas, comb or pitchfork figures, Maltese crosses and chevrons. Vessel forms include cups, flaring sided bowls, and narrow necked jars with flaring rims.

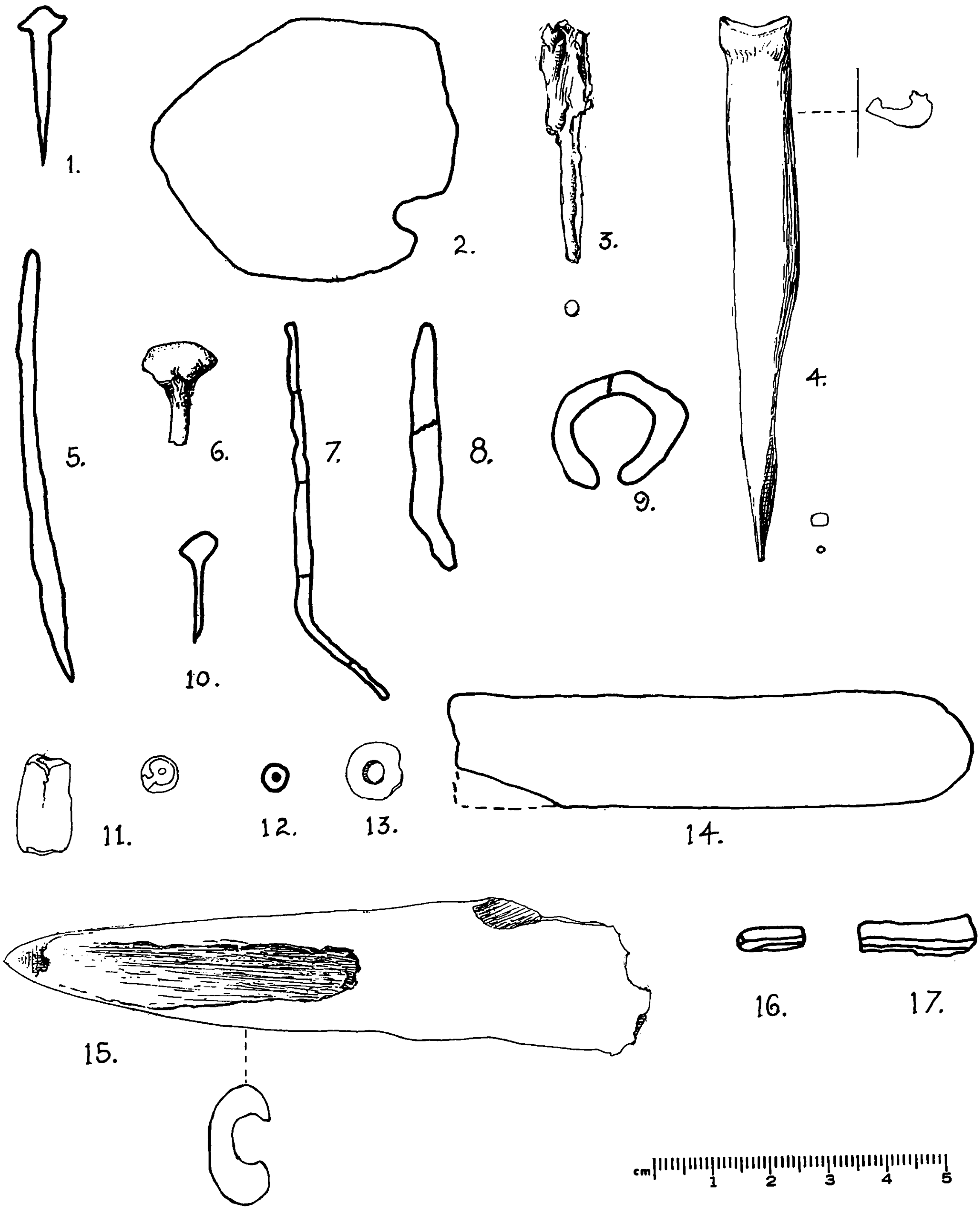
Bard Sir Red Slipped seems to occur in two principal forms. There are flat bottomed vessels with gracefully flaring sides and which in at least some instances have bases oval in plan. The other form is a sphere shaped hole-mouth vessel. Vessel walls are characteristically thin, 3-6 mm. The red slip covers the entire exterior, and in some vessels the interior as well. A frequently observed variation is "pattern burnishing" of the exterior surface probably done with a bone tool and resulting in a pleasing alternation of shiny lines and matte areas.

Bard Sir Plain sherds doubtless include some undecorated parts of Bard Sir Painted vessels. With an insufficient sample of complete vessels for study, the best we can say is that this type may be identical with Bard Sir Painted except for lack of decoration.

In view of the mixture of Iblis I and Iblis II pottery in the upper levels of Area A, we cannot safely assign the accompanying non-ceramic artifacts to one or the other, but must assume that they pertain to both periods or a transition between them. These will be discussed below after we introduce the Iblis II period pottery. We must mention, however, that in Area A Chase recognized the possibility that copper smelting might be older than the Iblis II period. There, ore, crucible fragments, copper artifacts, and slag fragments turned up in the levels above 60 cm in section A and in the level above 20 cm in section B. A radiocarbon determination for the 0-40 cm level in Area A was 4287 ± 40 B.C. (GX864), which is substantially earlier than the two dates Caldwell had previously obtained for crucible fragments in levels which we are now calling Period II. Another date earlier than the Iblis II dates also came from the excavations in Area E: 4110 ± 150 B.C. (GX865). If our dates for the Iblis II period are substantially correct, these two carbon samples may indicate that Iblis I was flourishing about 100 years earlier and there is a good chance that some of the crucible fragments, ore and copper artifacts from these levels pertain to Iblis I times.[1] A forthcoming metallurgical analysis of copper artifacts from the floors of the Iblis I houses excavated by Evett, and by Caldwell and Sarraf, should tell us whether copper was smelted or not during Iblis I times.

1 See Paper V.

FIGURE 32 - ARTIFACTS FROM AREA A, SECTIONS A AND B



Area A, section A, level 1: 1: (6) copper pin 2: (10) drilled marine shell section A, level 3: 3: (25) copper pin Area A, section B, level 1: 4: (31) bone awl 5: (32) copper pin 6: (35) copper pin 7: (38) copper pin 8: (39) copper pin fragment 9: (12) copper ring 10: (36) copper pin 11: (43) copper bead (scale 2x) 12: (44) greenstone bead 13: (45) bone or ivory bead (scale 1 1/2x) 14: (40) bone "spatula" 15: (56) bone awl 16: (48) white chert blade 17: (49) green chert blade

Iblis II

This period is distinguished by the addition of two pottery types, Iblis Painted and Iblis Plain. Bard Sir Red Slipped continued from the previous period. Lalehzar Coarse ware also continued but greatly decreased in popularity. It is probable that a certain amount of Bard Sir Painted also continued to be used: two occupation zones of Iblis II from which the Caldwell party in 1964 carefully extracted sherds also contained a few Bard Sir Painted sherds which were not recognized at the time.

Iblis Painted and Iblis Plain are thin-walled, well made, with controlled firing. Tempering appears to be finely divided vegetable material. They are readily distinguished from the Bard Sir types by a reddish paste and surfaces. The Bard Sir Red slipped of this period has a reddish paste but also a gray core. Sheila Caldwell has suggested, although we cannot be certain without experiment, that the gray core is a result of refiring to fix the slip.

The decoration of Iblis Painted has some of the same motifs that occurred in Bard Sir painted but the variety is less, and the motifs more standardized. Painting is well executed, either black or dark maroon, and is again confined to the upper part of the exterior of deep vessels. The most common motif is a close spaced multiple chevron pattern sometimes bordered by a horizontal painted band at the top but more frequently at the bottom of the design. The lower half or two-thirds of the vessels are left plain, but there is often another horizontal painted band around the base. Sometimes one finds a painted cross or X in the plain area, at other times this is on the bottom of the vessel. Cross hatching occurs with some frequency, either zoned in alternate squares or confined between lip and midline bands. There are also a few more complex designs. All decoration seems to be geometric; animal designs have not been noticed. Among vessel shapes the simple cup or beaker is most frequent. There may be some wide mouth bowls, but as yet we have no good examples. A small narrow mouthed jar (?) and a hole mouth vessel have been noted. Vessel bases are flat, sometimes slightly concave, or annular.

Many of the fragments counted as Iblis Plain are undoubtedly undecorated parts of painted vessels but plain vessels do occur. So far as we know these are not different from Iblis Painted except in lacking decoration.

Non-Ceramic Artifacts and Other Materials from Area A

As already indicated, the materials described in this section are from levels which contained both Iblis I and Iblis II pottery. They therefore belong to either both of these periods or to a transitional time between them.

Among the most common of non-ceramic artifacts were flake blades. These long, thin and faceted flakes had been removed from prepared cores of flint, jasper or, rarely, chalcedony.[1] A number of cores were found which had been discarded in various stages of use. Blades varied from 12 to 3 cm in length. Even large blades were rarely wider than 2 cm and the very small ones were about 3/4 cm in width. The use to which these blades were put depended to some degree on the size and shape. Larger examples were frequently re-touched along the cutting edge and not a few had been worked into a pointed implement at one end, probably for use as a drill; others were crescent-shaped. Very common was a high polish, or "sickle sheen," along the cutting edges. Such blades

1 See Evett, Paper XII

may have been mounted in a wooden sickle, for although bone sickles occurred at Tepe Sialk, none of these were found at Iblis.

Long rectanguloid chisel shaped objects of slate were found in a number of instances, and they may have come into use late in Iblis O times. Typical specimens are 6-8 cm long and from 1 1/2 to 2 cm wide, but seldom more than one-half cm thick. All were made of a blue-gray slate. The cutting edge seems to be at the end rather than along the sides.

Both calcite and steatite were used for small receptacles. In Area A only fragments were found. Complete vessels found elsewhere on the site were straight sided, thin walled with a thinned rim. Bases were flat. The calcite found on the site varies in appearance from an almost pure white to a gray white striated with impurities. The steatite is a dark green variety. Various other forms of stone were used for grinding and abrading, for ground "knives," both of slate and sandstone, and for the manufacture of beads and other small objects. So far neither ground nor chipped projectile points have been noted.

Bone tools, principally perforators or awls, occurred with some frequency. There were some awls, or perhaps pins, which were well made and highly polished. So far, particular types of bone artifacts have not been diagnostic of particular levels, but one class of flat ended objects, "spatulas," may turn out to be most characteristic of Iblis I.

There were also some non-vessel ceramic objects. Sherds were sometimes carved into small discs, and spindle whorls were often of clay.

Our evidence of copper industry in Area A included samples of azurite and, more commonly, malachite, both ores of copper. There were a number of crucible fragments. As reconstructed the average crucible would be a small oblong cup 11-15 cm long by 7-8 cm wide by 5-7 cm high. Vessel walls are relatively thick, from .6 to 1.5 cm on a few specimens we examined. Nearly every specimen showed green stain and slag adhering to the inside.

The copper objects in Area A were invariably small pins or perhaps awls or punches. Typical awls were pointed at both ends and were from 5-12 cm long. There were a number of small pins, rarely more than 2 cm long, with extraordinarily large heads. Two copper beads in Area A section B are of the rolled type, probably made from flattened sheets.

The Probable Continuum between the Iblis I and II Periods, Excavation Area E

We introduce excavation Area E at this point in the discussion because the materials recovered from it related entirely to the Iblis I and II periods, or what seems more likely, a segment of a continuum in which the first period gradually gave way to the second. Area E was situated approximately 60 m northeast of the mound. No structures were found, and from all appearances the area had been used as a dump. Our attention was directed to the place by erosional gullying in connection with a shallow trench which appeared to have been dug some time ago. Pottery and other artifacts were numerous in the vicinity. A high percentage of pottery on the surface was of the Bard Sir types we ascribed to the Iblis I period, but there were also substantial amounts of pottery typical of Iblis II.

Initially, section stakes were laid out for ten meter squares on a north-south, east-west line (magnetic). As in other excavation areas, sections were designated by letters. The plan was to emplace three sections, from north to south -- or, sections A, B and C, but with section C extending east from section B and section D extending north from section C--

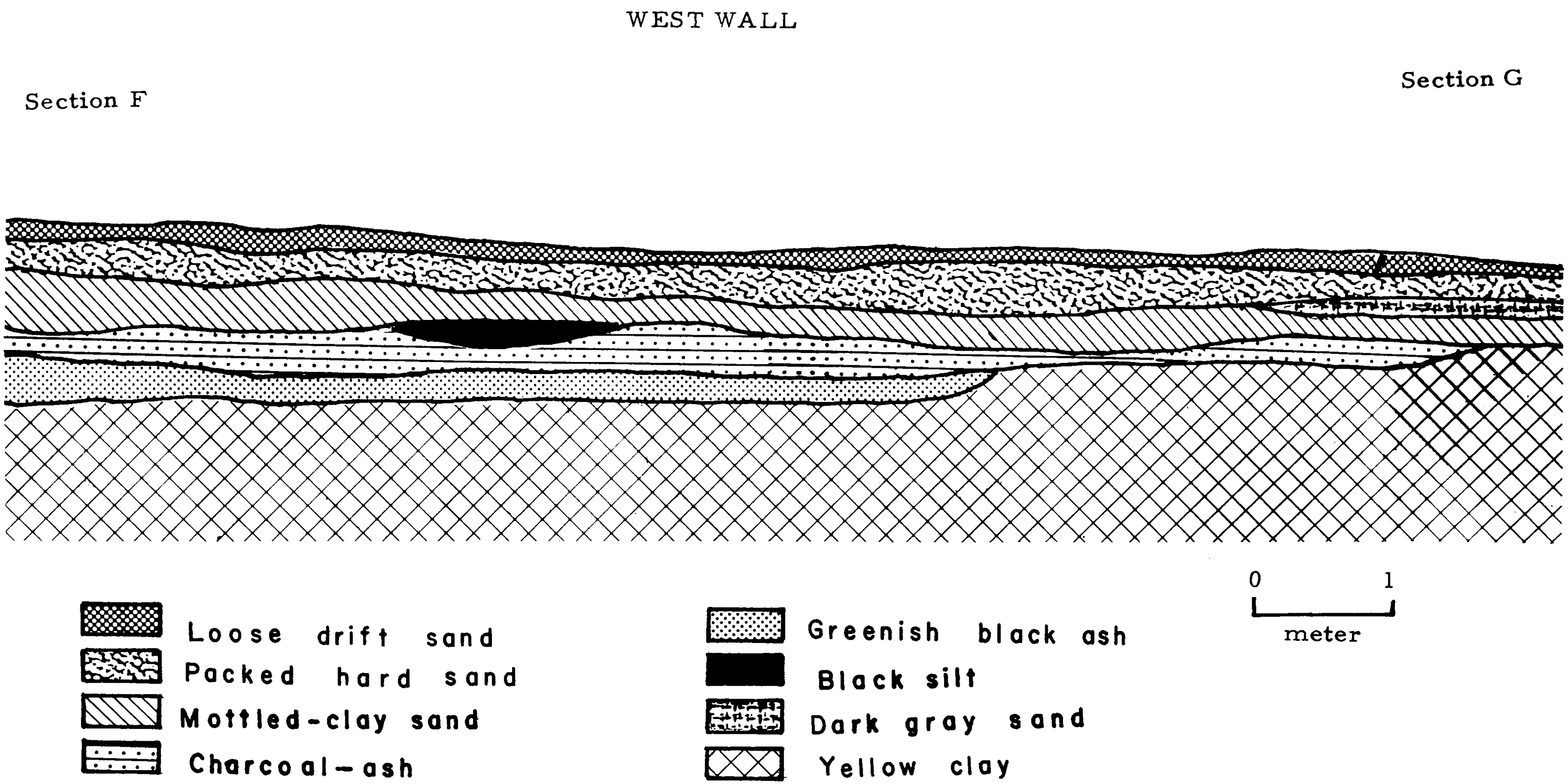


FIGURE 33 - AREA E PROFILES

making a sort of horseshoe. In the row of sections from D through G, only sections F and G were excavated.

The profile indicated a deposit of organically colored gray and very dark fine sand -- almost a dust with smaller bands of wood ash. This overlay a yellow clay which was charged with small water worn gravel pebbles. This lowest level was devoid of occupational evidence.

The northern end of the combined sections A and B showed a marked dip to the west. At the junction of the east and north wall of section A it was less than 1 meter deep but well over 1 meter at the junction of the north and west wall. The floor of section A also dipped sharply to the south toward section B. Upon excavating the latter section, it was noted that the same dip occurred in section B but this time from south to north so that the line forming the junction between sections A and B bisected a sort of trough. The cause of this configuration of the original gravel-clay surface could not be determined although it was suspected that it may have represented a segment of a natural run-off channel which, in times of rainfall, shed surface water into a larger channel and thence into the Lalehzar which flowed immediately to the east of the excavation area at that time. At the present ground surface level, the undulations disclosed on the floors of the two sections are not discernable. Refuse ultimately filled the gulleys and the rains and winds of the subsequent thousands of years simply leveled the overburden.

It was clear, however, that the stratigraphy of this area was very likely to be tilted. Although we were able to correct for this to some degree in digging, whatever continuum may be exhibited here in the pottery and artifact sequences may be exaggerated by the inclusion of earlier and later materials in each of our levels.

The topmost level in sections A and B, although only 20 cm deep, produced a large quantity of material and by far the greatest proportion of Iblis complex pottery. Levels 2, 3 and 4 below contained relatively more Bard Sir pottery, but Iblis types continued strongly all the way to the bottom. Lalehzar Coarse was expectedly present throughout.

Because of the uneven subsurface stratigraphy of sections A and B, it was decided to select two additional sections where artifact vertical distribution would be less effected by this condition. Tests indicated a better situation in an area roughly 20-30 m east of the completed sections. As shown in Paper V, Fig. 3, the two new sections were F and G.

The control in levels of these two sections was identical with that of sections A and B -- 20 cm for the top level, 30 cm for the second, 20 for the third and another 30 to the floor of the section area. The stratigraphy tended to still be disoriented to the horizontal plane and a tendancy showed to a gradual thinning out of occupational deposits toward the northern end of section G.

Both sections reflect a probable continuum or overlap between Bard Sir and Iblis times -- which improves the likelihood that these soundings intercept a transitional period. We should not neglect the possibility that some of the Iblis painted (Iblis II) pottery in the fourth zone (70-100 cm) are the result of animal burrows, roots, or human disturbance. In this regard, it is curious to note that there is a paucity of Iblis type sherds a little higher in the 50-70 cm level. This also occurred in sections A and B in Area E, most noticeable in section A.

A rather thick band of mottled clay and sand was seen about midway between the surface and the section floor. Although not reflected in the artifact count, this level contained a number of rather firm fragments of what might have been sun-dried brick. These were scattered and no great concentration was uncovered which would be regarded as a structure. Underlying this in successive lenses were beds of very black and fine dust or silt. A similar level, at the floor level of the pits,had a sort of green tinge to it. Exactly what this implied again could not be determined. That extensive burning of organic materials was involved as suggested by reddish and somewhat hardened portions of the normally light yellow clay which underlay the dump.

Area E, sections F and G again showed in the topmost zone a strong representation of Iblis complex pottery, which is ideally characteristic of Iblis II. In the lower levels, however, Bard Sir pottery of Iblis I was greatly in the majority. This can be more easily seen if we eliminate Lalehzar Coarse and Bard Sir Red Slipped which are companion types of both complexes:

Table IV

		0-20cm	20-50cm	50-80cm	70-100cm
SECTION F	Iblis sherds:	169	109	30	102
	Bard Sir sherds:	157	171	128	280
SECTION G	Iblis sherds:	171	176	26	17
	Bard Sir sherds:	218	447	283	150
TOTAL SHERDS, both Sections:					
	Iblis:	340	285	56	119
	Bard Sir:	375	618	411	430

Two things seem to be indicated here, the co-existence of Iblis and Bard Sir types and the decline of the Bard Sir types in the upper levels. In short, despite the evidence of tilting of the strata in Area E, sections A, B, and the probability that our levels each contain some earlier and later materials, Area E presents a picture of gradually shifting proportions of pottery types -- a continuum from Iblis I to Iblis II. An additional fact to support this interpretation is the much greater amount of Bard Sir Painted and Bard Sir Plain than occurred on the floors of the Iblis I houses in Area D, F, G, and in Area B. On those floors Lalehzar Coarse ware had a frequency of 95 to 100 percent, the Bard Sir types comprising the remainder, while in the dump Area E the percentage of Bard Sir to Lalehzar types, even exclusive of Bard Sir Red Slipped is as follows: section A, 75 percent; section B, 29 percent; section F, 14 percent; and section G, not quite 6 percent. We shall therefore regard Area E as transitional suggesting its time placement as "late Iblis I." All things considered, a radiocarbon determination of 4110 $\pm$ 150 years B.C. (GX 865) from the 4th level of section F may be just about right. As we should expect,it is just slightly older than the two dates obtained for the Iblis II period. To call Area E Late Iblis I has the consequence however that we should probably consider the houses D, F, G, and in Area B as "Early Iblis I."

Table V.-Artifact Distribution: Area "E", Section A

	Level 1 0-20cm	Level 2 20-50cm	Level 3 50-70cm	Level 4 70-100cm
POTTERY:				
Iblis Plain	527	217	76	139
Iblis Painted	268	70	25	37
Bard Sir Red Slipped	61	35	9	12
Bard Sir Plain	480	103	49	47
Bard Sir Painted	199	81	22	22
Lalehzar Coarse	745	304	96	165
STONE:				
Flake blades	109	47	21	17
Cores	4	3	3	2
Ground stone (frag)	2	2	1	1
Calcite sherds	2	1	1	1
Steatite sherds		2		2
Ground turquoise	1		1 (bead)	
CERAMIC:				
Chipped sherds*	27		2	

* Appear to be deliberately made tools -- chipped or re-touched broken sherds

	Level 1 0-20cm	Level 2 20-50cm	Level 3 50-70cm	Level 4 70-100cm
BONE:				
Animal	356	352	223	112
Human (?)	4			5
Awl	1	1	1	
COPPER INDUSTRY:				
Crucible fragment	3	1		
Copper ore	2			
SHELL:				
Marine shell fragment	2		1	
Conch fragment	2			
Bead	1			

Table VI.-Artifact Distribution: Area "E", Section B

	Level 1 0-20cm	Level 2 20-50cm	Level 3 50-70cm	Level 4 70-100cm
POTTERY:				
Iblis Plain	650	263	92	167
Iblis Painted	162	102	126	77
Bard Sir Red Slipped	7	42	15	29
Bard Sir Plain	36	141	52	51
Bard Sir Painted	26	51	10	23
Lalehzar Coarse	434	383	191	320
STONE:				
Flake blades	72	112	48*	28
Core	5	6	3	1
Ground knife		2		
Turquoise bead		1		
Carnelian bead			1	
Flint scraper	2	2		
Calcite sherd	1	1	1	
Steatite sherd	1	2		
OTHER CERAMIC:				
Chipped sherds	8	11	9	3
Small painted "spout"			1	
COPPER INDUSTRY:				
Copper ring	1			
Crucible fragment	2	2	1	
Copper ore		3	1	
BONE:				
Awl			1	
Spatula				1
Animal	572	279	102	98
Human	2	3		
SHELL:				
Bead			1	

* One obsidian

Table VII.-Artifact Distribution: Area "E", Section F

	Level 1 0-20cm	Level 2 20-50cm	Level 3 50-70cm	Level 4 70-100cm
POTTERY:				
Iblis Plain Type	198	74	12	67
Iblis Painted	71	35	18	35
Bard Sir Red Slipped	58	42	43	78
Bard Sir Plain	124	93	85	182
Bard Sir Painted	33	78	43	98
Lalehzar Coarse	503	668	1013	2041
OTHER CERAMICS:				
Animal effigy			1	1
Chipped sherds	14	3	2	4
Ground disks	3	2	5	4 (2 perforated)
Bead	1	1	1	2
STONE:				
Flake blades	253	252	295	214
Cores	12	10	7	6
Ground turquoise				1
Ground stone	4	1 (knife)	3	5 (1 knife)
Turquoise bead		2		
Basalt bead				1
Calcite sherd	15	7	5	7 (1 disk)
Calcite cup (restored)		1		
Crescent shaped object		1	2	
Chipped drill	1	1		
Scraper	2	2		
Chipped chert disk		1		
Quern		1		

Table VII (cont'd.)

	Level 1 0-20cm	Level 2 20-50cm	Level 3 50-80cm	Level 4 70-100cm
Quartz crystal		3		
Powdered hematite			1	
COPPER INDUSTRY:				
Awl		1		2
Pin		2	2	1
Bead		1		1
Crucible fragment		2		2
Ore (copper)	5	4	1	4
BONE:				
Animal	501	1056	1769	3193
Human		1	3	1
Turtle				1
Awl		1	2	
SHELL:				
Marine shell fragment		2	2	2
Conch shell fragment		2		1
Conch core bead			2	
Engraved cruciform object				1

Table VIII.-Artifact Distribution: Area "E", Section G

	Level 1 0-20cm	Level 2 20-50cm	Level 3 50-70cm	Level 4 70-100cm
POTTERY:				
Iblis Plain	126	115	12	12
Iblis Painted	45	61	14	5
Bard Sir Red Slipped	87	251	118	26
Bard Sir Plain	75	202	156	93
Bard Sir Painted	143	245	127	57
Lalehzar Coarse	275	808	574	212
STONE:				
Flake blades	163	409	109	44
Core		10	5	2
Slate chisel		1		
Amber bead		1		
Calcite sherd		7	2	2
Steatite sherd		3		
Quartz crystal (unworked)			1	1
Pebble hammer		1	2	
Pestle (?)			1	
Ground carnelian		1		
CERAMIC:				
Spindle weight		1		
Animal effigy		1	1	1
Human effigy (female)		3		
Ground clay disk		3		
Bead		1		
Chipped sherds		3		

Table VIII (cont'd.)

	Level 1 0-20cm	Level 2 20-50cm	Level 3 50-70cm	Level 4 70-100cm
BONE:				
Awl		3		1
Animal	897	4864	1751	608
METAL:				
Arrowhead (?)		1		
COPPER INDUSTRY:				
Crucible fragment		1		
Copper artifact (pin)		2	1	
Copper ore		9	10	6
SHELL:				
Marine shell fragment		8	3	1
Worked marine shell		3	1	
Bead		4	3	2

Other Materials from Area E

On the basis of the ceramic evidence we shall provisionally consider the various materials and minor artifacts from Area E as belonging to the latter part of the Iblis I period in a continuum leading to Iblis II.

Nine instances of isolated human bones found in the refuse of Area E cannot readily be explained. One possibility is that cannibalism was occasionally practiced. Accidental prehistoric disturbance of burials seems less likely. There was only one find which might possibly be termed a burial: the cranium of a child was uncovered at a depth of 60 cm (level 3) in section A. All that was left were the bones above the nasal bridge, the upper parts of the orbits, the occiput and the upper parts of the temporal bones. This was numbered burial 1, but the brain could well have been extracted and the remains of the skull thrown in the dump. It is to be noted in this connection that two other skulls of children or adolescents occurred in Iblis II deposits in Area C among refuse in a dumping area.

A greater number of stone artifacts, especially flake blades, occurred in Area E than in Area A, partly, at least, because the excavation of E was more extensive. In sections A, B, there were stone beads, usually of carnelian or turquoise, and in one instance a very hard black stone identified as basalt. Fragments of calcite and steatite vessels were also present. An inventory of chipped and ground stone objects from Area E is given in the accompanying Tables.

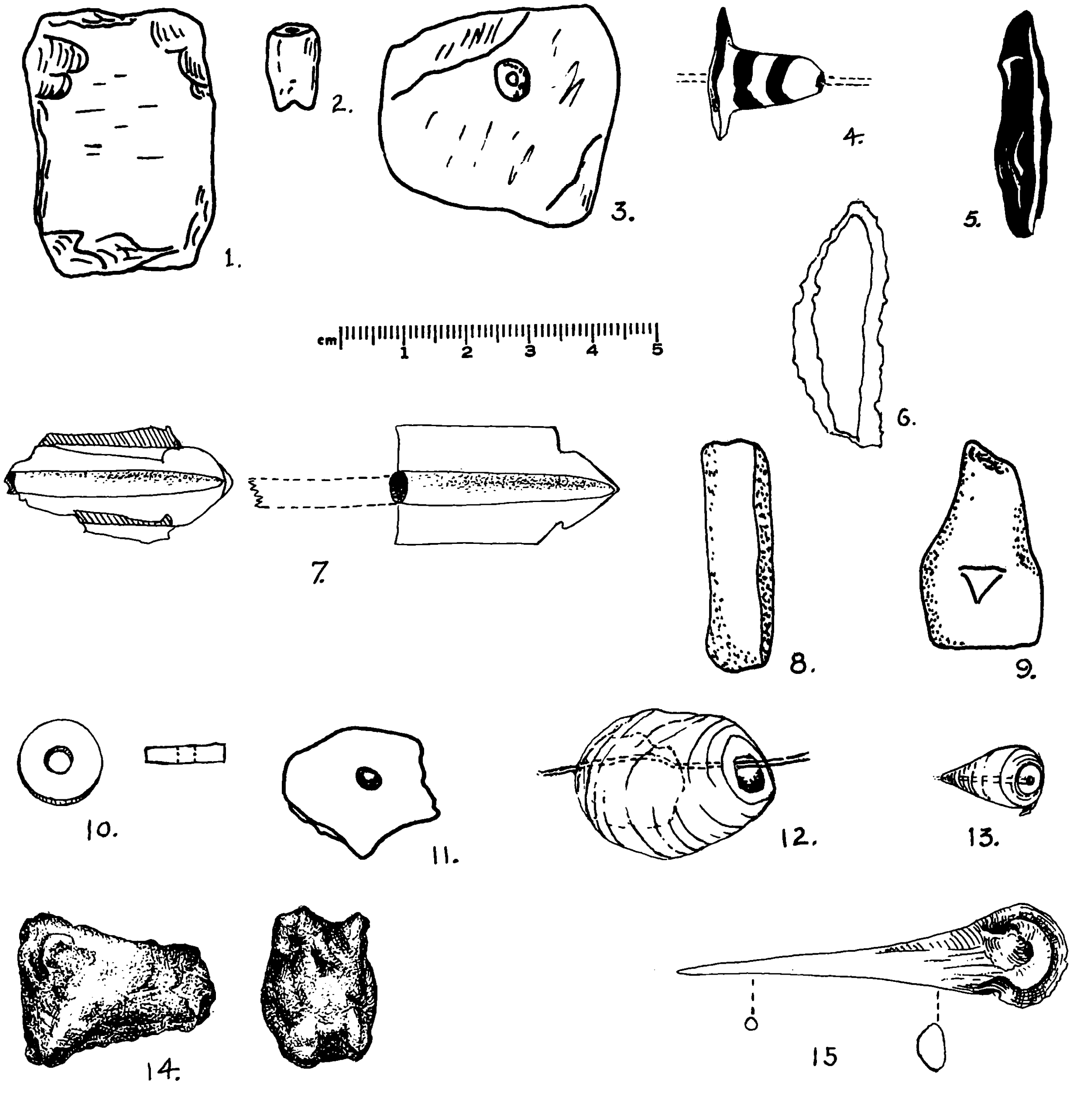
The popularity of flint flake tools was again reflected in sections F and G. Blades apparently had a multiple usage as reflected in their various shapes, the nature of the retouching, and size. In the case of certain retouched semi-lunar shaped forms "sickle sheen" indicates their use as teeth in a bone or wooden sickle.

Calcite bowl fragments showed up in lower zones indicating usage from the beginning of Area E. The recovery of what seemed to be an amber bead probably reflects trade. Stone beads, found in several instances in section F, were absent in section G. Instead, we find shell or ceramic beads occurring at all levels. Drills and scrapers fashioned from the flake blades were an interesting departure from the basic knife type flake. Of all the stone objects, three small crescent-shaped artifacts were the most intriguing. These crescents may have been jewelry or charms of some sort. One was made of carnelian and the other two were of calcite. We are not yet aware of such objects having been found at other sites in western Asia.

Among the pottery artifacts in Area E, sections A and B were a number of sherds, roughly circular, oval and sometimes rectangular in shape which had been deliberately chipped on all edges as if they were stone. Others had previously occurred in Area A. Chipping was probably done with a small flaking tool and the work applied to both faces of the sherd and confined to the outer edge. None of these were notched nor bored for suspension on a string. No undue wear was noted in any of the specimens which would suggest their use as knives. They may have been used as counters in a game. Ground sherd discs occurred in 17 instances. Two of these were perforated. One factor was constant -- they were made invariably of pottery of either the Iblis or Bard Sir type. Insufficient data has been recovered thus far to give any idea when these objects reached their height of popularity. Chase regards these crude but curiously altered sherds as diagnostic artifacts of the transition between Iblis I and II.

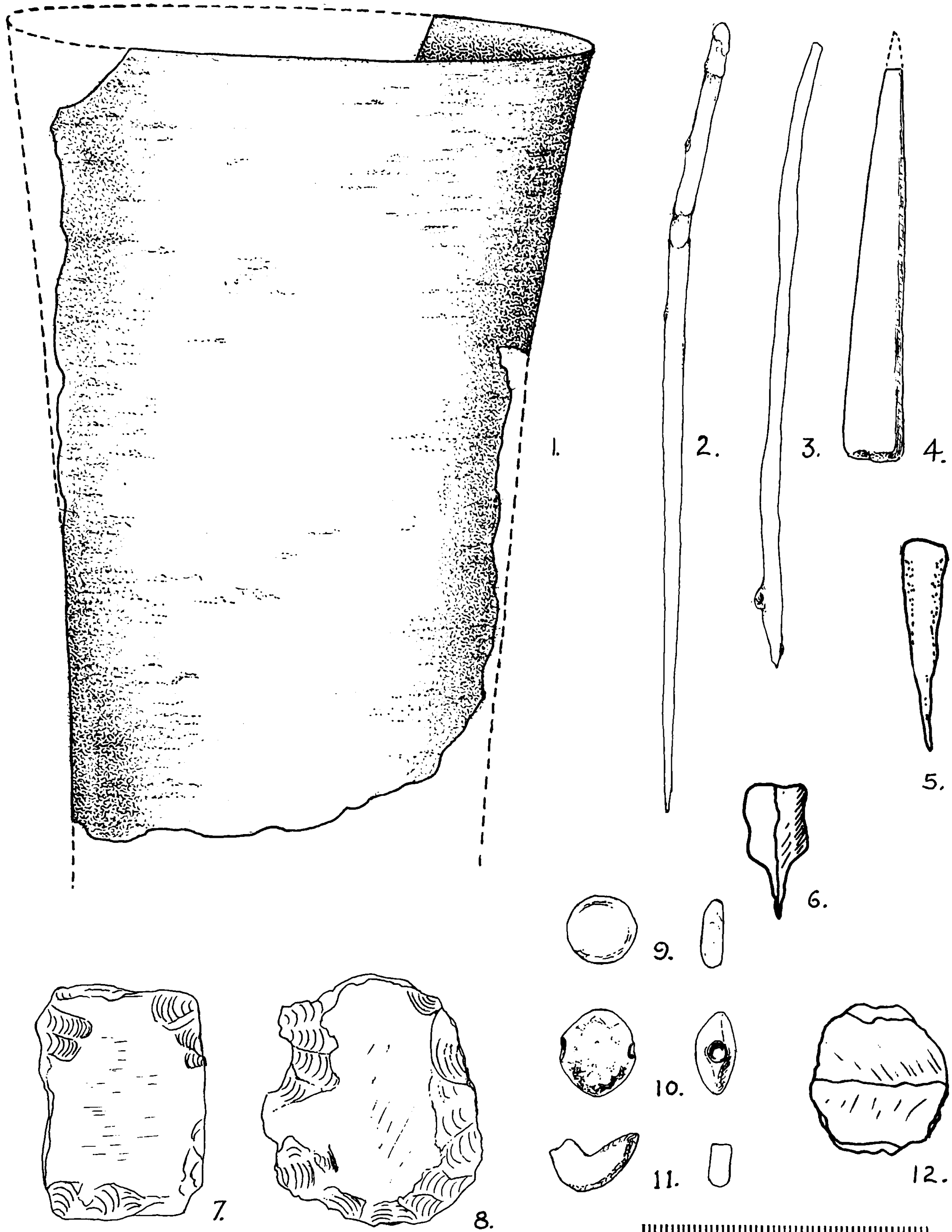
Chipped sherds were as common, especially in the upper control zones, of sections F and G as they had been in sections A and B. Again, most seemed to have been made of Iblis or Bard Sir sherds. Ground sherd disks were found in 17 instances. Only two were

FIGURE 34 - AREA E, SECTIONS A, B AND G



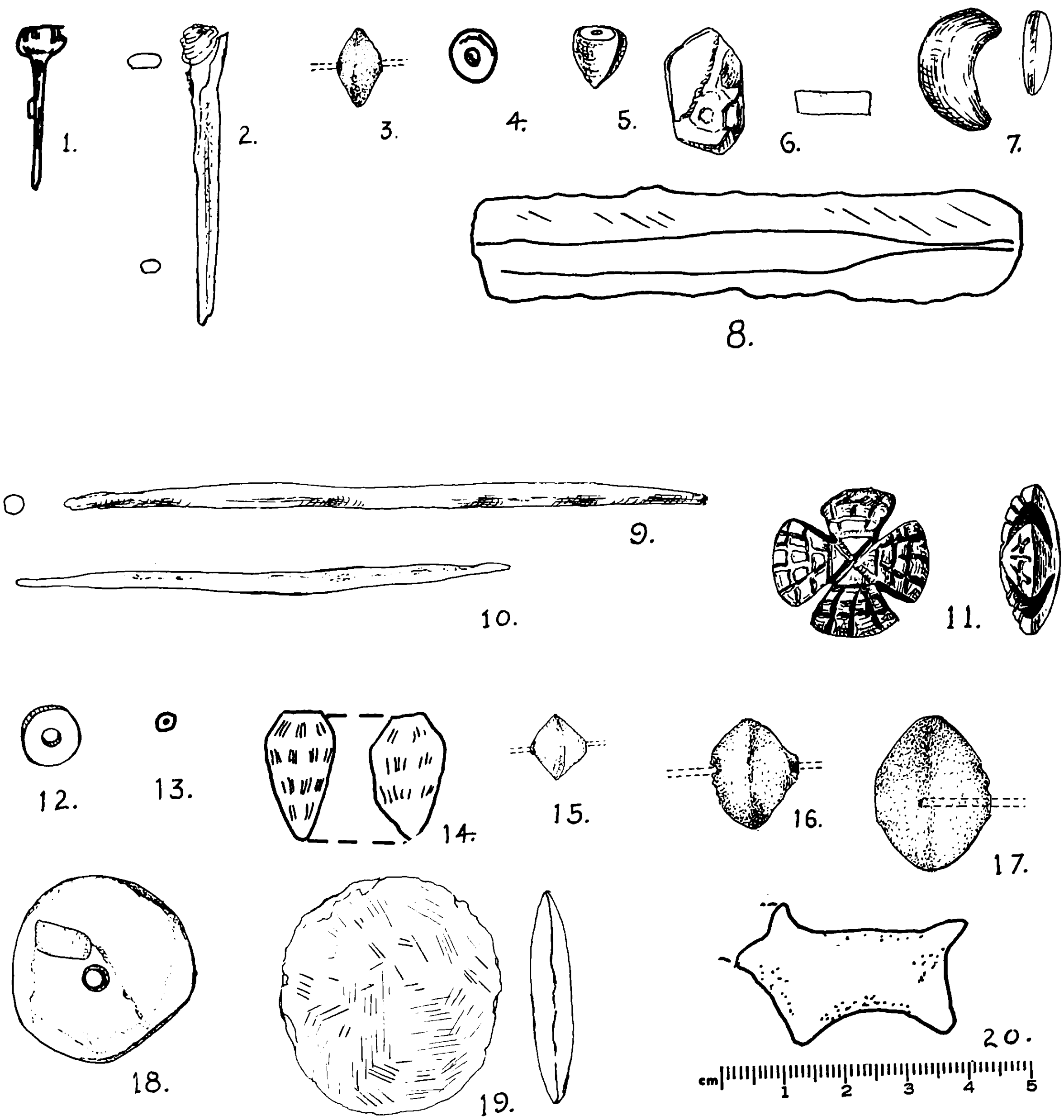
Area E, Section A, Level 2: 1:(52) Chipped sherd 2:(54) Turquoise bead Section B, Level 3: 3:(160) Perforated sherd 4:(168) Perforated pottery fragment 5:(162) Obsidian blade 6:(165) Amigdaloid basalt blade Section G, Level 2: 7:(94) Object of unidentified metal with restoration 8:(204) Slate chisel 9:(201) Figurine, possibly female 10:(111) Shell bead (scale 1 1/2 x) 11:(110) Drilled shell 12:(105) Shell bead (scale 2 x) 13:(109) Shell bead (scale 1 1/2 x) 14:(205) Pottery animal figurine Section G, Level 4: 15:(107) Bone awl.

FIGURE 35 - OBJECTS FROM AREA E



Area E, Section I, Level 2: 1:(175) Calcite vase 2:(91) Copper pin 3:(92) Copper pin 4: (176) Slate tool 5:(184) Bone awl fragment 6:(182) Jasper drill 7:(52) Chipped sherd 8:(no number) Chipped sherd 9:(183) Polished Stone Disc of Smithsonite 10:(181) Turquoise bead (scale 2X) 11:(177) Marble crescent 12:(no number) Chert disc.

FIGURE 36 - OBJECTS FROM AREA E



Upper: Area E, Section F, Level 3: 1:(122) Copper pin 2:(121) Copper pin 3:(123) Clay bead 4:(124) Shell bead 5:(128) Shell bead 6:(125) Cut turquoise 7:(127) Stone crescent 8:(126) Flint blade

Lower: Area E, Section F, Level 4: 9:(99) Copper pin 10:(98) Copper pin 11:(187) Cruciform object of bone or ivory 12:(96) Shell bead 13:(188) Shell bead 14:(190) Shell bead 15:(97) Clay bead 16:(209) Clay bead or spindle whorl 17:(210) Unfinished clay, spindle whorl (?) 18:(185) Perforated sherd disc 19:(103) Marble disc 20:(186) Clay figure, head missing.

perforated, possibly for suspension.

Of special interest were the animal and human effigy forms. Eight were found in Areas F and G. Three may have been made to represent human females. The animals were especially crudely made.

Only five bone artifacts were found in the two sections A and B of Area E. Awls were found in all levels. The flattened end "spatulas," occurred in the lowest level of section B, Area E and in the lowest level of section B, excavation Area A.

Most impressive was the large quantity of animal bone present in all levels of sections A, B. The species represented could not be determined in the field.[1] This high concentration of food remains reinforced the suggestion that the area was a communal dump.

Although several bone tools were found in sections F and G, most impressive was the extraordinary amount of animal bone refuse. A total of 14,138 fragments of discarded animal bone were counted. Unfortunately only a small proportion of these were subsequently available to Dr. Bokonyi for study.

Worked shell artifacts, especially beads, were fairly frequent in sections F and G and as in sections A and B indicated contact with the Persian Gulf or the Gulf of Oman. One object made of the thick wall of some large shell perhaps a conch, was an engraved cruciform object. Unlike most stamp-seals of Halaf and Bakun and Sialk, this had no button-like protrusion on the back nor perforation for stringing. The cross motif does occur in the designs of these seals but this specimen does not appear to be a seal, and no seal impressions have yet been found.

Area E, sections A and B, provides few clues as to the precise point at which copper smelting appears on the site. No refuse (slag, ores, crucible fragments) or copper artifacts were found below the third level, 50-70 cm from the surface,below which Lalehzar Coarse ware was most abundant. On the whole the evidence is less clear than in section A, Areas A and B.

Other artifacts of copper -- pins, awls and beads occurred with some frequency in sections F and G. There were five crucible fragments and thirty-nine ore fragments in these two sections. The presence of sixteen of such items in the 70-100 cm zone strongly suggests the industry flourished in Iblis I times as Chase suspected during his work in Area A. A C14 determination for the fourth level of section F, was (GX 869) 4111 B.C. ± 150 years, which would fall within the proposed transition from Iblis I to Iblis II and is only slightly later than the determination of 4287 ± 40 B.C. (GX 864) recovered from Area A, section B which was associated with the earliest crucible fragments from that area.

Among the more interesting finds from section G was what appeared to be an arrowhead made of a metal which, at the time of this writing, has not been identified. The object was apparently made of flat pieces of the metal which were somehow or other laminated and formed to create a socket which could then be fitted on the end of an arrowshaft.

1 See Bokonyi, this volume. Ed.

Area A, Section C, Area C, and the 1964 samples.

Area A, sections A and B, illustrated the putative period Iblis O, and introduced the Iblis I and II periods, although in those sections they may be mixed. The various houses excavated by Evett and by Caldwell and Sarraf elsewhere on the site have given us a fairly comprehensive picture of Iblis I, unmixed with Iblis II. The excavation in Area E suggested a gradual transition between Iblis I and Iblis II. Iblis II was the lowest level reached in Area A section C, dug by Chase, and was the lowest level reached by Mrs. Fehérvári in her Area C. Both stratigraphic excavations, only a short distance apart, will be described together beginning with the earliest period reached. In Area A, section C, the 230-260 cm level yielded a surprising quantity of Bard Sir sherds. This may be additional evidence of the same continuity between Iblis I and II already suggested by Chase's work in Area E.

Essentially, Area A, section C, was an extension of section A into the west wall of the mound. The purpose of this cut was to expose the entire vertical profile and secure materials from each level of occupation. Due to the irregularity of the east wall face, the exact east-west dimension of section C varied somewhat but was approximately 200 cm. The width of the section equalled that of section A, 3.2 m.

The overall depth of the section was 260 cm. Further excavation was suspended when a wall-like structure was encountered in the upper portion of the Iblis II Period.

Iblis II

Turning now to the earliest levels in section C, Table IX shows that small amounts of pottery of the Bard Sir types were present in the Iblis II level, strengthening the proposition that some Bard Sir pottery continued to be made at this time. Lalehzar Coarse was also present as might be expected and this, in fact, continued upward to the 150 cm level and the Iblis III period. We are now reasonably certain that it continued to be used during the Iblis II period, but its occurrence in Iblis III may be fortuitous. The numerically most important fine wares in the 200-230 cm level were Iblis types.

Wall Feature. What appeared to be a badly eroded mud brick wall was encountered in section C at a depth of 225 cm. Examination of this feature showed what appeared to be rectangular brick units included in it, but no measurements could be made. From the floor of the section, the wall measured 35 cm high. The wall varied in width from 20 to 50 cm. The exposed portion was 160 cm long.

Despite the continued occurrence of Bard Sir sherds, level II clearly embraces the Iblis Period village with its red and black painted thin ware and important copper metallurgy. The profile of the 200-230 cm zone was heavily flecked with charcoal, a condition which seemed to consistently coincide with the evidence of copper industry and an abundance of crucible fragments. In section C, 128 crucible fragments came from this level.

In Area C we reached the Iblis II level in a 5 m square, at about 2.80 m from the surface and we were able to remove this level to a depth of 40 cm deeper. In the profile this level comprised gray and brown sand, charcoal and ash underlaid by a layer of yellow clay. As already mentioned, no structures were encountered -- the deposit, marked by quantities of charcoal, looked like a dump and within it parts of the skulls of two children or adolescents were found together.

Table IX.-Artifact Distribution: Area A, Section C (Cut in west wall)

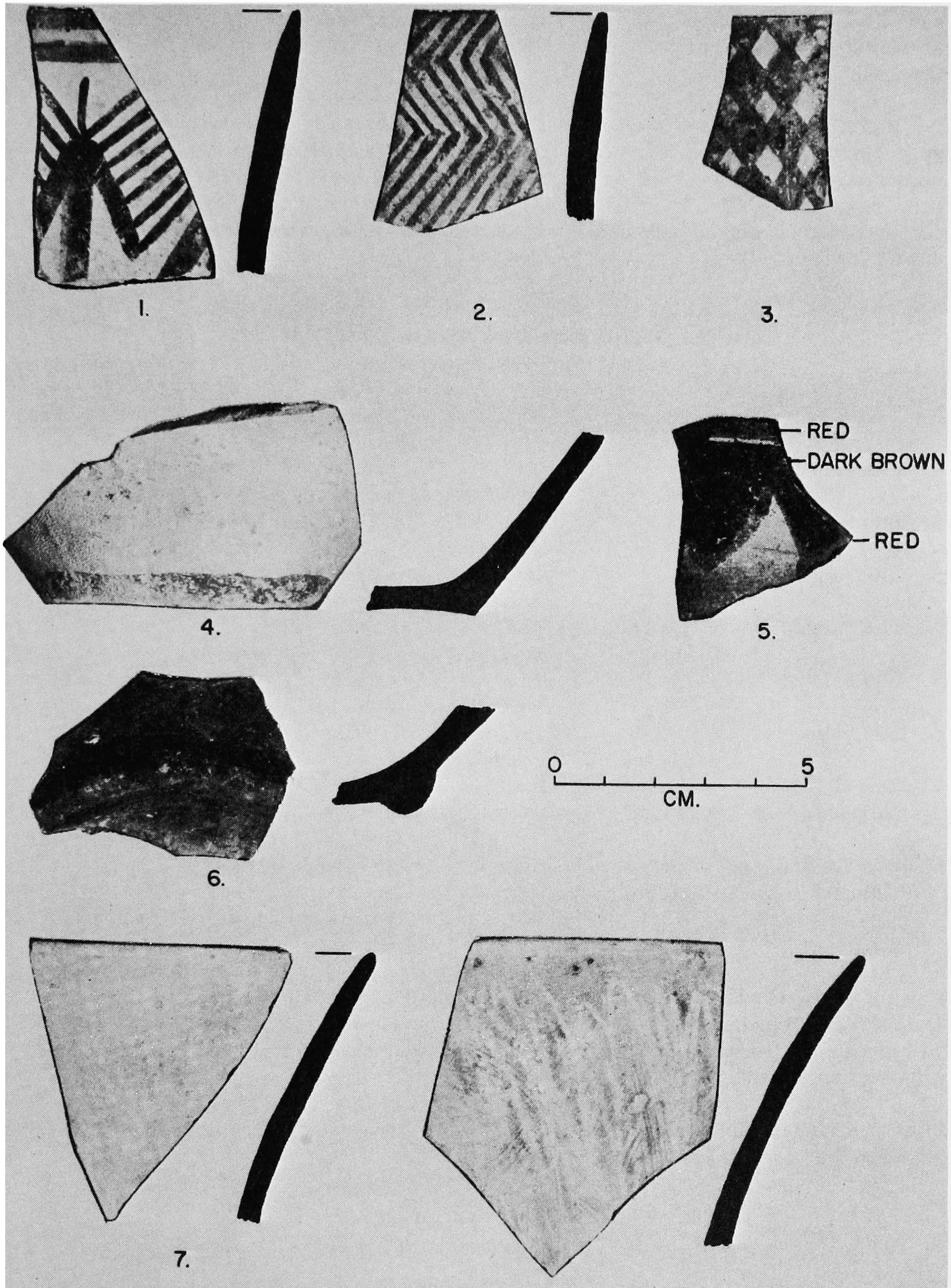
	0-100cm	100-150cm	150-200cm	200-230cm	230-260cm
POTTERY:					
<u>LEVEL V:</u>					
Plain Redware (Mashiz type)	5	2			
Curvilinear Incised		2			
<u>LEVEL IV:</u>					
Ali Abad Plain	28	121	6		
Ali Abad Painted	19	32	5		
Ali Abad Polychrome		2	1		
Ali Abad Brushed			10		
<u>LEVEL III:</u>					
Dashkar Plain		15	276	78	20
Dashkar Decorated		3	10	1	
<u>LEVEL II:</u>					
Iblis Painted			12	216	16
Bard Sir Red Slipped*			14	76	19
Bard Sir Plain				5	27
Bard Sir Painted				33	12
Lalehzar Coarse			92	340	320
Fabric Impressed(?)				1	
Chahri River type (grit tempered)			8		
OTHER CERAMICS:					
Disk			3		
Perforated disk			1		
Chipped sherd				4	

* Red slipped ware occurs first in Level I and persists through Level II.

Table IX (cont'd.)

	0-100cm	100-150cm	150-200cm	200-230cm	230-260cm
METAL INDUSTRY:					
Copper artifact				1 (pin)	
Copper slag			3	142	47
Crucible fragment (ceramic)			4	128	72
Copper ore			1	17	4
STONE ARTIFACTS:					
Flake blade			3	55	28
Core				2	
End scraper					
Chips and spalls (chert, jasper, etc.)		1	9	120	75
Ground stone knife				1	
Calcite sherd	1	2	1	1	
Steatite sherd				2	
BONE ARTIFACT:					
Awl			1		
ANIMAL BONE:					
Animal refuse bone			20	384	293
Turtle refuse bone				2	
Human (?)				3	

PLATE 4 - IBLIS PAINTED AND BARD SIR SLIPPED.
FROM DARK BAND BELOW IBLIS II DUMP.
1964 INVESTIGATION.



As earlier stated, we did not have time to classify and count all the materials from Area C, an error which can be remedied in the next season. In the Iblis II level of Area C we were able to note about 300 crucible fragments. We can also say quite definitely that all the sherds we observed were typical of Iblis II. Of those brought back to America, we have illustrated a selection of forms and decoration in Figs. 12 to 17. For the proportions of the Iblis II pottery types we must rely on Chase's excavation of Area A, section C (Table IX).

We also illustrate and describe two samples of Iblis II sherds carefully extracted from the upper and lower portions of the Iblis II dump during our 1964 visit. The lowest level appeared as a dark 8 cm band containing much charcoal and ash and gave a radiocarbon determination of 4091 $\pm$ 74 B.C. (P-925). The top of the dump was marked by a 9 cm concentration of charcoal and ash 50 cm above the lower and gave a determination of 4083 $\pm$ 75 (P-926 A).

Table X. -Sherds from Dark Band below Iblis II Dump (See Pl.4), 1964 Investigation.

No.	Type	Diameter	Temper	Surface	Paste	Color of Paint
1	Iblis Painted		fine vegetal	exterior buff slip	pink	dark brown
2	Iblis Painted		fine vegetal	no slip	pink-brown	dark brown
3	Iblis Painted		fine vegetal	exterior buff slip	pink-brown	dark brown
4	Iblis Painted	5 cm (base)	fine vegetal	no slip	pink-brown	maroon
5	Iblis Painted		fine vegetal	exterior buff slip	pink-brown	red and brown
6	Iblis Plain	12 cm (base)	fine vegetal	no slip	brown	
7	Bard Sir Red Slipped	14 cm (rim)	fine vegetal	red slip, pattern burnished	pink with gray core	
8	Bard Sir Red Slipped	20 cm (rim)	fine vegetal	red slip, pattern burnished	gray	

None of these sherds are a true buff ware like the Bard Sir Painted of Iblis I, but exterior buff slips on vessels with a pinkish brown paste seem to be common. In Table XI following, a listing of sherds from the dark band at the top of the Iblis II dump, buff slips are infrequent.

Most of our examples of artifacts other than pottery from the Iblis II dump where it was penetrated by Area C are shown in Figure 37.

Iblis III

In Area A, section C, the surface of Iblis III was 157 cm from the top of the excavation. The soils of this level were mostly brown sands and yellow clays, the former predominating. It is conceivable that the clays were floors or parts of mud brick ruins, but in any

PLATE 5 - IBLIS PAINTED, FROM DARK BAND ABOVE IBLIS II DUMP. 1964 INVESTIGATION.

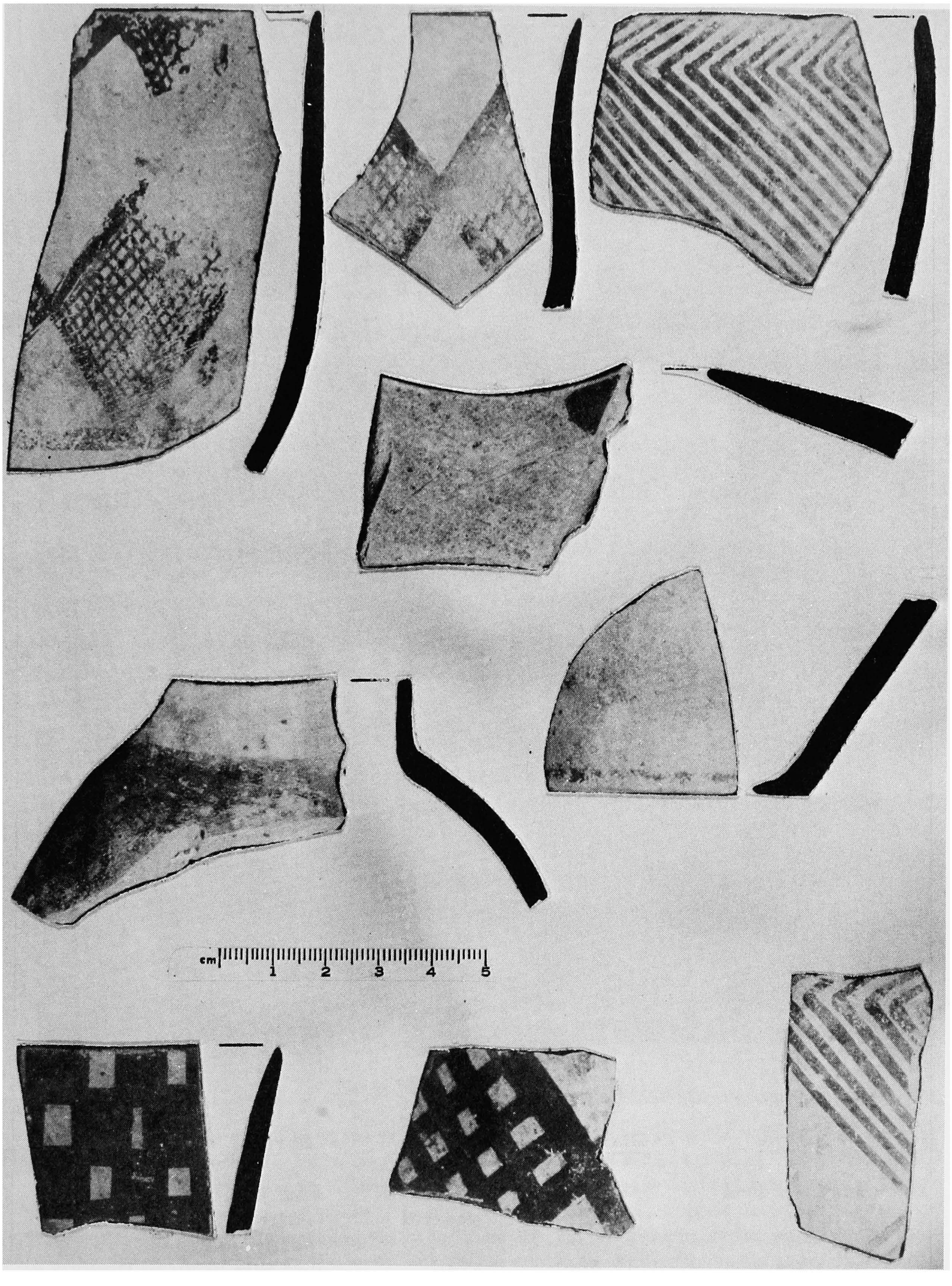
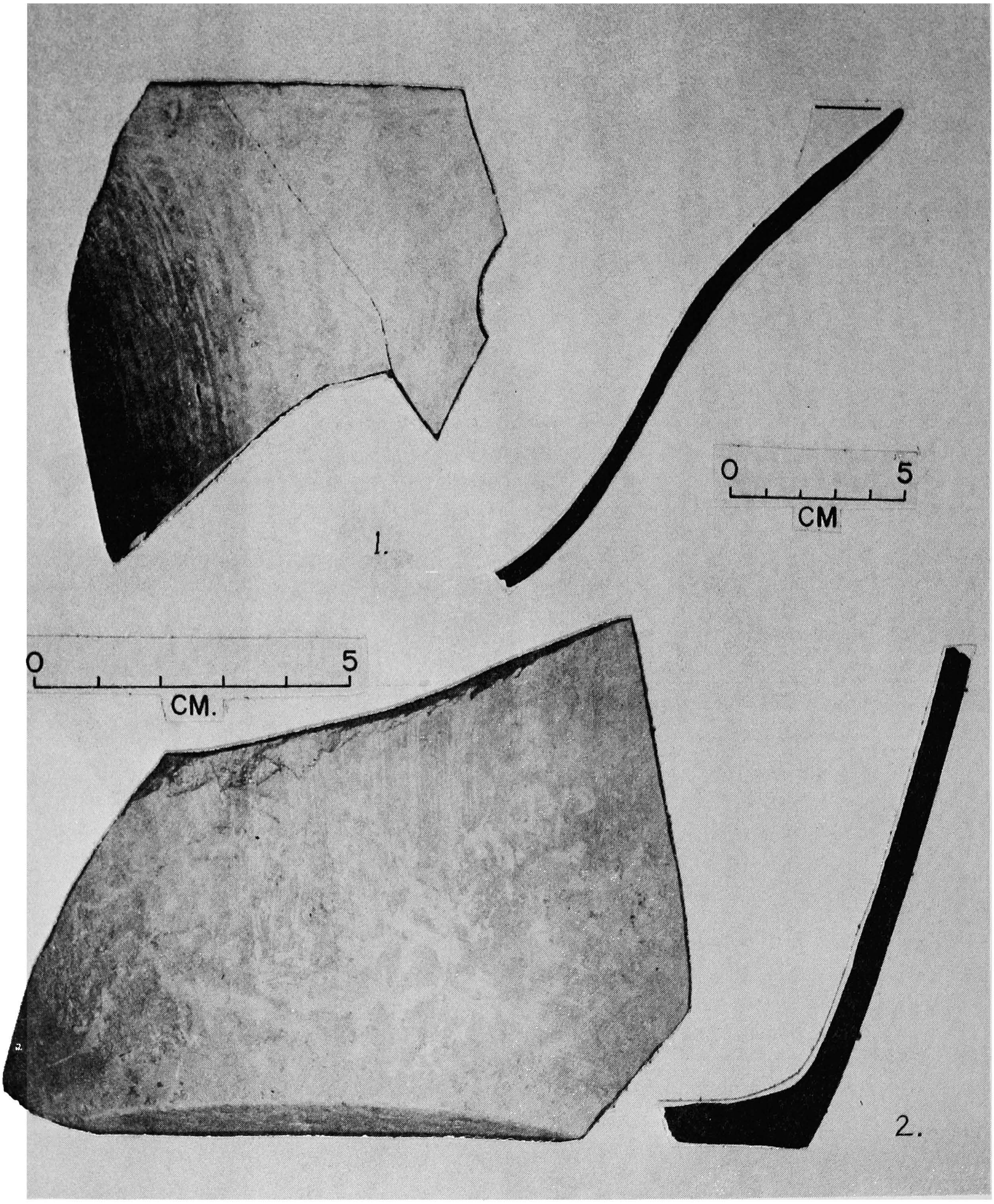


PLATE 6 - BARD SIR RED SLIPPED FROM DARK BAND ABOVE IBLIS II DUMP, 1964 INVESTIGATION.



No.	Type	Diameter	Temper	Surface	Paste
1	Bard Sir Red Slipped	22 cm (rim)	Fine vegetal	Red Slip, (Pattern burnished)	Gray
2	Bard Sir Red Slipped	12 cm (base)	Fine vegetal	Red Slip, (Pattern burnished)	Pink

Table XI. -Sherds from Dark Band above Iblis II Dump (See Pl.5), 1964 Investigation.

No.	Type	Diameter	Temper	Surface	Paste	Color of Paint
1	Iblis Painted	14 cm (rim)	fine vegetal	no slip	light pink	black
2	Iblis Painted		fine vegetal	no slip	light pink	black
3	Iblis Painted	10 cm (rim)	fine vegetal	no slip	light pink	black
4	Iblis Painted	14 cm (rim)	fine vegetal	no slip	orange	brown
5	Iblis Painted	5 cm	fine vegetal	no slip	pink	brown
6	Iblis Painted	6 cm (base)	fine vegetal	no slip	pink	brown
7	Iblis Painted	12 cm (rim)	fine vegetal	no slip	orange	brown
8	Iblis Painted		fine vegetal	buff slip	light orange	black
9	Iblis Painted		fine vegetal	no slip	pink	brown

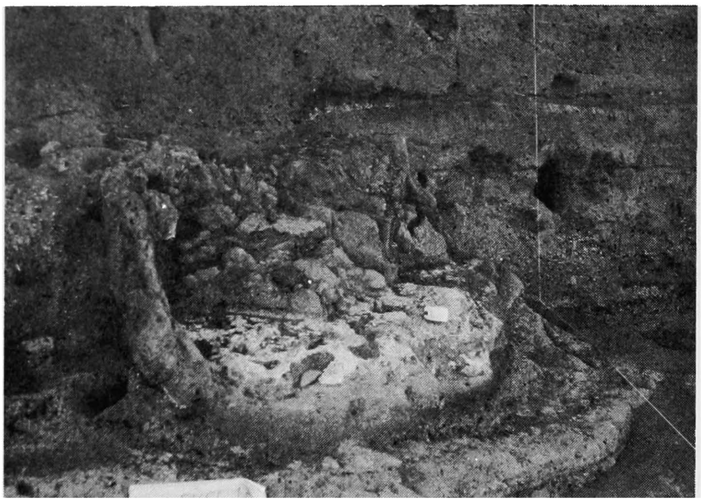
case the area continued to be used as a dump.

Iblis III was notable for the appearance of three new pottery types; Dashkar Plain, Dashkar Brushed, and Dashkar Painted. These are often a whitish buff, less frequently light pink or tan. Of these Dashkar Plain was overwhelmingly predominant in Area A, section C, but in a sealed fill of a gypsum burning furnace originating from Iblis III the other two types were better represented. One reason for the predominance of Dashkar Plain is that paint is used sparingly on Dashkar Painted. Many of the sherds from broken painted vessels would not show any paint. The decoration of Dashkar Painted is often a pale pink -- probably once a clear red -- which is so faded as to be hardly discernable on some sherds. The Dashkar types are usually thicker walled than the types of the Iblis II period preceding. Vessel forms include cups, wide mouth bowls, and bowls with incurving rims, but most distinctive are large undecorated pots with small mouths and short everted rims.

In Table IX the 150-200 cm level of Area A, section C, showed a predominance of Dashkar types. The fact that it also contains significant amounts of Iblis II and Iblis IV pottery should not be taken as necessarily implying a ceramic transition, but is partly a result of digging in arbitrary 50 cm levels. The sealed deposit in the aforementioned gypsum burning kiln originating from the surface of Iblis III contained Dashkar types and no others. (Figs. 19, 20). Similarly, a small sample of pottery extracted from the surface of Iblis III by the 1964 party also contained Dashkar pottery exclusively (Pl.7).

The Iblis III pottery actually bears very little resemblance to the pottery of Iblis II and there is every reason to believe that its appearance marks a discontinuity in the occupation of the site. Artifacts of chipped stone become rare in contrast to their frequency in Iblis II, and there is a virtual disappearance of crucible fragments, copper ore, and slag. Metallurgy may well have continued during Iblis III, but its evidences are no longer found in this part of the site. According to our radiocarbon determinations this proposed discontinuity happened sometime during a three hundred year span. Yet the site may not have been unoccupied long, if at all, and the original inhabitants may have been displaced by

PLATE 9 - GYPSUM BURNING FURNACE NEAR AREA A.



Remains of furnace showing fragments of fallen superstructure lying on floor of powdered gypsum.

Furnace cleaned out. At right rear are plastered bricks. At center, fallen bricks. At lower right the floor has been dug through.

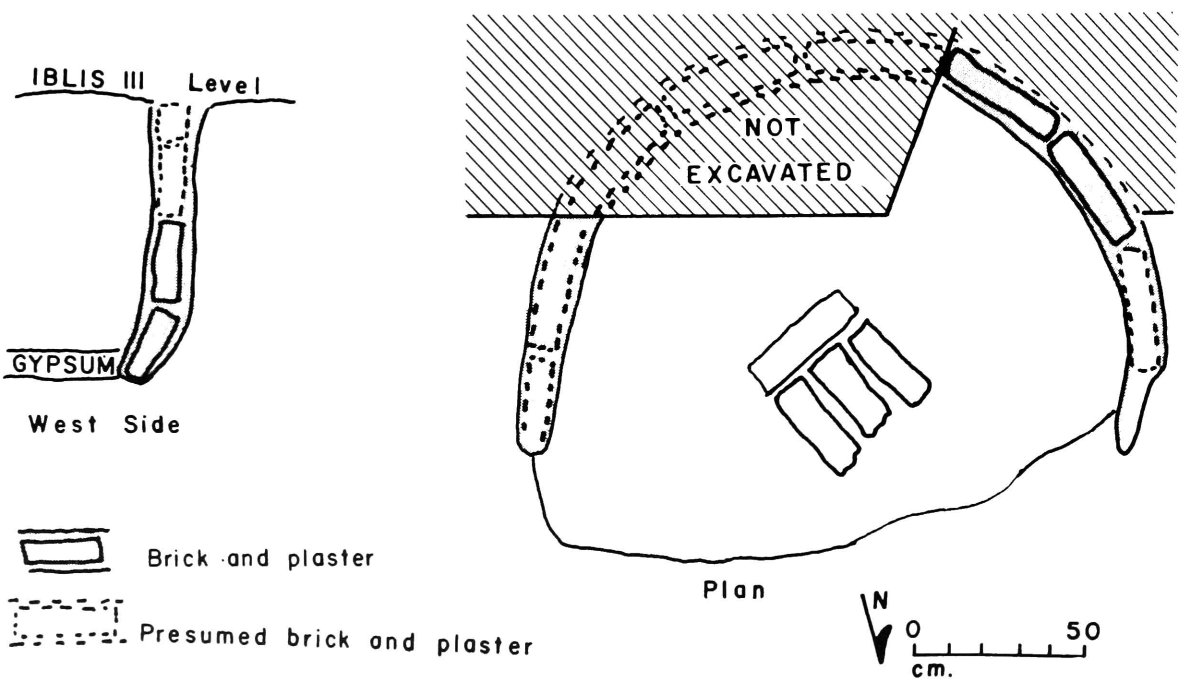
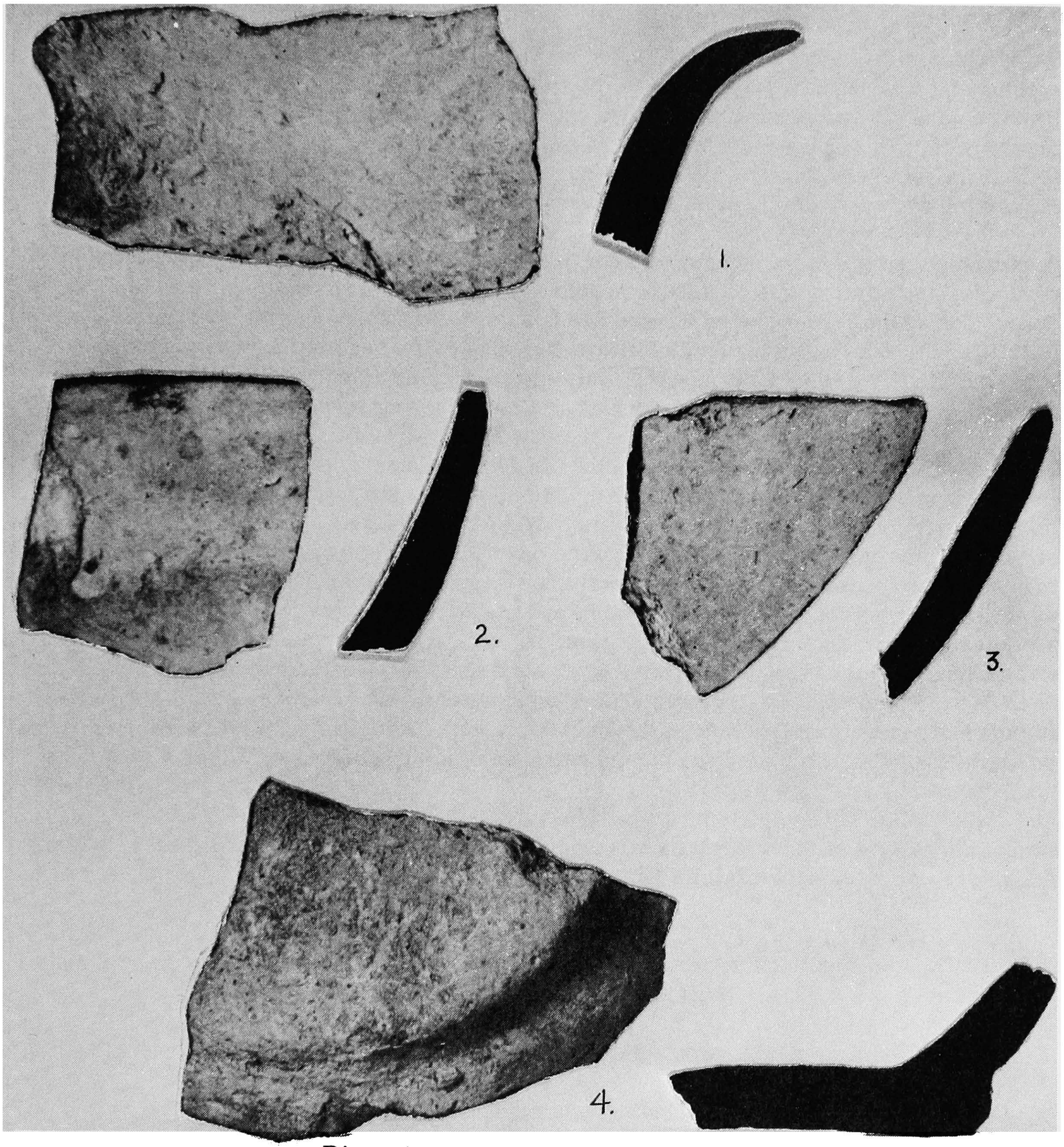


PLATE 7 - IBLIS III, DASHKAR PLAIN, 240 cm LEVEL. 1964 INVESTIGATION



No	Type	Diameter of Rim	Temper	Surface	Paste
1	Dashkar Plain	8	Straw	Brick-red	Brick-red
2	Dashkar Plain	60?	?	Red-brown slip or self-slip	Brick-red
3	Dashkar Plain	14	Fine straw	Red-brown	Red-brown
4	Dashkar Plain	base 12	Fine vegetal	Exterior buff slip	Brick-red

another group. The C^{14} determination obtained by the 1964 party for the top of the Iblis III level was 3792 $\pm$ 60 years B.C. (P-927), some 300 years later than the top of the Iblis II level, but during this interval 33 cm of mixed fill had accumulated in the section of the profile from which these determinations were made.

While there is no evidence of a transition from Iblis II to Iblis III there are some indications of a transition from Iblis III to Iblis IV. Dashkar Brushed resembles Aliabad Brushed, and the few painted designs we know of Dashkar Painted bear a certain resemblance to the style of Aliabad Painted. Moreover, a sample of pottery from an early Iblis IV midden struck by the 1964 party contained both Dashkar and Aliabad sherds, suggesting a true ceramic transition between the two periods (Pl.8).

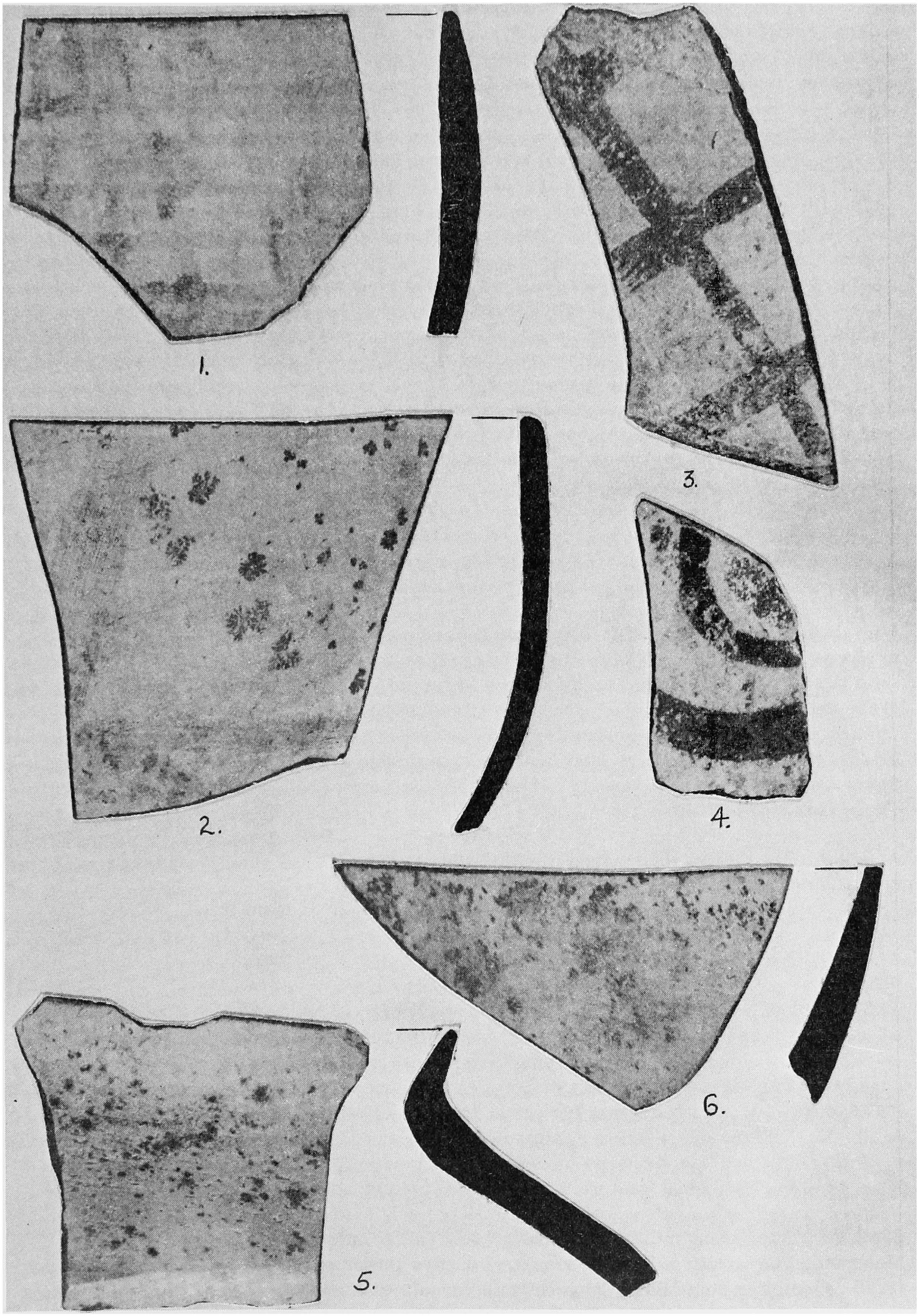
In cleaning the face of the mound remnant just west of Area A we came upon a mass of fired clay. When this was cleaned we could see a pit about 1.70 m diameter and 80 cm deep. The pit had fired clay sides and had been dug down from a level corresponding to Iblis III. Below a certain amount of clay debris and extending evenly over the entire bottom of the pit was a 10 cm layer of white powder, which Cyril Smith later found to be gypsum. The presumption is that we have the subterranean part of a gypsum burning furnace. The debris inside lying above the powdered gypsum included many large fragments of fired clay or mud, 4-10 cm thick, in various curving shapes and often showing the impressions of withes or poles 1-4 cm in diameter. We suppose that these clay fragments had been part of a rounded superstructure. When the furnace was destroyed the superstructure simply fell or was thrown into the pit. Of particular interest were three bonded bricks near the center of the floor directly on the gypsum layer. These were bonded so as to leave apertures between two of them and may have been part of a system of vents. We left the furnace for future investigation, but not until we first ascertained that there was no burned floor below the gypsum layer, and that the sides had been lined with bricks each 38 x 23 x 10 cm, which on rapid inspection appeared to be mold made. The bricks in turn had been covered with a greenish clay plaster. In future work we shall have to be on the lookout for materials, perhaps plaster, in which fired gypsum was one of the components.

Among the debris of the superstructure and on the floor were a number of broken pottery fragments, all assignable to Iblis III.

Table XII.-Sherds from the Fill of the Gypsum Burning Furnace (Figs.19,20).

Dashkar Plain	31	including 1 flat base, and 1 low annular base.
Dashkar Brushed	33	including 2 straight rims, 2 flaring rims, 1 base with circular (mat) corrugations.
Dashkar Painted	4	1 with interior design but brushed on outer surface, 1 with an exterior painted band and a brushed surface.

PLATE 8 - EARLY IBLIS IV



These sherds were extracted by the 1964 party from an occupation zone called Level 4. The sample includes both Iblis III and Iblis IV types and is offered as evidence of a ceramic transition between these periods.

Iblis IV

A large sample of pottery of this period was obtained in Area C. The Iblis IV level averaged 1.7 m thick. Of this the deepest 55 cm represented an early stage of Iblis IV as previously described in which we noted the coexistence of Iblis III and Iblis IV pottery types. At the top of this a burned dark gray 13 cm "floor" was noticed on the 1964 profile and also on the mound remnant at a point 10 meters west of Area A. Directly above the floor was one layer of bricks, averaging 38 x 20 x 10 cm. Above these was a mass of bricky debris 55 cm thick. The bricks and bricky debris were fired red, although originally the bricks may have been merely sun dried in the usual fashion. Above this was another burned level 10 cm thick. The edge of the bricky debris extended into Area A, section C, but apparently without the burned levels directly above and below. It also extended into Area C where it appeared as a steep slope of burned sand and earth. In Area C we exposed this steep slope without digging into it. We can learn more about this feature in future work if we approach it from the northwest side where the black floor and layer of bricks are already partly exposed. Aside from a curious clay feature (see Fig. 1, F-1) resembling an oven, and inadvertently removed before it was properly studied, the only structural remains beside the aforementioned burned slope was a poorly preserved mud brick wall in the western corner of the excavation. This was not followed outside the excavated area. The top of the wall was less than 30 cm below the surface and what may have been a late floor a few cm below this was very difficult to trace. All the associated sherds were Iblis IV. Just east of this on a slightly higher level was a concentration of trash, a mass of broken bricks and sherds including one beveled rim bowl. The entire 5 m square in which these features occurred was left for a future season, and work was concentrated in the two remaining 5 m squares of Area C.

With the small crew available, only the northernmost of these squares (7-11 m E, 25-30 m N) could be dug down to Iblis II levels; the other was carried down only to the bottom of Iblis IV. Both squares were occupied by a series of sandy layers lying almost horizontally above the burned slope, and we dug these in nearly horizontal levels. The 0-20 cm level of loose sand contained a number of sherds demonstrably later than Iblis IV and which will be described presently. The 20-70 cm layer contained some later sherds but with a substantial amount of Iblis IV pottery. The 70-100 cm layer and the 100-140 cm level were altogether Iblis IV.

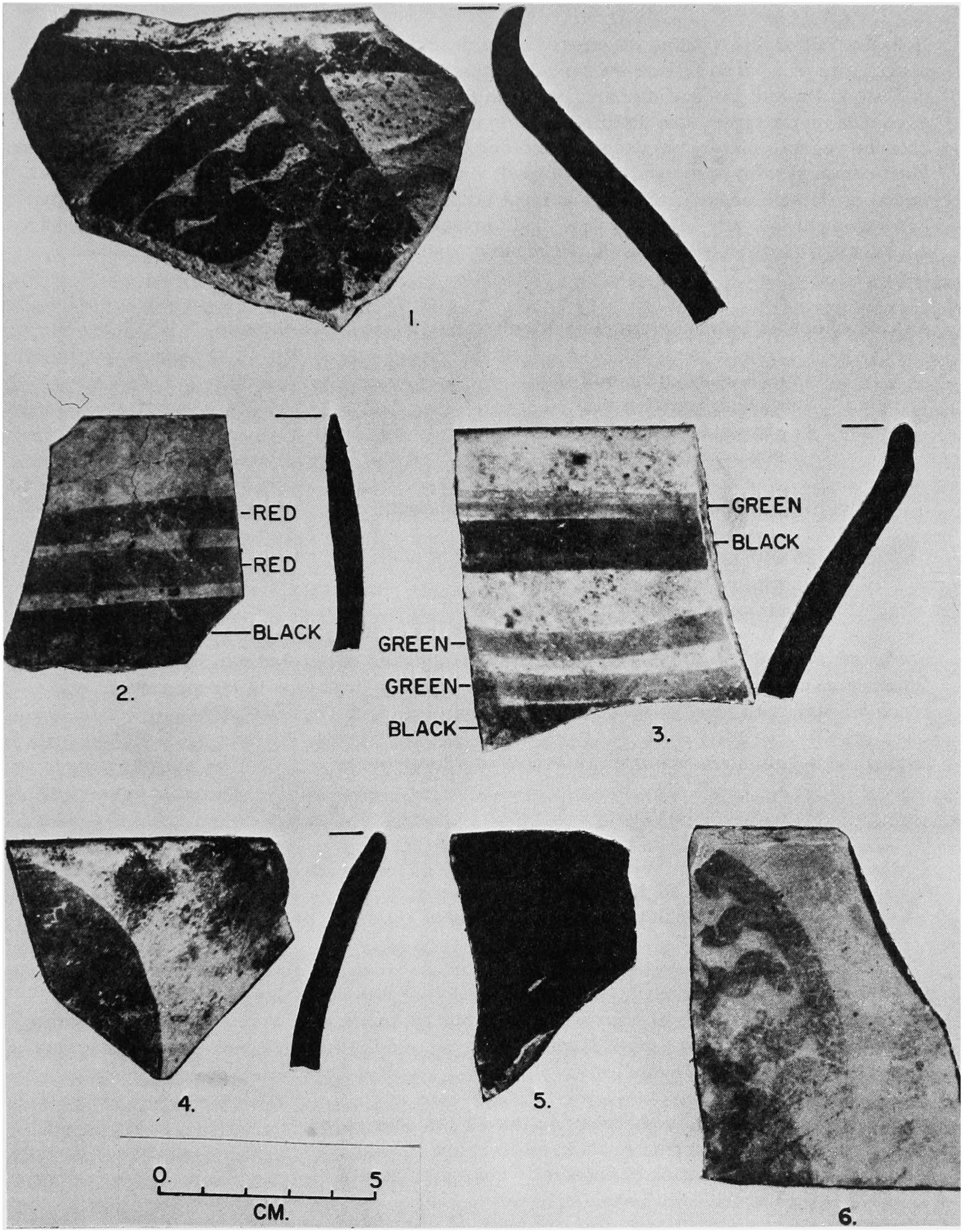
At about 140 cm from the surface was the bottom of the burned slope, and below this for some 80 cm was the level we call Early Iblis IV.

The pottery of Iblis IV (Pl. 10 and Figs. 23-27) comprises Aliabad Plain, Aliabad Painted, Aliabad Bichrome, Aliabad Brushed, and Aliabad Ridged. With the exception of Aliabad Ridged and one or two minor types of plain, Aliabad pottery was hand made as in preceding periods. The Ridged type sometimes shows string cut bases. All of the Iblis IV wheel made vessels are larger and thicker than the handmade ones. The latter are usually smaller, lighter, thinner walled, and "finer." Not only must we reckon with the possibility of a difference in function between hand and wheelmade vessels at this time, but also with the possibility that the potter's wheel was introduced as part of a "trait complex" which included string cutting of the base and particular kinds of heavy utilitarian vessels. The idea that the wheel could be used to make fine ware does not appear until after Iblis IV times, and we know of no Iblis IV painted vessels which are wheelmade.

Some very interesting minor types are present in the Iblis IV assemblage. The Mesopotamian variety of beveled rim bowl occurs rather sparingly as does a "flower pot type" resembling some Early Protoliterate vessels of southwest Iran.[1] There are also a

1 See Paper V, this Volume, p. 23.

PLATE 10 - IBLIS IV, ALIABAD PAINTED AND ALIABAD BICHROME, 130 CM LEVEL. 1964 INVESTIGATION.



few shoulder spouts reminiscent of Warkan and Early Protoliterate of Mesopotamia. We can also note the first appearance of trays, and some of the annular bases are higher than in the earlier periods.

In Paper VIII of this Volume we offered brief descriptions of Iblis IV pottery from the nearby site of Aliabad. Here we can add some brief comments, but the material has had only a limited amount of study. Aliabad Plain, Aliabad Painted, and Aliabad Bichrome, our three major types, are not distinctively tempered and it seems likely that finely chopped vegetal matter was used. The color of the paste is generally pinkish brown. The most common form is the wide mouth bowl, either entirely plain, or decorated on the inside or outside or both. One of the most striking characteristics of bowls is an outside groove or channel just below the lip. Tall vessels with annular bases are not infrequent; a few vessels are globular with small mouths, and there are rare examples of footed bowls.

A count of 50% of Aliabad Plain rims from the 70-100 cm level showed:

148 with an exterior buff slip
86 with no apparent slip
42 slipped on exterior and interior
5 slipped on interior only

A count of 50 body sherds from the same level showed:

28 with an exterior buff slip
10 with no apparent slip
12 slipped on exterior and interior

In this same level out of 735 sherds, 17 were fragments of beveled rim bowls, one shoulder spout closely resembling the Warkan or early Uruk type in Mesopotamia, one crude angular handle, and two examples of Aliabad Ridged.

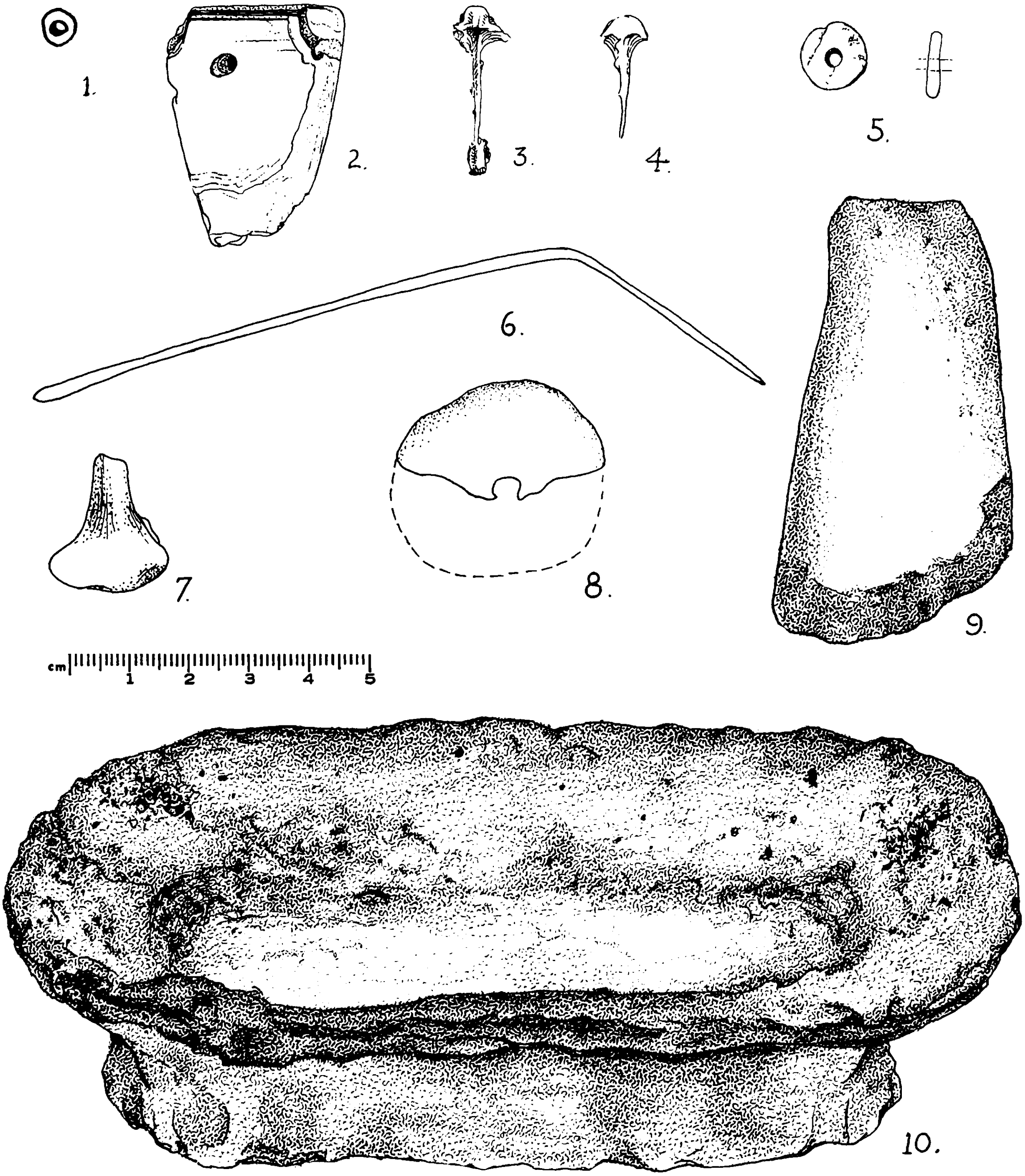
Among the basal fragments examined from this level were:

13 high annular base
13 low annular base
8 flat base
23 flat base, slight heel
2 very small flat base with slight heel

Of a sample of Aliabad Painted and Aliabad Bichrome from 95-100 cm, Aliabad Painted was about 6 times as numerous as the Bichrome, and the same repertory of motifs was used in either color, i.e. shades of brown to black, and shades of red to pink. Elaborate combinations of motifs are more frequent than not, so the following list gives a somewhat erroneous impression of simplicity:

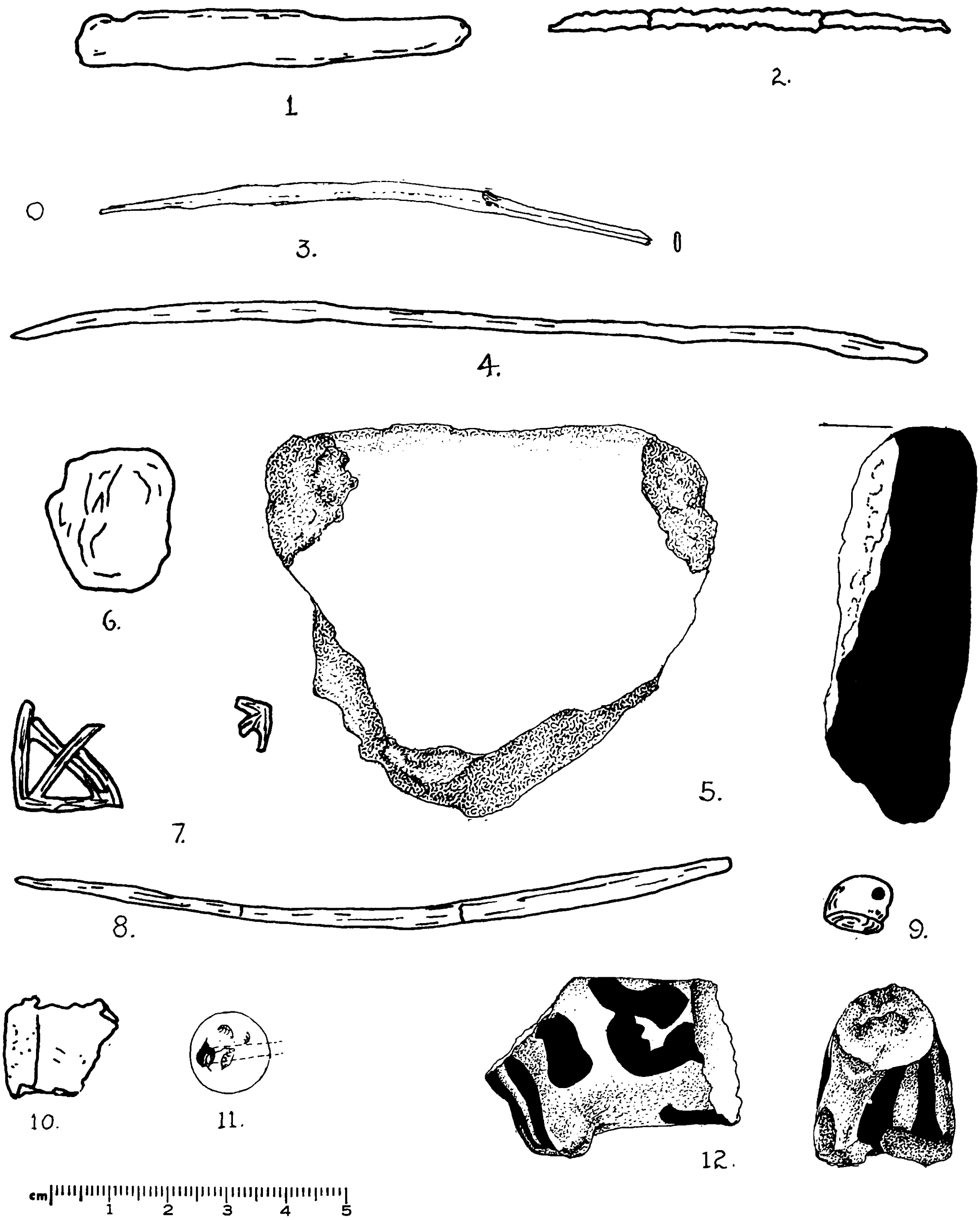
Vertical bars, sometimes outlined by thinner bars and with horizontal chain motif below the rim. This decoration is especially characteristic of tall vessels with annular bases	33
Parallel bars and/or lines	15
Wavy lines between parallel lines	14

FIGURE 37 - OBJECTS FROM AREA C, EARLY IBLIS IV AND IBLIS II



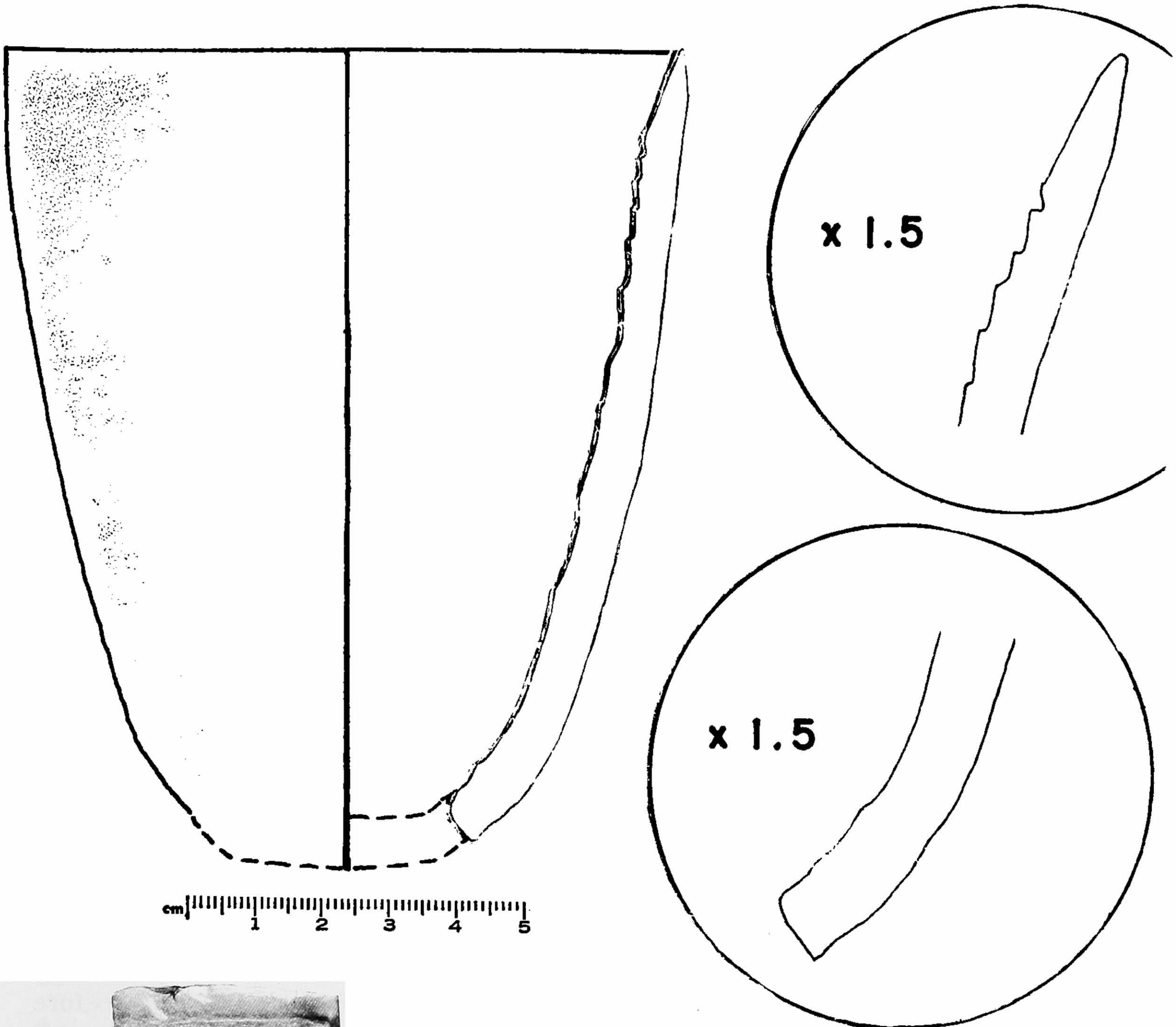
Area C, 160-190 cm (Early Iblis IV): 1:(88) Shell bead 2:(149) Cut marine shell. Not shown are two fragments of copper pins (89, 135) 270-310 cm (Iblis II): 3:(217) Copper pin 4:(275) Copper pin 5:(279) Turquoise bead 6:(274) Flat-ended copper pin 7:(281) Clay figurine 8:(282) Clay spindle whorl 9:(218) Clay object 10: (277) Crucible restored from large fragment.

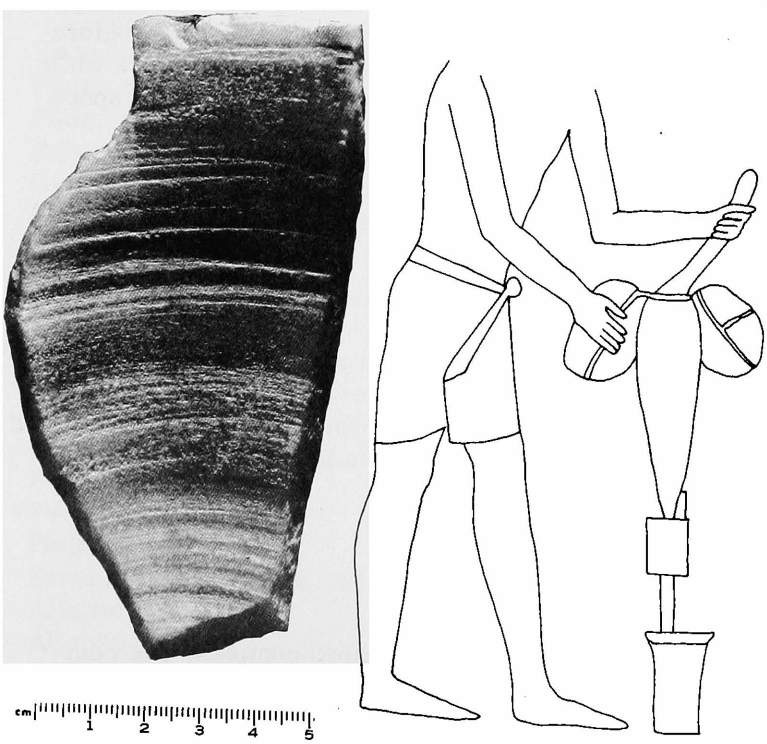
FIGURE 38 - TOP LEVEL AND IBLIS IV LEVELS 60-150 CM



Area C, 0-30 cm: 1 (22) whetstone (slate ?) 2 (24) iron pin 60-90 cm (Iblis IV): 3 (51) flat-ended copper pin 90-110 cm (Iblis IV): 4 (56) flat-ended copper pin 5 (63) crucible fragment 120-150 cm (Iblis IV): 6 (16) amber fragment 7 (222) copper ornament 8 (84) copper pin 9 (85) shell bead 10 (86) copper fragment 11 (93) spherical gold bead (scale 2x) 13 (281) clay figurine.

PLATE 11 - CALCITE SHERD FROM EARLY IBLIS IV





Upper: Reconstruction of the marble vase fragment with enlargements of sections.

Lower: Marble vase and Egyptian bas relief from a tomb at Saqqara of about 2500 B. C.

Wavy lines within rectangles or circles	3
Hachures	7
Cross hatched band, rectangle, triangle or diamond	7
Circles around solid circle (bull's eye)	1
Alternate filled chequers or triangles	5
Miscellaneous curvilinear designs	3
Unidentified parts of designs	23
Concentric diamonds (?)	3
Ladders	3

Minor artifacts of Iblis IV are illustrated in Figures 38 and 39. Of particular interest was a sherd from a much larger type of crucible than the small crucibles characteristic of Iblis I and II. There were several copper pins and one ornament, a hollow gold bead, and a fragment of a painted clay animal figurine, perhaps a bull.

Not illustrated are several small fragments of calcite vessels which occurred both in Early Iblis IV and Iblis IV levels. One fragment from Early Iblis IV (Pl.11) is unfinished and therefore of particular interest. The interior was not polished but shows the marks of drill bits, probably of a graded series. These marks tend to be step-like toward the top of the vase but slightly concave toward the bottom. In our illustration is shown a later Egyptian relief from Saqqara, about 2500 B.C., in which the axis of the drill was off center. The even horizontality of the marks on the Iblis vase, however, suggest that the axis of the drill was centered. Again, contrary to the Saqqara relief, it has been suggested (Richard Leary, communication) that it would be better to drill out the inside before finishing the outside of the vessel: it would be easier to anchor an irregular block while drilling, and it would be easier to carve the outside to correspond to the interior space than *vice versa*.

Iblis V

A few sherds of this period occurred in the top level of Area A, section C, and in the top level of Area C. This material is referred to as the Mashiz complex and its characteristic pottery types occur on the surface for several hectares around the mound, marking the greatest extent of occupation of the site. The pottery is heavily grit tempered and extremely hard but continues at least some of the shapes and probably some of the painted designs which first appear in Iblis IV. This material is discussed in Paper VIII of this Volume.

Iblis VI

A distinctive pottery assemblage tentatively called the Najaferabad complex, and comprising certain types which were new to us and other types resembling Sialk IV pottery occurred in the upper levels of a 5 m test excavation (Test II) about 180 m southwest of the mound periphery. Underlying this were Iblis IV levels and still deeper were a few sherds of Iblis I and II. For the time being we shall regard the topmost assemblage as being approximately contemporary with Sialk IV.

Table XIII. -Materials from Test II

0-20 cm

Plain body sherds	62
Plain, constricted neck, with slight outcurve	6
Plain, constricted neck, strong outcurve	8
Plain, bowl, straight rim	4
Plain, bowl of Sialk IV form	1
Plain, high annular base	2
Plain, low annular base	4
Clay nail	1
Shell disc bead	1
Clay object	1
Broken fired brick, 21 cm wide, 5 cm high and more than 23 cm long	1
Plain, button base	1
Plain, rounded base	2
Plain, slightly concave base	6
Plain, flat base	4
Plain, flat base, slight heel	5
Painted designs including horizontal bands	7
Trough spouts	4
Beveled rim bowl fragments	61

20-40 cm Not counted

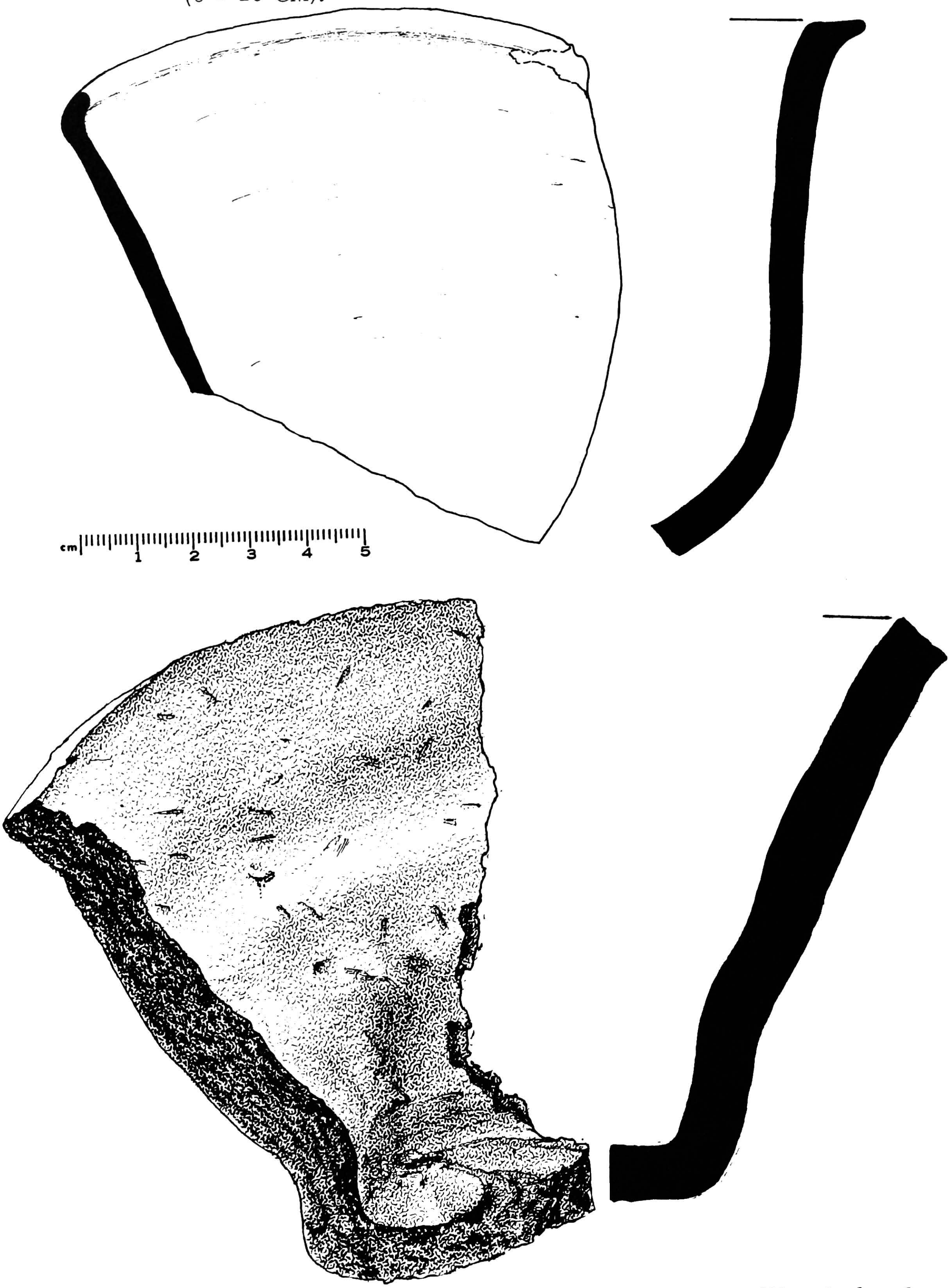
40-60 cm

Plain body sherds	106
Plain, constricted neck with slight outcurve	1
Plain, straight rim	5
Painted, horizontal red bands	1
Overhanging rim	1
Beveled rim bowl fragments	25
Aliabad Plain rims	2
Aliabad Painted	1

60-80 cm

Plain body sherds	70
Plain, constricted neck, vertical rim	1
Plain, straight rim	9
Plain, high annular base	1
Plain, flat base	5
Beveled rim bowl fragments	13
Aliabad Plain	2
Aliabad Painted	1
Aliabad Ridged, including 1 string cut base	9

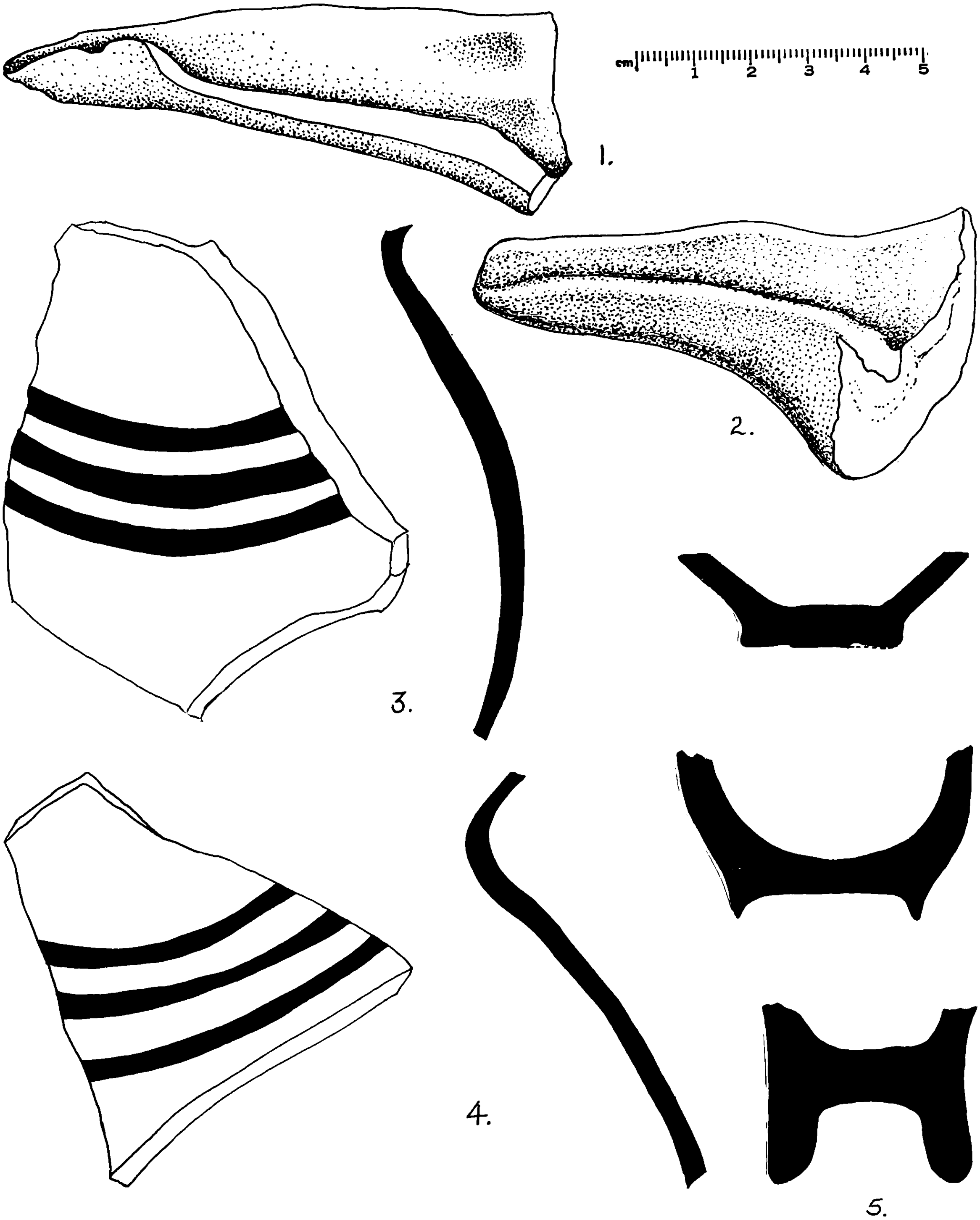
FIGURE 39 - IBLIS VI (NAJAFARABAD COMPLEX) SHERDS FROM TEST II (0 - 20 CM).



Upper: Distinctive form which occurs in Sialk IV and in Protoliterate levels at Tall-i-Ghazir in Southwest Iran. Red paste.

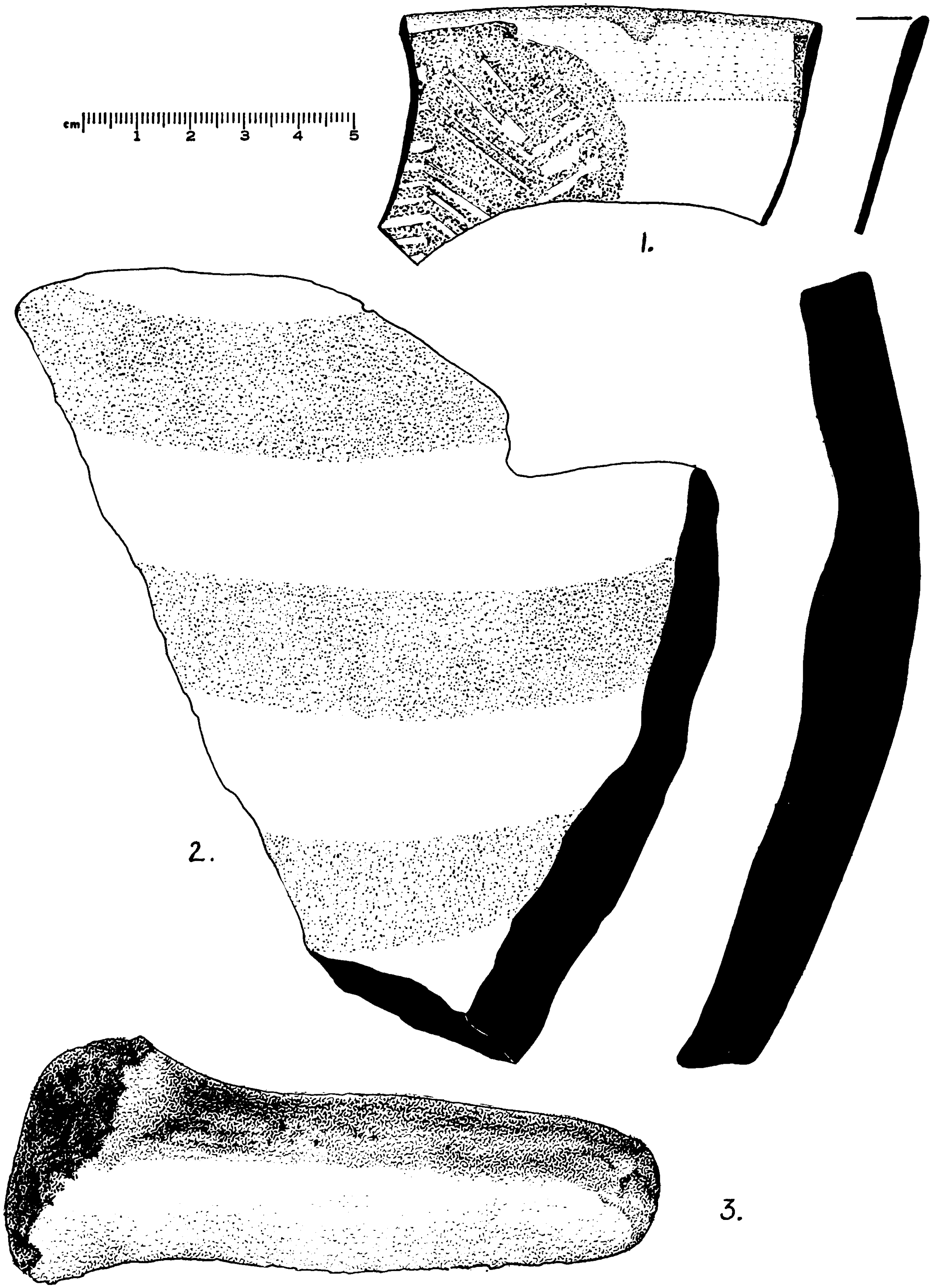
Lower: Inside view of beveled rim bowl.

FIGURE 40 - IBLIS VI (NAJAFARABAD COMPLEX) POTTERY FROM TEST II (0 - 20 CM).



1, 2 Rim spouts 3 Orange paste, polished red slip, painted black bands 4 Orange paste, cream slip, painted black bands 5 Varieties of bases.

FIGURE 41 - IBLIS VI SHERDS FROM TEST II (0 - 20 CM)



1 Red paint on pink slip, gray paste. 2 White paint on red-brown slip, orange paste. 3 Unknown pottery object.

FIGURE 42 - IBLIS VI SHERDS FROM TEST II (0 - 20 CM)

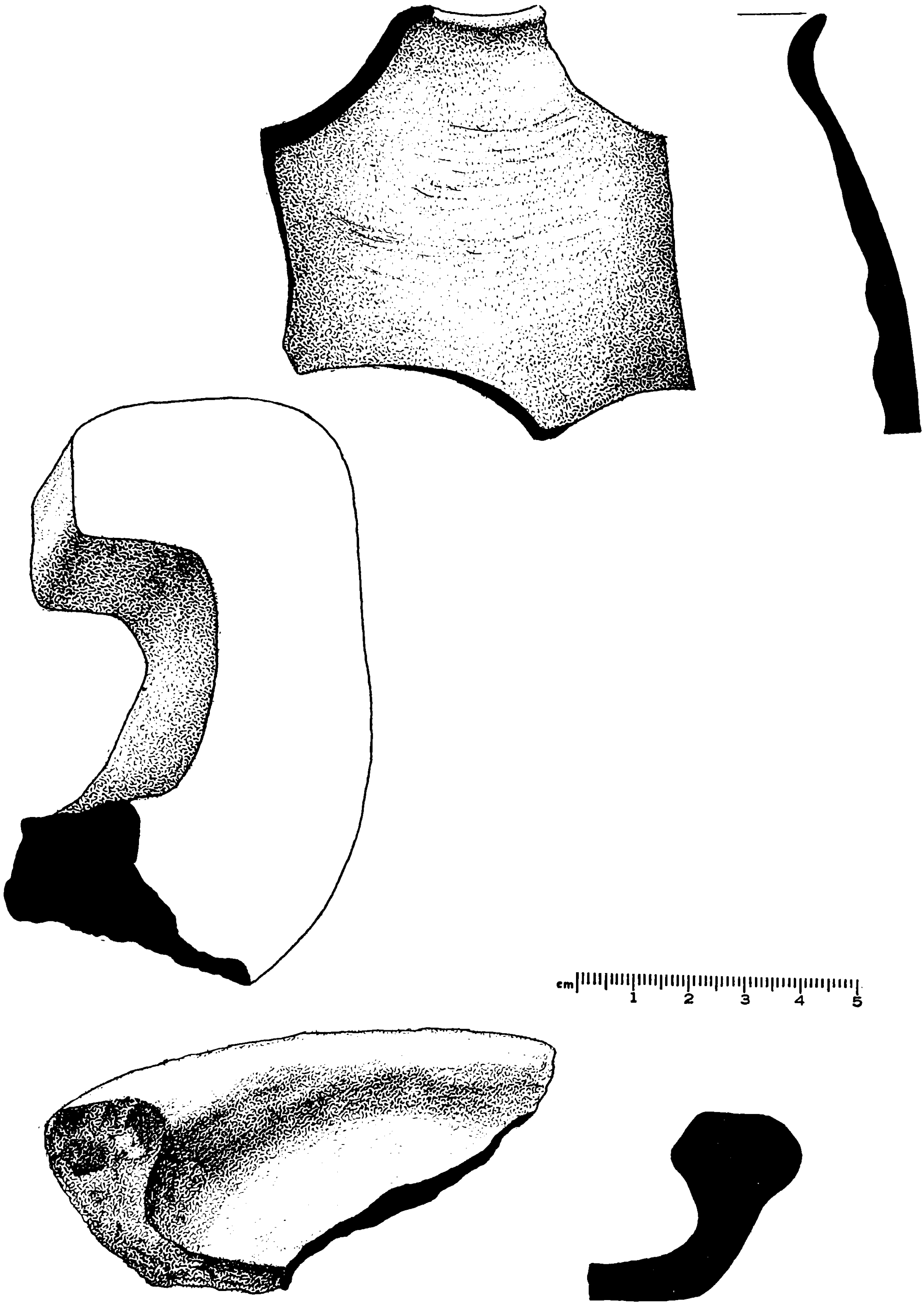


FIGURE 43 - SHERDS, PROBABLY IBLIS VI FROM TEST II (0 - 20 CM)

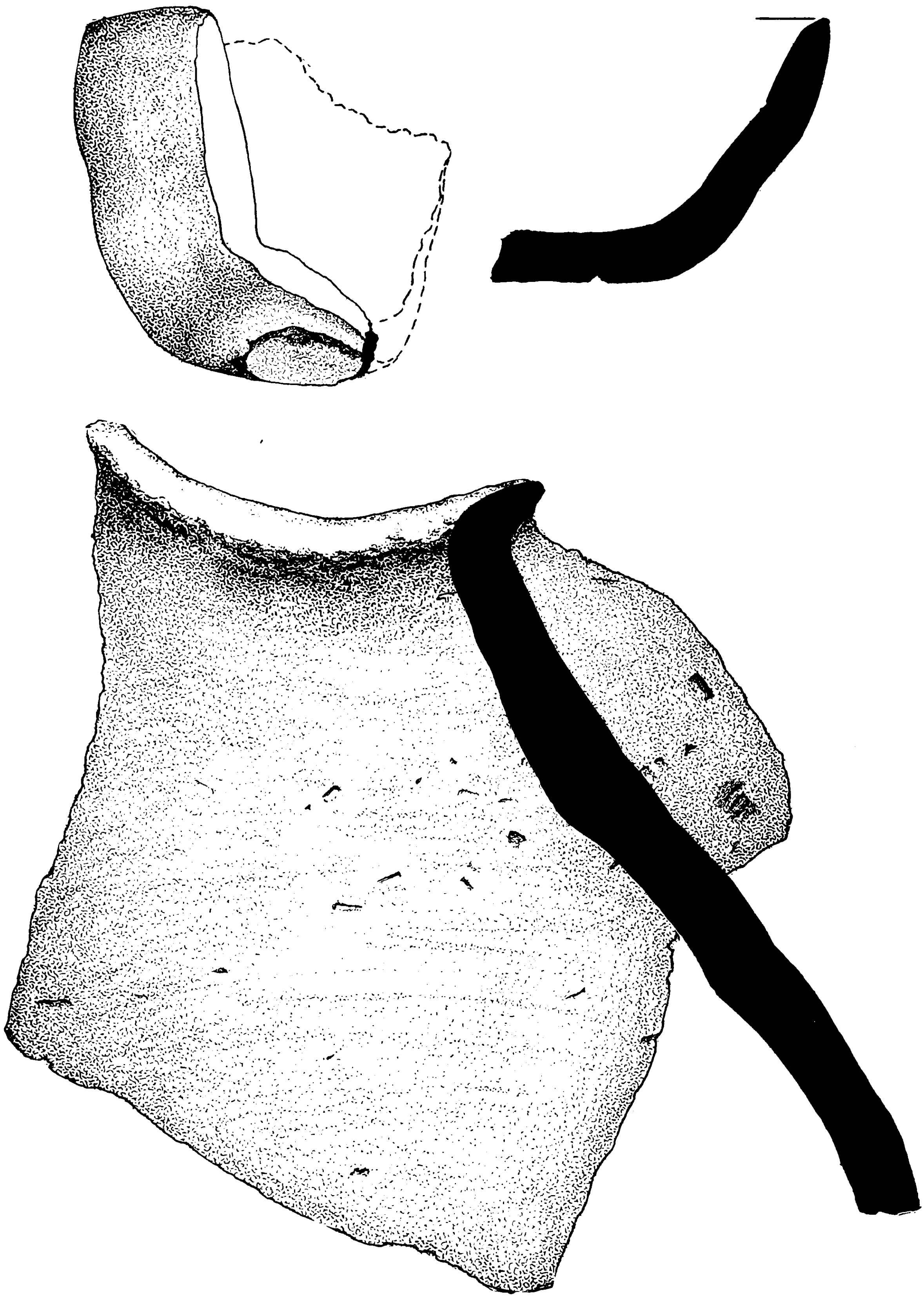


FIGURE 44 - STANDING BRICK RUIN

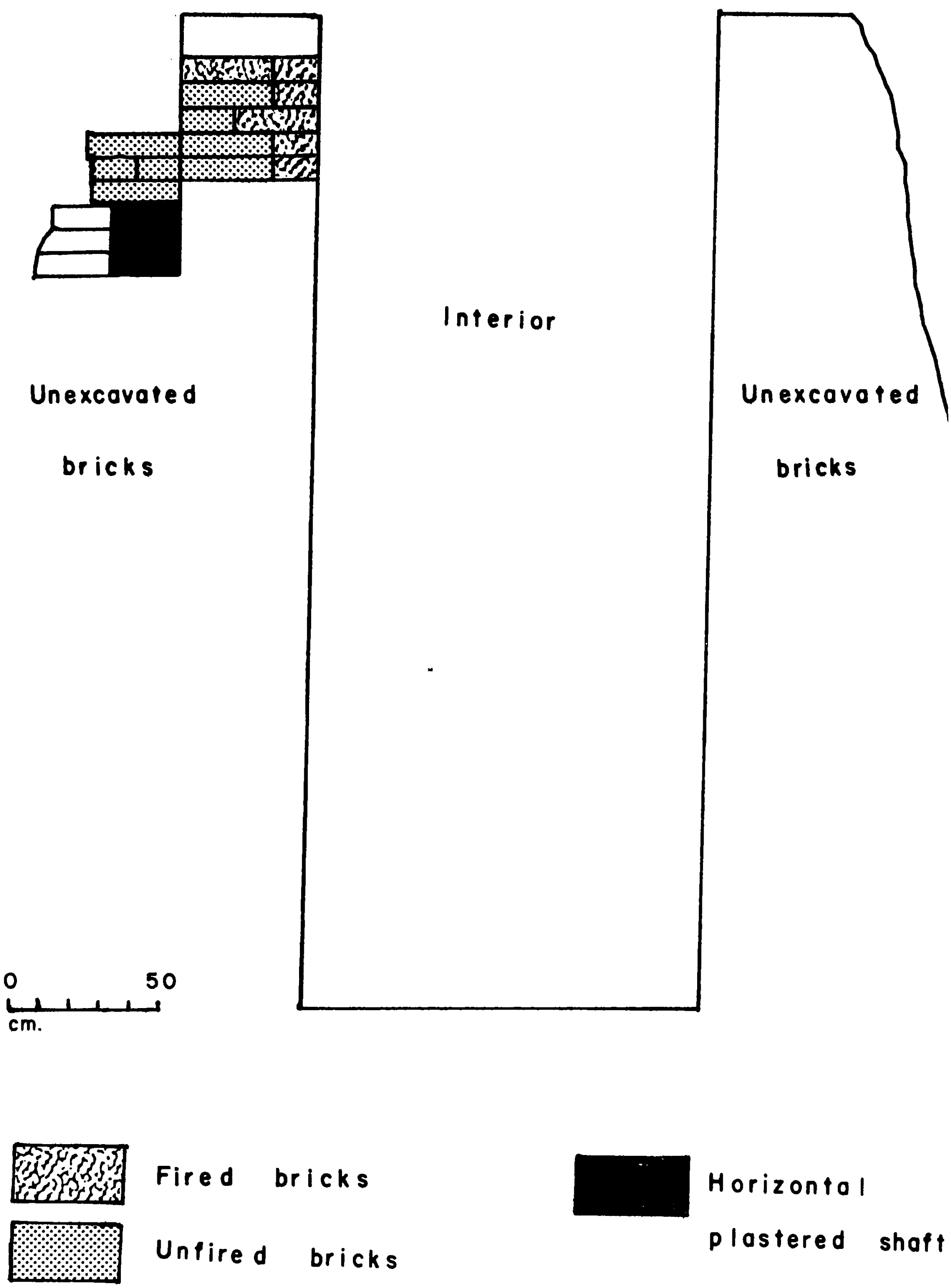


PLATE 12 - STANDING BRICK RUIN

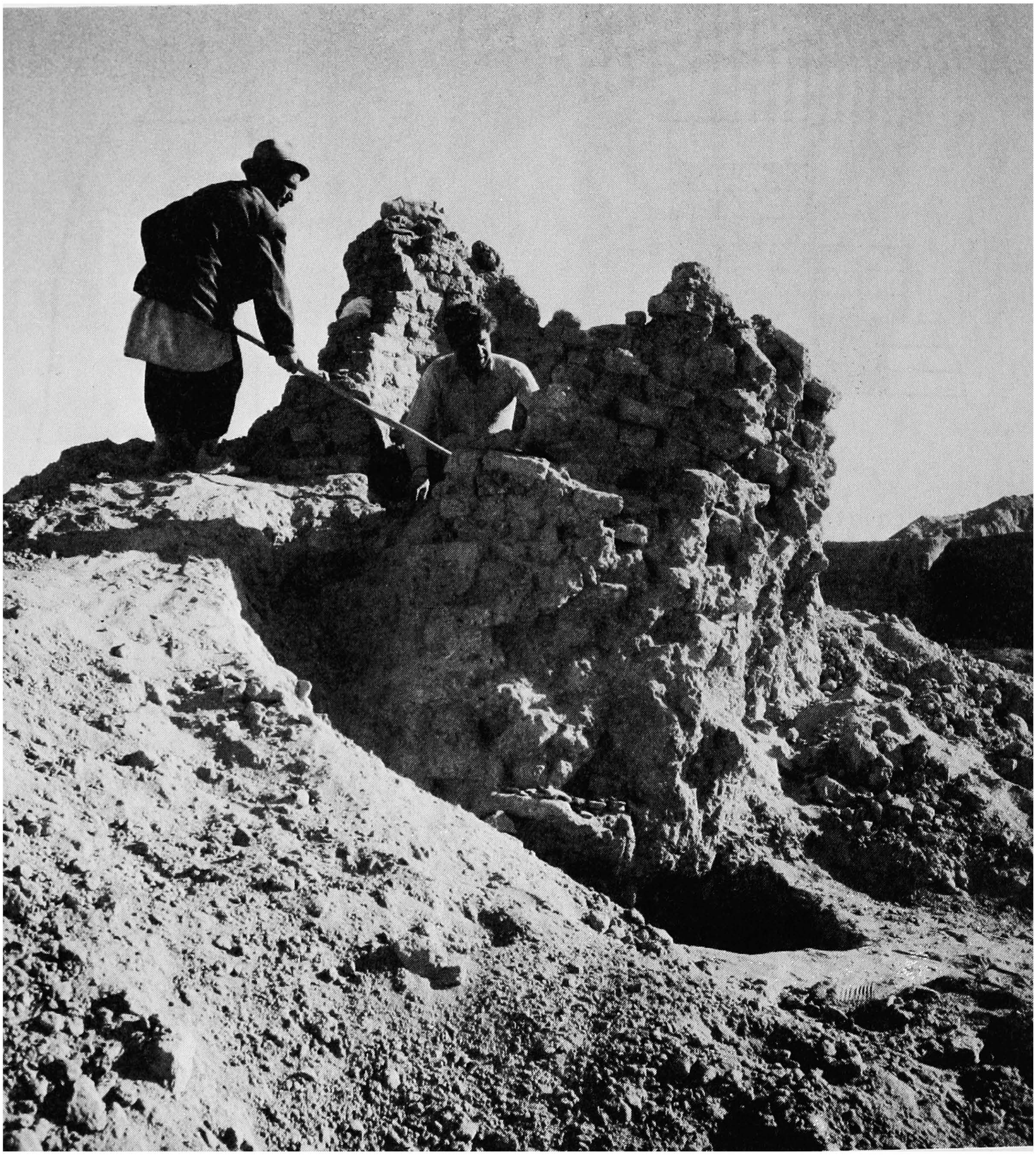


Table XIII (cont'd)

80-100 cm

Plain body sherds	36
Plain, simple bowl, straight rim	2
Plain, high annular base	1
Plain, low annular base	1
Aliabad Plain	2
Aliabad Painted	6
Aliabad Bichrome	4

100-120 cm

Iblis Painted	1
Lalehzar Coarse ware	20

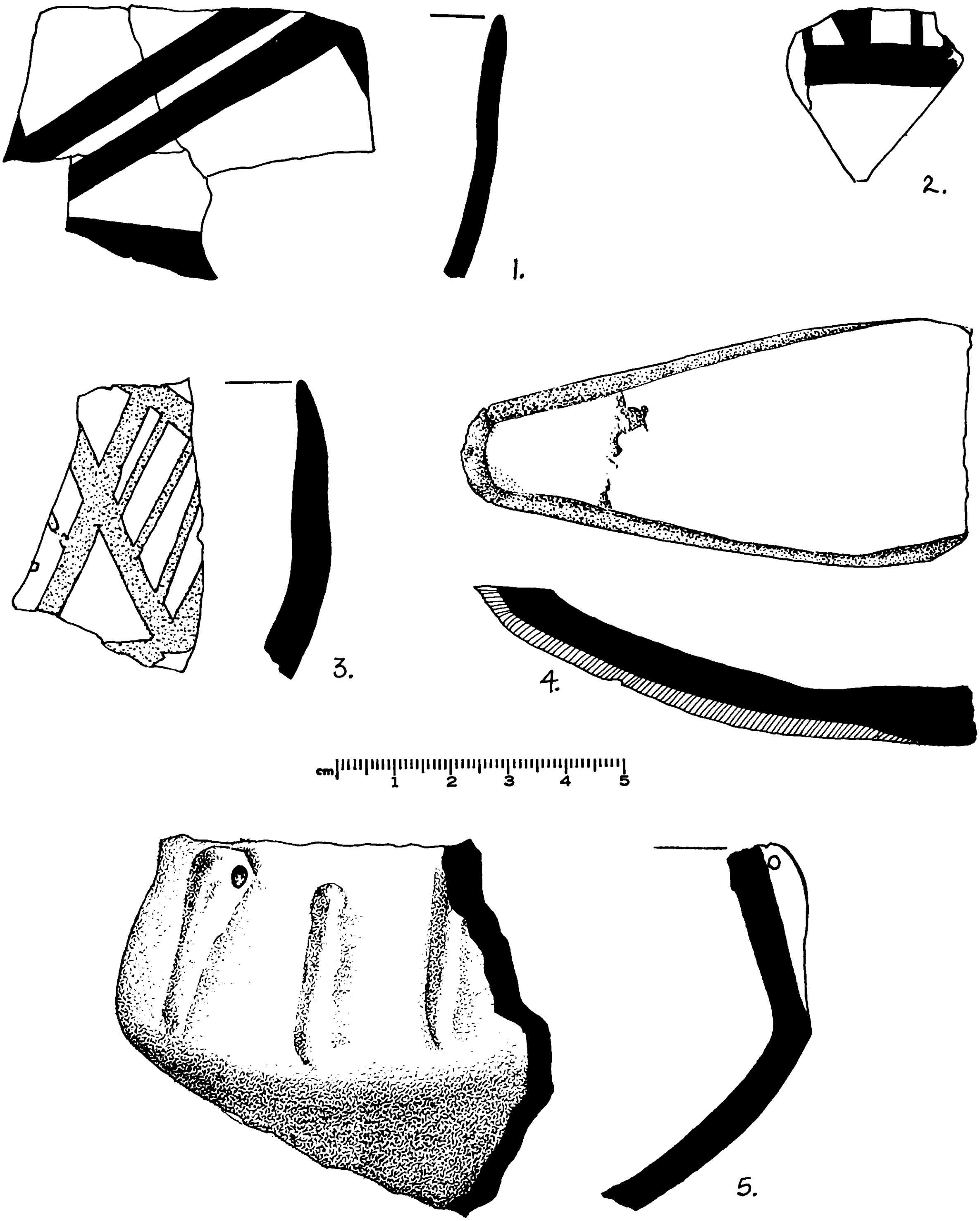
120-140 cm

Bard Sir Painted	1
Lalehzar Coarse ware	5

A short distance southeast of mound center in the area removed by the fertilizer diggers was a standing brick ruin notable for having both baked and unbaked bricks. The ruin was roughly circular and extended a little extra distance toward the east. It was about 3.5 m high. During the last week of excavation we made a hasty examination, clearing out fallen bricks and cleaning the outer faces of the bricks in situ. At the same time we commenced digging down into the top. It soon became apparent that this was either a tower or a reservoir and the inside was almost exactly circular like a well. The inside was excavated in 1 m levels. At 3.40 m from the top we judged that we had reached the bottom, although we are now not absolutely certain that we did. The inside diameter of the bottom was 1.35 m, practically the same as that of the top. The brickwork comprised both baked and unbaked bricks as shown in Figure 44, but we only examined a few of these, and only after we had left the site did we notice that of the bricks we had recorded, those facing the interior, were all fired. Brick sizes were slightly variable: 34-31 cm long, 18-15 cm wide, and 8-7 m high. The bricks had been laid with mud mortar.

In the meantime, while Evett was exposing Iblis I walls in Area F, he found extensive disturbance of the Iblis I level in the places nearest the standing brick ruin, as if the builders, before beginning construction, had dug deeply through older deposits. In this disturbed area he noticed some fragments of Iblis IV pottery, but as the lists below show, the inside of the structure contained not only Iblis IV (Aliabad) pottery, but some varieties we cannot yet recognize, and at the very bottom was a perforated nose lug of a kind which one might expect in late Uruk and Jemdet Nasr levels in Mesopotamia. Considering this to be perhaps the latest fragment in the interior of the brick ruin, and that the aspect of some of the other pottery is not Iblis IV or earlier, we hesitantly suggest that the ruin belongs to Iblis VI and the still poorly known Najaferabad complex. We also suspect that it may have been a reservoir and that we did not dig deeply enough to find the bottom. But reservoir or not, it is certainly part of some larger structure most of which was removed by the fertilizer diggers. Notice in Figure 44 how the mass of bricks extends outward toward the east. On this side also was a horizontal shaft 24 cm square and plastered with mud. This was preserved only for a distance of 104 cm. In sum, our examination of this structure was far too hasty to give us any understanding of its purpose or to be absolutely certain of its period.

FIGURE 45 - SHERDS FROM INTERIOR OF STANDING BRICK RUIN



1, 2, 3, 4 are from Level 1 - 2 m. 4 is a scraper made from a sherd.
5 is from Level 2.70 - 3.40.

Table XIV. -Contents of Fill of Standing Brick Ruin

Top to 1 m	
Aliabad Painted	1
Unusual painted design	1
Beveled rim bowl fragment	1
Plain, thin wheelmade pottery	2
Calcite or alabaster vessel fragment	1
Plain, constricted neck, straight rim	1
Clay "nail" fragment	
1-2 m	
Plain body sherds	18
Aliabad Painted	3
Unusual plain rims (not Aliabad)	2
Low annular base	1
2-2.70 m	
Plain body sherds	3
Unusual painted sherds	3
Beveled rim bowl fragment	1
Plain rim	1
Cut sherd artifact	1
2.70-3.40 m	
Plain body sherds	11
High annular base	2
Aliabad Painted	2
Aliabad Plain	1
Plain rims, slight flare	3
Cut sherd disc	1
Sherd with perforated nose lug	1

Later Materials

In the topmost level of Area C (0-20 cm) were a number of sherds we did not recognize, but presumably nearly all are later than Iblis IV (Figs.29, 30, 31). Some of these also occurred in the upper levels of the Iblis IV deposit (20-70 cm) and random samples from both layers are listed below.

Among the later pottery were sherds of a distinctive gray ware, gray in paste and with gray surfaces. One of those illustrated (Fig.30:1) was badly eroded and clearly showed particles of a coarse grit temper, but other examples show that the surfaces were originally burnished. This is especially apparent in those illustrated in Plate 13 which, although they came from the fertilizer diggers excavation, seem to be of the same type.

Another variety in these two latest levels, with a wavy line incised decoration, is tentatively regarded as belonging to Iblis VII, the Haidarabad complex, believed to be associated with the pottery kiln disclosed in excavation Area B (see Paper XIII, this Volume). The latter had radiocarbon determination of about 1100 B .C.

There was also an abundance of plain sherds in these levels and inasmuch as Aliabad Painted was not strongly represented in the 0-20 cm level, we suspect that many of these are Mashiz Plain or some other. As previously noted, there has been insufficient study of Aliabad and Mashiz Plain to enable us to sort them easily in the field. The fact that Mashiz Plain, known mostly from surface collections, usually has sun blasted and eroded surfaces adds to our difficulty. The surface sherds show grit temper quite visibly whereas Aliabad Plain does not, and seems probably vegetal tempered. Vessel forms do not show much difference, and a major difference between the ceramic assemblages of Iblis IV and Iblis V may turn out to be a greater proportion of undecorated sherds in the latter.

Also in these topmost levels is a kind of white buff plain of which one characteristic form is an overhanging rim (Figs. 29:3 and 30:7). Study may show other distinctive forms made in this paste and color.

Apparently our two topmost levels on Area C are somewhat contracted and include sherds from several periods later than Iblis IV. That the time covered extends into the Iron Age, at least to some degree, is indicated by an iron pin in the 0-20 level.

Of all the materials found on the site, one of the latest is an iron dagger from Area B (see Paper XIII, this Volume) identified as probably Achaemenian. On the surface one may rarely see a glazed sherd but as yet there are no indications of settlement after 1100 B.C.

Table XV.-Random Sample of 6 Sacks of Sherds from Area C, Top Level, 0-20 cm Below Surface.

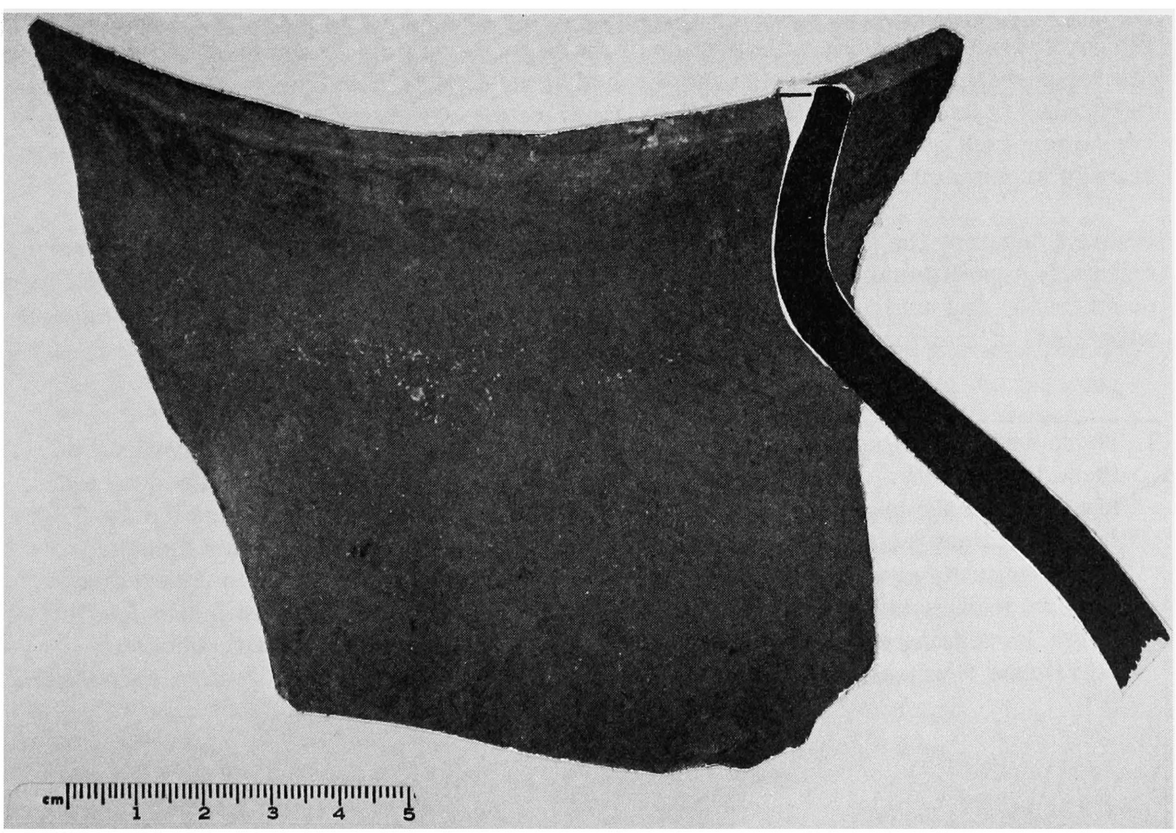
Plain, mostly Mashiz Plain and other, but some Aliabad Plain	312
Plain, with buff slip, including 1 shoulder spout	54
Plain, white-buff paste and surfaces	37
Plain, gray paste and surfaces	30
Sherd with "rope" decoration	1
Wavy line incised decoration	2
Beveled rim bowl fragment	1
Mashiz Painted (?)	2
Aliabad Painted	29
Aliabad Ridged, including 1 string cut base	3
Aliabad Plain (outside lip channel)	1
Unworked flint fragments	6
Animal bone fragments	6

Table XVI -Random Sample of 4 Sacks of Sherds from Area C, 20-70 cm Below Surface

Plain, probably both Mashiz Plain and Aliabad Plain	852
Plain, with buff slip	191
Plain, with white-buff paste and surfaces including 3 straight rims, 1 overhanging rim, and 4 with outside lip channel *	181
Plain, pebbly eroded surfaces (Mashiz Plain ?)	27
Plain, gray paste and surfaces (some are perhaps overfired and not technically "gray ware")	65
Plain, high annular base	4
Overhanging rim, red paint	1
Plain beveled rim vessel (not "beveled rim bowls")	3
Plain, low annular base	4
Plain, flat base	2
Beveled rim bowl fragments	24
Plain, flaring rim	1
Aliabad Ridged	3
Aliabad Painted (including Bichrome)	275
Aliabad Plain (outside lip channel)	5
Plain straight or nondescript rims, probably Aliabad Plain	5

* The outside lip channel is generally characteristic of Iblis IV. The overhanging rims, generally on a white-buff paste, are clearly later than Iblis IV.

PLATE 13 - GRAY WARE FROM FERTILIZER DIGGINGS.



XI

ARTIFACTS AND ARCHITECTURE OF THE IBLIS I PERIOD: AREAS D, F, AND G

Daniel Evett

This is a preliminary report on the data recovered from the clearing of some fifty rooms, about equally distributed between excavation areas D, F, and G. For the present I am confident that each of these areas represents a domestic "house" and I will refer to these areas as houses throughout the report. These houses lie quite near to each other horizontally, and as will be indicated later in the paper they are also close chronologically. At the time we were delighted to have exposed such a considerable amount of architecture and in fact our digging in these areas D, F, and G reflect a bias towards remaining within rooms. In retrospect we regret that the gaps between the houses were not closed and that possible "courtyard" areas outside of the houses were not explored more thoroughly.

To those familiar with the difficulties of excavating mud brick or tauf architecture in the Near East it will seem that fifty rooms is an extravagant figure to claim for so short a field season. However we were confronted with some exceptionally favorable conditions. As has already been mentioned the diligence of the local fertilizer diggers was responsible for exposing a considerable portion of the lower levels of the center of the mound. By and large their efforts stopped at the level of hard, light, clayey rubble which contained the houses of areas D, F, and G. Thus, we were almost entirely relieved of the time-consuming task of removing extensive overburden. This factor, and the generally fine state of architectural preservation made for relatively rapid excavation.[1]

Before I describe the data and offer interpretations I must repeat a caveat: this is very definitely a preliminary report. It is preliminary at almost every level of data collection, description, and analysis. I think it only reasonable that the reader be given a sense of what kinds of information presently are, and are not available.

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1 There were two other relevant factors that contributed to the "rapid excavation" of these house units. After a period of about two weeks the excavator had acquainted himself with the vagaries of mud brick architecture and was able to develop a fairly efficient technique for finding and clearing walls. Subsequently I managed to transmit my growing knowledge to my workmen, who were quick to understand what we were seeking and how to go about careful excavation. As an indication of our increasing efficiency I need only mention that House D took five weeks to dig; House F was about two weeks and House G was a little over a week in excavation.

Part I The Artifacts

We present first a brief descriptive section on the artifacts found in the fill and on the floors of Houses D, F, and G. Table 1 lists the summary totals by artifact category for these areas.[1] The descriptive categories are as follows: ceramics, ground stone, chipped stone, worked bone, worked shell, worked gem stones, clay objects, copper artifacts, and other artifacts. Each of these categories subsumes a variety of data which we will seek to characterize in summary statements rather than discuss in fine detail. Studies on the chemical and physical characteristics of the diverse raw materials have not been completed so that we are unable to give more than generalized terms for most of the minerals.

Ceramics. - Tables 2, 3, and 4 present the pottery counts according to the standardized typology for Tal-i-Iblis. By far the most common Lalehzar Coarse ware shape is the small base vessel (Fig. 1: 1). In general, these are large vessels, and they seem best suited for storage. Other shapes of coarse ware vessels occur but rarely (Fig. 1: 2, 3). There are also three examples of drum-shaped vessels (Fig. 1: 5). Many of the small base vessels have applique decoration, deployed in a variety of simple designs (Fig. 2). The applique does not protrude sufficiently to be useful as suspension lugs. Occasionally the Lalehzar Coarse ware has a few broad lines or splotches of red paint were applied to the vessel. It is likely that with a larger sample and more significant contexts these decorative aspects of Lalehzar Coarse ware, as well as the variations in body morphology, would be very useful in helping define horizontal and vertical differences at Tal-i-Iblis. This is only to say that the coarse ware, being our most common ceramic in the lowest levels, is worthy of more extensive study.

The Bard Sir types, Plain, Painted, and Red Washed are characteristic of the Iblis I period and are the major contributors to the small percentage of finer wares found in Houses D, F, and G. We limit our comments to the following: there are different repertoires of vessel shapes for Bard Sir Red Slipped and for Bard Sir Painted. The very few sherds of Bard Sir Plain do not suggest shapes differing from those of the Bard Sir Painted style. No decision has been made as to what the differences in paint color (red to maroon to brown-black to black) signify. Although the general impression is that the firing of Bard Sir pottery was carefully controlled, we must note that there is a small but ever-present number of "overfired" sherds. In some cases the entire sherd had begun to fuse and vitrify; unfortunately we can in no way verify that such alteration took place at the time of firing. The inventory of design elements and patterns on our Bard Sir painted sherds is largely coincident with those found in areas E and A. Designs are neatly executed with a generally even balance between positive and negative spaces (Fig. 3). The great majority of total vessel designs are repeated, rectilinear, geometric patterns. However we have two examples of zoomorphic designs (Fig. 3: 2, 9). One very simple observation -- the bigger vessels are decorated with broader lines and possibly freer patterned designs, i.e., the symmetries are less rigid. The very few representatives of the Iblis wares from Houses D, F, and G differ in no way from those found elsewhere at Iblis (Fig. 5).

Ground Stone. - The ground stone materials exhibit clear correlations between the nature of the raw material and the kinds of artifacts made from them. What we have called small and large grinding tools are made from a dark crystalline basaltic rock. The surfaces of these milling tools tend to be pocked and pitted, reflecting in part, spots where looser

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1 The discussion of artifacts other than pottery includes materials found on the floors of Houses D, G, and F. Table 1 lists only the materials found in the room fills. Materials from the floors are presented in Table 15.

TABLE 1 Artifacts From Fills

	Area D	Area F	Area G	Total
Large Milling Stones		1	1	2
Small Milling Stones	4	7	2	13
Large Pestles	-	-	1	1
Small Pestles	1	1	-	2
Possible Large Mortar	-	1	-	1
Possible "Doorsocket"	1	-		1
"Ax"	-	1	-	1
"Manos"		1		1
Possible Hammerstones	1	-	1	2
Calcite Bowls (frags.)	2	2	1	5
Calcite Figurine	-		1	1
Calcite "Pestle"	-	1	-	1
Slate Spatulas	2	-	4	6
Grooved Steatite	1	-	1	2
Small Sandstone Slabs	1	3	4	8
Sandstone "Knives" (frags.)	-	-	3	3
Bone Awls	3	10	11	24
Other Bone	1	1	1	3
Shell Beads	2	1	5	8
Other Shell	-	1	1	2
Turquoise Beads or blank	1	4	-	5
Carnelian Beads or blank	-	1	1	2
White Stone Beads	1	-	1	2
Azurite Beads	1	-	-	1
Other Gem Stones	1	1	1	3
Clay Objects				
Animal Figurines	1	5	7	13
Female Figurines		1	4	5
Balls		3	5	8
Sling Missiles	-	2		2
Nails	1	3	6	10
Spindle Whorls	-	1	3	4
Disks ("Pot Lids")			1	1
Other		1	2	3
Copper Ore (lumps)	3	5	6	14
Crucible Frags.	-	-	2	2
Copper Pins	-	-	3	3
Copper Beads	1	1	1	3
Copper Bracelet (frag.)		1	-	1
Flaked Sherds	-	1	3	4
Sherd "Pot Lids"			1	1
Minerals				
Mica		1	-	1
Red Ochre	-	1		1
Calcite Crystal	1	-	1	2

TABLE 2 Area D: Sherd Counts

	Upper Black Fill	Fill N. & E. of Houses	Room Fill	Floors
Lalehzar Coarse	434	624	797	274
Bard Sir Painted	16	5	5	
"Overfired" Bard Sir Painted	-		4	-
Bard Sir Plain	4	1	2	-
"Overfired" Bard Sir Plain	4	-	2	1
Bard Sir Red Slipped	9	2	4	-
"Overfired" Bard Sir Red Slipped	4		-	-
Iblis Painted	8	1	7	-
Iblis Plain	3	8	2	-
Probable Iblis Painted	1	1	-	-
Total	483	642	823	275

TABLE 3 Area F: Fill and Floors Sherd Counts

	Fill	Floors
Lalehzar Coarse	896	135
Bard Sir Painted	17	1
"Overfired" Bard Sir Painted	5	-
Bard Sir Plain	17	-
"Overfired" Bard Sir Plain	4	1
Bard Sir Red Slipped	36	2
Iblis Painted	11	-
Iblis Plain	8	-
Probable Iblis Painted	7	-
Total	1001	139

TABLE 4 - Area G: Fill and Floors - Sherd Counts

	Fill	Floors
Lalehzar Coarse	1636	241
Bard Sir Painted	80	8 plus 1/2 cup
"Overfired" Bard Sir Painted	5	-
Bard Sir Plain	33	1
"Overfired" Bard Sir Plain	9	-
Bard Sir Red Slipped	21	1
Iblis Painted	2	-
Iblis Plain	9	-
Probable Iblis Painted	9	
Total	1804	252

FIGURE 1. LALEHZAR COARSE WARE

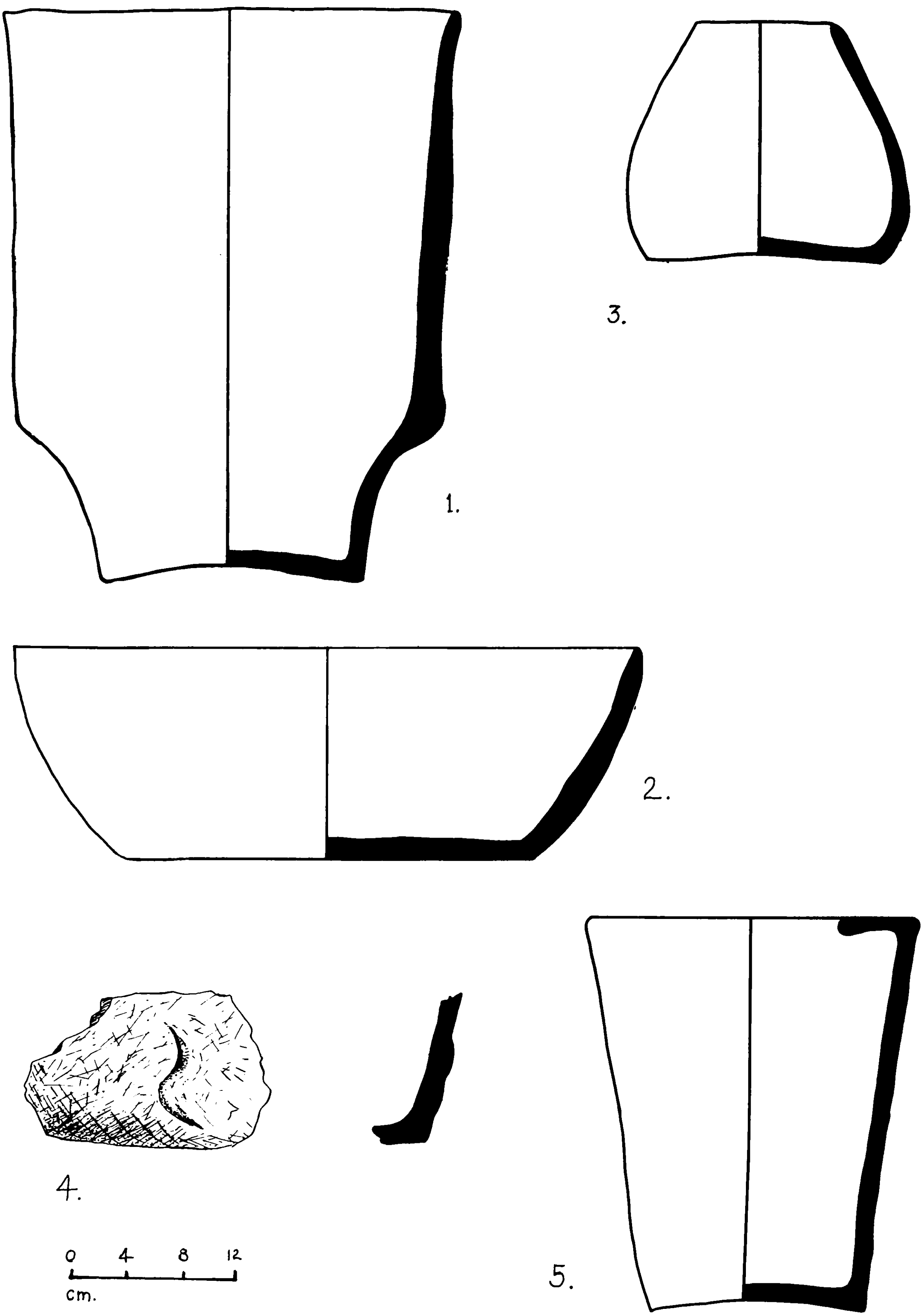
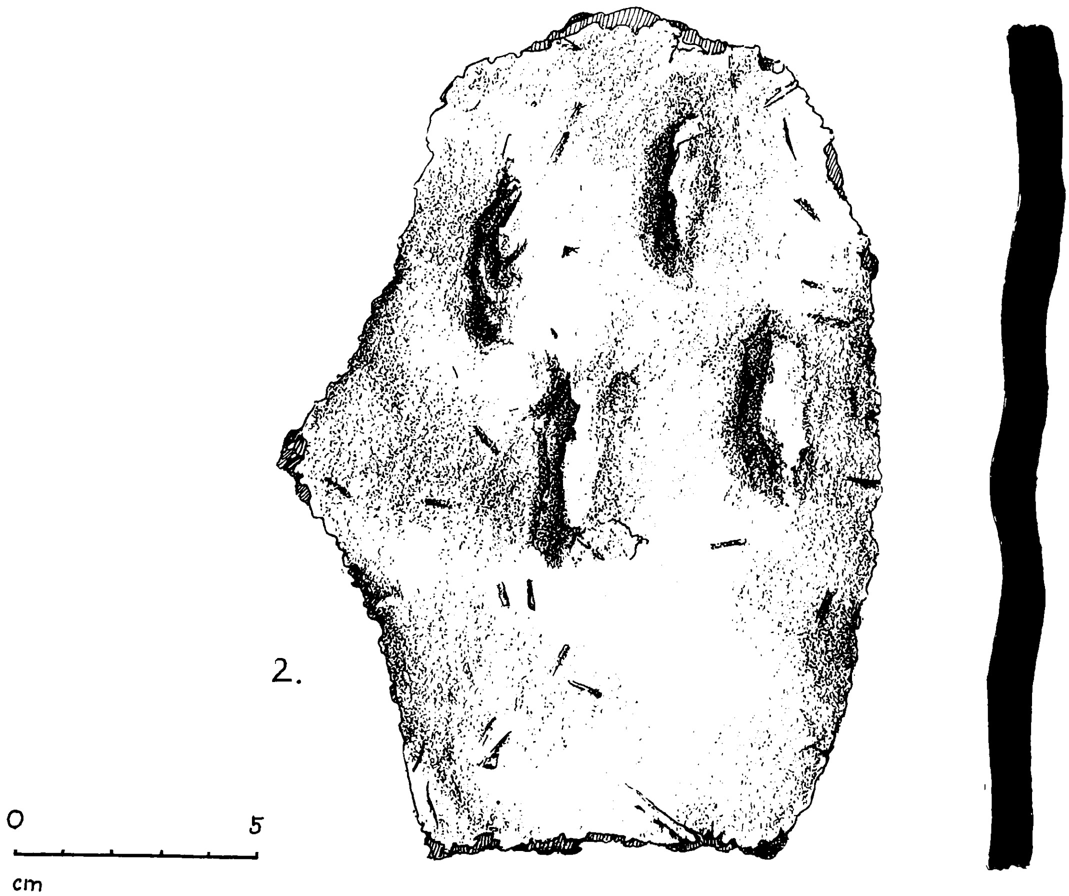


FIGURE 2. - LALEHZAR COARSE WARE

1.



2.

1 Area F, Room 1, Fill. 2 Area G, Room 14, Fill.

FIGURE 3 - BARD SIR PAINTED

FIGURE 4. BARD SIR PAINTED

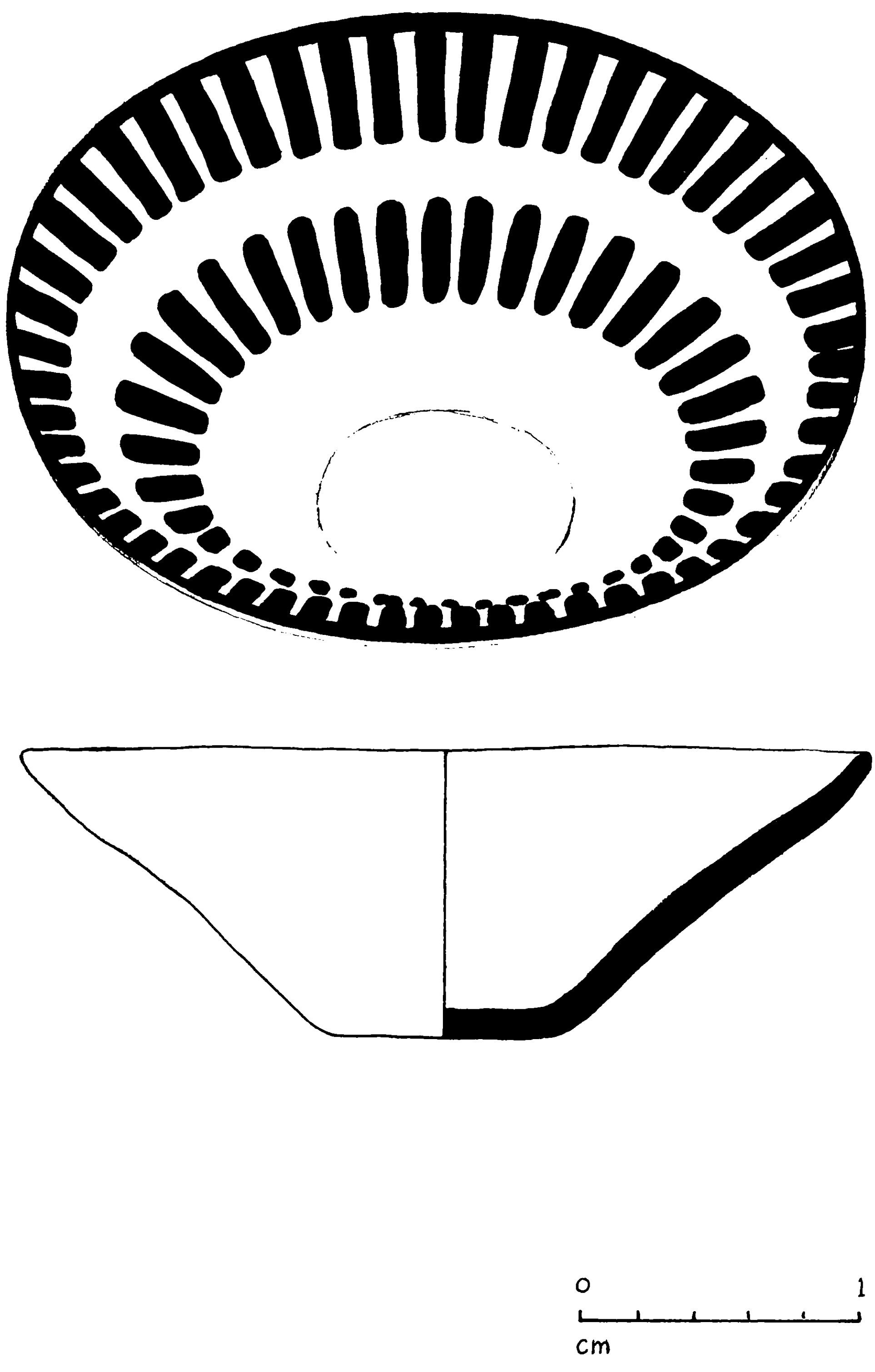
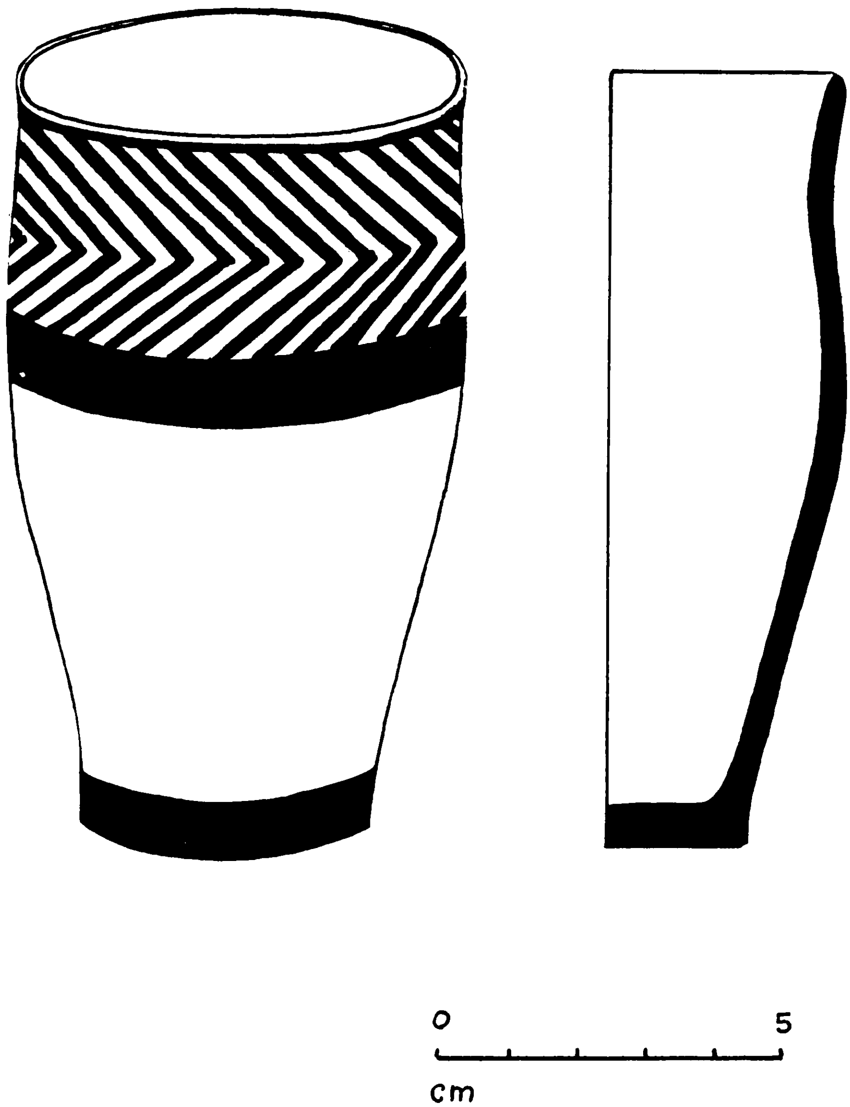
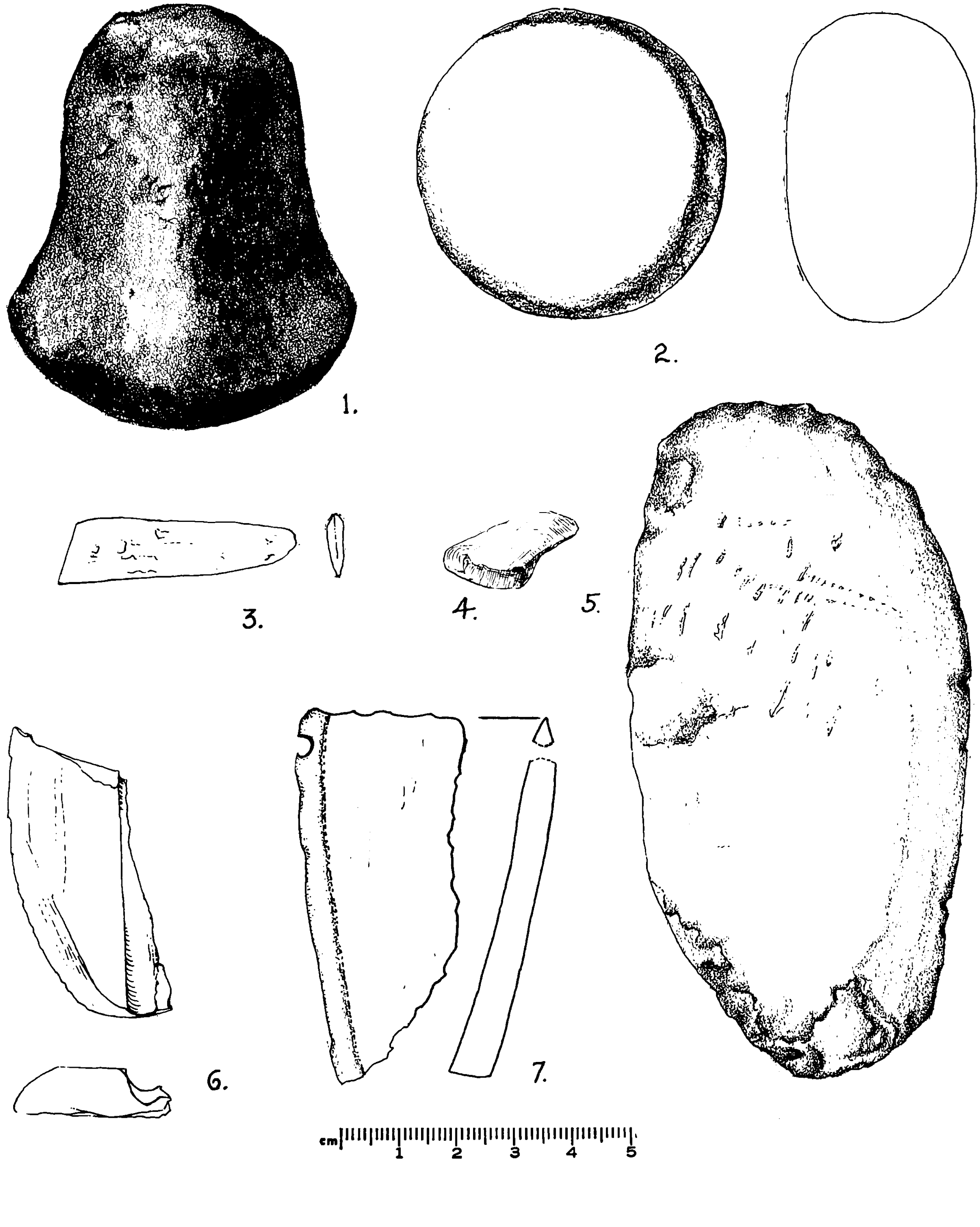


FIGURE 5. - IBLIS PAINTED



HOUSE F, ROOM 9, FILL.

FIGURE 6. - ARTIFACTS OF STONE



1 (301) Pestle, quartzite, House G, room 7 2 (no number) Mano, unidentified stone, House G (?) floor 3 3 (29) "Spatula", Slate (?), House D, room 15, fill 4 (293) Figurine (?), Calcite, House G, room 14, fill 5 (no number) Knife (?) Unidentified stone, House G, room 12, floor 6 (272) Arrowshaft smoother (?) Shale, House G 7 (no number) Fragment of bowl, Steatite, House D, room 8, floor.

crystals have dropped out and in part the pecking used to manufacture the tools. The dimensions of the small grinding stones are remarkedly uniform, ranging from 20 to 28 cm x 14 to 18 cm width and 3.5 to 5.5 cm thickness. The plan view shapes of these tools range from a rectangle with rounded corner grading into oval shapes to almost perfectly circular forms. There are very few fragments of the large "built-in" querns of the type found in area B. The examples found in Area B were long (ca. 60 cm), fairly narrow, (20-30 cm), and thick, (10-15 cm).[1] Almost all the working surfaces of the smaller items are either slightly concave or slightly convex. The in situ find in House G, room 11, of an obviously matched pair of these tools, one with a concave surface, one with a convex surface suggests that most of these items were made and used in similar matched pairs. There are three examples of small pestles, roughly bell-shaped, made from the same crystalline rock (Fig. 6: 1). Unfortunately we have no convincing mortars to fill out the presumed set.

There are other small grinding tools which seem to belong to a category apart from the above described items. We have two "rubbing stones," which if found in the American southwest would be called "one-hand manos" (Fig. 6: 2). They are both made of a very dense, metamorphic rock and both are highly polished and stained with red ochre. The other half of the set may well be represented by a number of smallish sandstone slabs, most of them with smoothed, flattish surfaces carrying some trace of red ochre. The sandstone, which is very fine-grained, was also used to make a kind of dull-edged "knife" (Fig. 6: 5). We say "knife" with due reservation although the wear pattern on these objects is congenial with such an interpretation. In House G we found two quite large, unused sandstone slabs. It seems likely that these were "blanks" for the tools made from this material.

There is a handful of puzzling artifacts worked in slate (Fig. 6: 3). My guess is that the parallel striations which dominate the texture of these objects are the result of manufacture and not of use. The tips of one of these items are covered with multidirectional striations, indicating that these tools were used with a rotary motion. For lack of a better term we have called these "spatulas" and include them as the smallest member of the "grinding" kit.

Calcite was the primary raw material used in producing stone bowls. Most of the small fragments recovered from Houses D, F, and G were once part of straight-sided vessels or shallow squat bowls. There are two other objects worked in calcite. One, which we have labeled a figurine, resembles a seal more than any other animal (Fig. 6: 4). The other object is very similar in outline to the small pestles except that the working end of the object is concave. Steatite was used to make at least two kinds of items. Although calcite was used more frequently to produce stone vessels, steatite was also employed for this purpose. The one example we have comes from an almost straight-sided bowl with a simple bit of relief decoration and a drilled hole which could have been used either for suspension or to repair the bowl (Fig. 6: 7). We have two fragmentary examples of a small sub-rectangular piece of steatite with a smooth straight groove running down the middle of the stone (Fig. 6: 6). In the New World these items would be called "arrow shaft straighteners" but despite the formal similarity I would rather avoid a functional label for these objects. However we might hazard a guess that the special quality of a steatite was being chosen to give an especially smooth polish to some other artifact or artifacts, be they arrowshafts, beads, bone awls or whatnot.

1 See Caldwell and Sarraf, this volume.

The last item in the ground stone inventory is represented by two "axes." They differ considerably in form and presumably were used for different purposes. Both were made from local chert. The smaller ax was chipped and ground. The larger ax, a flattish cobble, is slightly modified by flaking at the edges. Both items show bi-facially chipped, not striated, wear at the bit edges.

This is the sum of the ground stone artifacts from the fill and floors of Houses D, F, and G. The frequency of any or all the items does not suggest that ground stone working in any way dominated the local crafts. It is quite probable that the scarcity of suitable local raw materials was a limiting factor in the production of ground stone objects, especially those made from calcite, steatite, and the dense metamorphic rock. We would imagine that artifacts wrought from such materials were rare in a sociological and/or ideological sense, but we have no real data to test this kind of hypothesis.

Chipped Stone. - Tables 5, 5A, 6, 6A, 7, and 7A summarize the data on the chipped stone. The industry, as represented by the materials from these areas, is dominated by a true blade technology. Almost all the free struck flakes have some rind (cortex), and they probably are derived from the initial steps of core preparation. There is only one convincing flake core. The raw materials used in the blade technology are flint cobbles and chalcedony geodes. Neither of these materials are found on the Lalehzar Plain. Occasionally there is a large flake struck from a coarse-grained chert locally available in cobble form. There is a high percentage of "micro-blades," (i.e., less than 10 mm width). This, plus the numerous blades with bits of rind, and the complete lack of macro-cores, suggest that the raw material was generally available in small sizes.

Core renewal and preparation products are fairly distinctive, including crested blades. As mentioned above, many flakes carry areas of rind; in addition we have created the category of "Rind removal" for flakes or blades that are extensively covered with rind. "Face cleaning" flakes or blades are those pieces which carry a number of blade scars on the dorsal surface. "Platform renewal" flakes take the form of a total or partial cross-section of a blade core.

There is a fairly high percentage of manufacture modified tools, but these are essentially of two kinds of tools -- drills and backed lunates. The drills are uniformly narrow-bitted (ca. 2-3 mm) and shouldered. The range of the length of the lunates is quite variable (1-6 cm), yet all show signs of edge use and about 50% of these have "sickle sheen." Sickle sheen is also present on several use-modified blades. A good percentage of the "non-manufacture modified" blades were used to the extent that wear nicks are easily visible. There is a tendency for "dubious"[1] and "unused" blades and flakes to be quite small and/or irregular in shape. We feel that these facts add to the picture of an industry that made exhaustive use of the available resources. The general impression is that the workmanship was controlled and that the technical procedures and finished products were highly standardized.

Worked Bone. - Almost the entire collection of worked bone artifacts from Houses D, F, and G can be called "awls." These seem to be of two basic kinds: those with very sharp points (Fig. 7: 1, 3), and those with duller points (Fig. 7: 2). The awls tend to be made from the metapodial of a goat which, according to Dr. Bökönyi, is one of the strongest bones available. In general, the awls are simply fashioned, but we have two examples

1 "Dubious" refers to our difficulty in deciding whether certain kinds of edgewear are due to natural causes or were man-made.

TABLE 5 - Area D: Chipped Stone From Fills

		Blades		Flakes		Chunks	
		Flint	Other	Flint	Other	Flint	Other
Manufacture	micro	6	-	-	-	-	-
Modified	macro	8	-	2	-	1	-
Use	micro	7	-	1	-	-	
Modified	macro	25	-	11	-	1	-
Dubious	micro	5	-	-	-	-	-
Use	macro	7	-	4	-	2	-
	micro	5	-	6	-	2	-
Unused	macro	7	-	9	2	2	1
Total		70	0	33	2	8	1

TABLE 5A - Area D: Cores and Core Preparation

2 blade cores
1 flake core
1 - core face fragment
0 rind removal blade
3 rind removal flakes
0 - face cleaning blades
1 - face cleaning flake
2 - crested blades
1 platform renewal

TABLE 6 - Area F: Chipped Stone From Fills

		Blades		Flakes		Chunks	
		Flint	Other	Flint	Other	Flint	Other
Manufacture	micro	4	-	-	-	1	-
Modified	macro	11		2		-	-
Use	micro	11			-	1	-
Modified	macro	51	-	7	4		-
Dubious	micro	15	-	-	-		
Use	macro	12	-	2	1	-	-
	micro	15	-	8	-	5	-
Unused	macro	3	-	9	8	8	-
Total		122	0	28	13	15	0

TABLE 6A - Area F: Cores and Core Preparation

6 - blade cores
2 core face fragments
2 - other core fragments
2 rind removal blades
12 - rind removal flakes
0 face cleaning blades
3 - face cleaning flakes
6 - crested blades
1 platform renewal

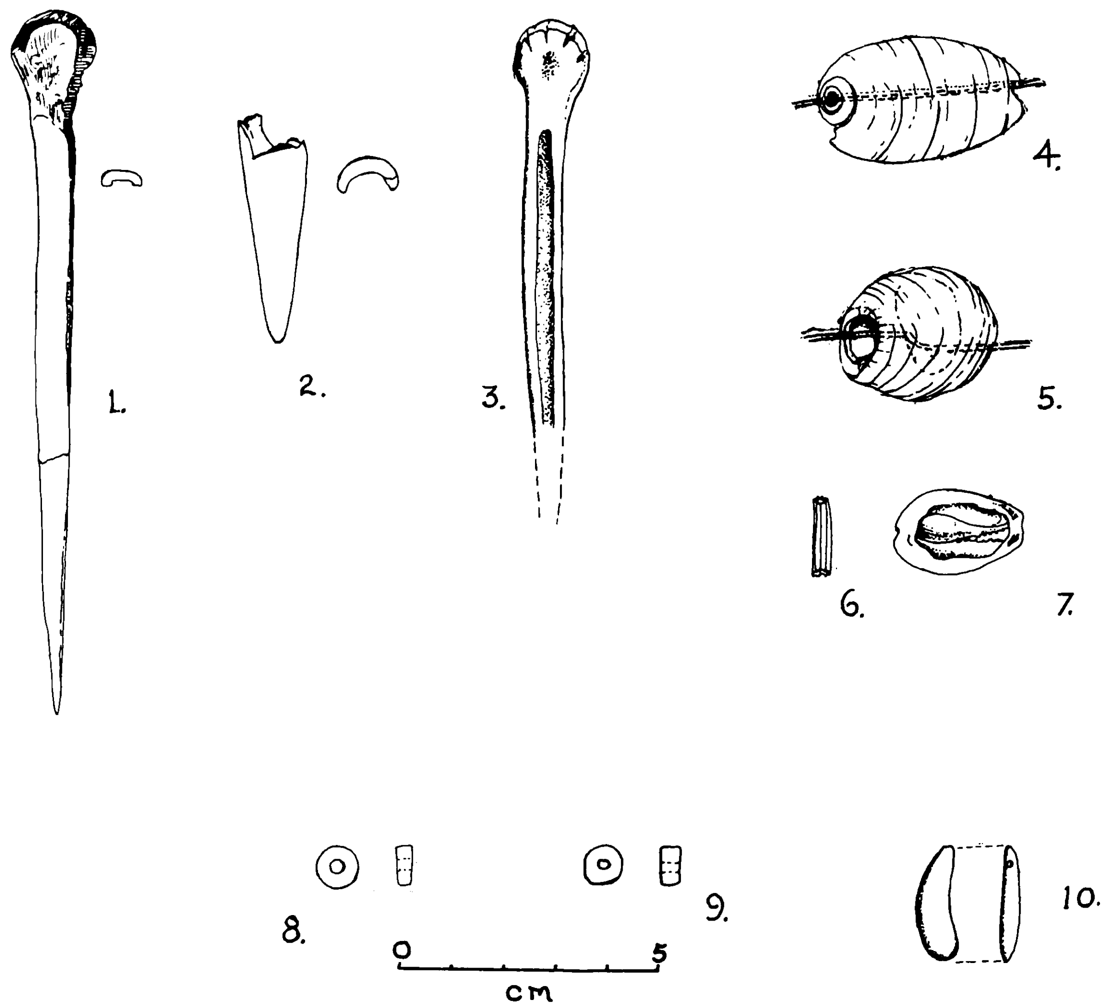
TABLE 7 - Area G: Chipped Stone From Fills

		Blades		Flakes		Chunks	
		Flint	Other	Flint	Other	Flint	Other
Manufacture	micro	14		-	-	-	-
Modified	macro	23	-	2			
Use	micro	28		-	-	1	
Modified	macro	102		16	1	1	-
Dubious	micro	25	-	1	-	-	
Use	macro	41		15	4	1	
	micro	11		10		9	1
Unused	macro	12		18	8	16	-
Total		256	0	62	13	28	1

TABLE 7A - Area G: Cores and Core Preparation

17 - blade cores
2 core face fragments
3 other core fragments
3 - rind removal blades
31 rind removal flakes
0 face cleaning blades
3 face cleaning flakes
9 crested blades
3 - platform renewal

FIGURE 7. ARTIFACTS OF BONE; ORNAMENTS OF SHELL AND STONE



1 (229) Bone awl, House G, Room 5, Fill 2 (291) Awl tip, House G, Room 15 3 (206) Decorated bone awl, House F, Room 12, Fill 4 (270) Shell bead, House G, Room 9, Fill 5 (289) Shell bead (1 1/2x), Nerita albicilla Linné 6 (83) Shell bead, Dentalium bisexangulatum Sowerby, House D, Room 4, lower floor 7 (303) Shell bead, Cypraea (Erosaria) ocellata Linné 8 (269) Turquoise bead (2x), House F, Room 7, Floor 9 (268) Carnelian bead (2x), House F, Room 7, Floor 10 (288) Pendant (unidentified stone), House G, Room 14.

where a bit of decorative flourish was added (Fig. 7: 3). The lack of variety in the bone industry is curious, but this certainly is not due to a shortage of raw materials or to lack of the appropriate skills on the part of inhabitants who were adept at abrading and carving awls.

Worked Shell. - There is not a great quantity of worked shell from areas D, F, and G, but what we have is of considerable interest (Fig. 7: 4-7). The interest stems from the presence of a fair variety of marine mollusca. The genera represented include Dentalium Cypraea (Cowrie), Oliva, and an unidentified genera.[1] The technology of shell working is simple and straightforward. The Oliva and Cypraea shells were ground down until the internal canals were exposed. The Dentalium shell need only be snapped off at one end to allow for stringing. We can be fairly confident that all of the shell was used for personal adornment. But as usual our distributional data are too scanty to allow for hypothesis about possible sociological or ideological contexts.

Worked Gem Stones. - Although our sample is small, carnelian and turquoise seem to have been the most frequently used gem stones. In the examples from Houses D, F, and G, these materials appear both as small, smooth pebbles and as shaped and drilled beads. The turquoise beads are all the same form (Fig. 7: 8). The carnelian bead is barrel-shaped (Fig. 7: 9). All the beads are bi-conically drilled. There are a few other examples of shaped and/or drilled stone made from stones which are neither carnelian or turquoise but which remain to be identified. One kind of bead worked from a pure white stone is identical to the turquoise beads in form. Another object, our only pendant, was worked from a dark blue stone (Fig. 7: 10). In sum, gem stones seem to be few and far between in areas D, F, and G. Furthermore they are quite modest in size and very simple in form. The presence of undrilled "blanks" suggests that it was the new material and not the finished products that were being imported.

Clay Objects. - Areas D, F, and G were fairly rich in modeled clay objects. These objects can largely be subdivided into: figurines, "clay nails," clay balls, "sling missiles," and spindle whorls. It appears that some of the figurines and clay nails were intentionally fired, however many of the fire-hardened pieces came from the burned rooms of House G. All of these objects were made from the same local clay as the pottery, but with little or no chaff tempering.

The animal figurines are all small-scale productions, and with a few exceptions they are not precise in detail. The most readily identifiable are illustrated by Bokonyi.[2] The few anthropomorphic figurines represent females. We have no complete females but a reconstruction might involve an upper part like Fig. 8: 1 and a lower part like Fig. 8: 2. We can note the obvious; those parts of the human female that are most distinctly female are emphasized even in these elementary figurines.

We have included a number of diverse pieces in the clay nail category. There is only one complete "nail" and it might be something of an anomaly with a curled tail (Fig. 8: 3). In general these nails are small (1 cm in diameter) and short (estimated 4-5 cm). They are one of our many "mystery" objects since we have no contextual or other evidence which would allow us to state their probable use. Clay balls are another puzzling item. They range in size from 2-3 cm and are quite spherical (Fig. 8: 5). There are also two examples of bi-conical sling missiles (Fig. 8: 6). There is also a clay disc (Fig. 8: 9) and a clay bead (Fig. 8: 10). Spindle whorls are not common but we have examples of

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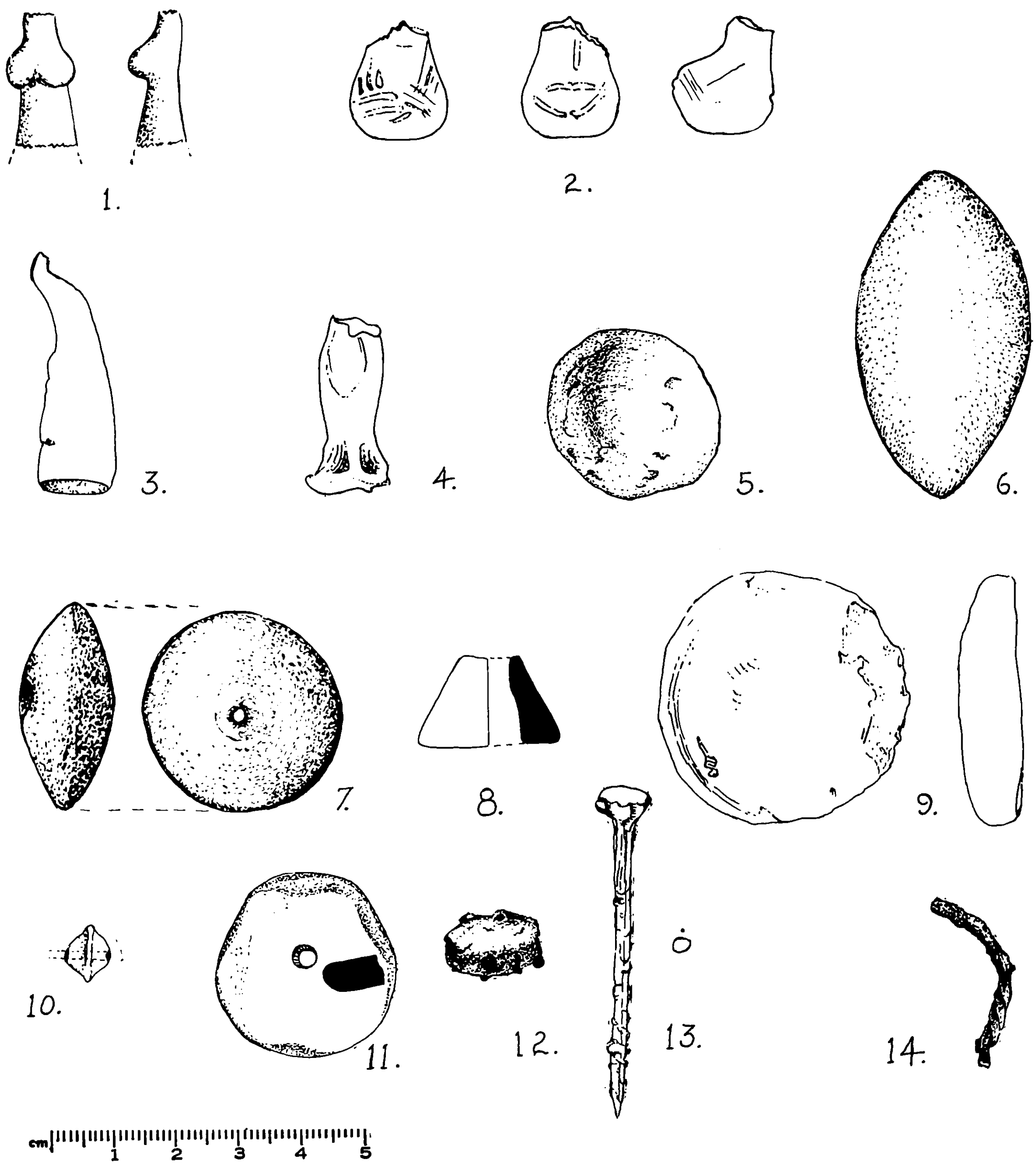
1 Since these lines were written, the shells brought to America were identified by Dr. R. Tucker Abbott, See page 408.

2 See Bokonyi, this volume.

FIGURE 8. ARTIFACTS OF CLAY; ARTIFACTS OF COPPER



1 (260) Female figurine, House G, Room 2, Fill 2 (239) Possible female figurine, House F, Room 6, floor 3 (no number) Clay "nail", House G, Room 2, Fill 4 (143) Clay "nail", House D 5 (no number) Clay Ball, House F, Room 12, Fill 6 (208) Clay sling missile, House F, Room 12 7 (256) Spindle Whorl, House G, Room 6, Fill 8 (194) Spindle whorl, House F, Hallway, Fill 9 (no number) Clay Disk, House D, Room 8, Floor 10 (97) Clay bead 11 (185) Perforated sherd disk. Both 10 and 11 are actually from Area E, Section F, Level 4. 12 (no number) Copper bead, House F, Room 2, Fill 13 (259) Copper pin, House G, Room 2, Fill 14 (no number) Fragment of copper bracelet, House F, Room 2

two different forms (Fig. 8: 7, 8). Occasionally Bard Sir ware sherds were ground and drilled to produce disk-shaped whorls (Fig. 8: 11).

In sum, these clay artifacts are small and relatively inconspicuous items. The spindle whorls and sling missiles are assigned standard uses in the literature. Clay balls and clay nails could well be either tools or toys but we have no other data to assist us in making a decision. Figurines have already been thought over by a host of other archaeologists, most of whom had far more ample materials to muse about. We have no further thoughts to add to the literature.

Copper Objects. - Copper objects were by no means frequent in areas D, F, and G. The few items recovered comprise two barrel-shaped beads, three pins, and a fragment of a bracelet (Fig. 8: 12, 13, 14). Since the analysis of these artifacts by Prof. Cyril Smith has not been completed there is nothing to be said on the method of manufacture. Morphologically these objects are all quite simple forms. Functionally they could be placed in the "personal adornment" category.

Other Objects. - Not all broken sherds were assigned to the garbage dump. Mention has already been made of spindle whorls shaped from Bard Sir pottery. A very similar method of grinding and occasionally flaking was used to produce "pot lids." These occur both in the Lalehzar Coarse ware and the Bard Sir ware. Bard Sir sherds were occasionally worked with a flat bi-facial retouch. These tools are not heavily worn; indeed it is not certain that they were used. It is hard to imagine the advantage sherds would have over stone, unless the already mentioned scarcity of stone was a factor.

The remaining "other artifacts" are not so much artifacts as they are bits and pieces of minerals in their unaltered state. The great majority of these pieces are various copper ores. To the small pile of copper ores we add a small lump of hematite, a calcite crystal and a piece of sheet mica. The hematite is, of course, a logical find in view of the number of red floors, walls and red stained grinding tools present in areas D, F, and G.

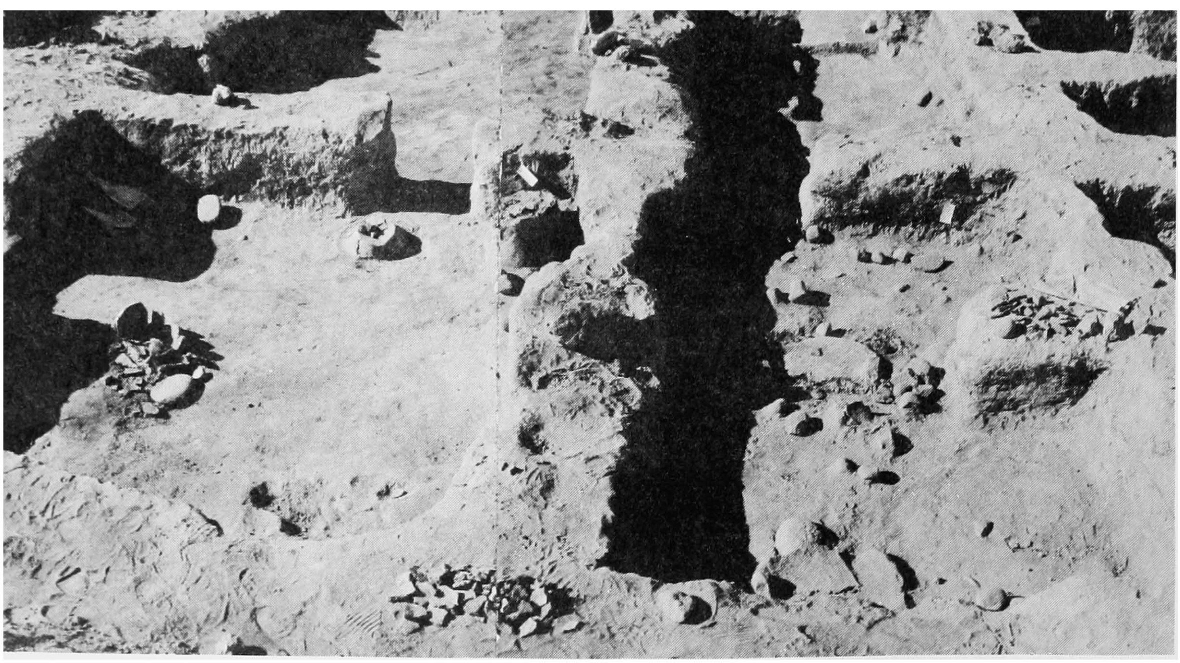
This concludes the descriptive section on the portable artifacts. There is very little of a positive nature that we can add to what has already been said. If we may venture a value judgement; all of these objects are well made but there is a minimum of decorative touches. There is much that we do not know about these items, both in the way of economic use and possible social and ideological functions, that can only be inferred when a wider range of contextual associations has been found. As was noted in the introduction, many of the raw materials used at Tal-i-Iblis were not locally available. Since this is a preliminary report we can partially excuse ourselves for not having located the sources for each of the materials in question; however this is clearly the next step, especially if we intend to understand the nature of Iblis's relations with the outside world.

Part II - The Houses: Construction and Building Materials

Our information on the building materials and construction of walls is somewhat limited in Houses F and G but fairly adequate in the case of House D. However, unless otherwise noted the following statements hold true for all of the houses. The basic building block of the walls is an unfired, hand-molded, heavily chaff-tempered, mud brick. The mortar is similarly a chaff-tempered mud. A series of bricks from House D showed that width and height were consistent in any one wall (respectively room 12, north wall 25 cm width and 20 cm height; room 10, west wall - 21-23 cm width and 20 cm height). In contrast, length was quite variable, ranging from 38 to 70 cm. House D bricks are

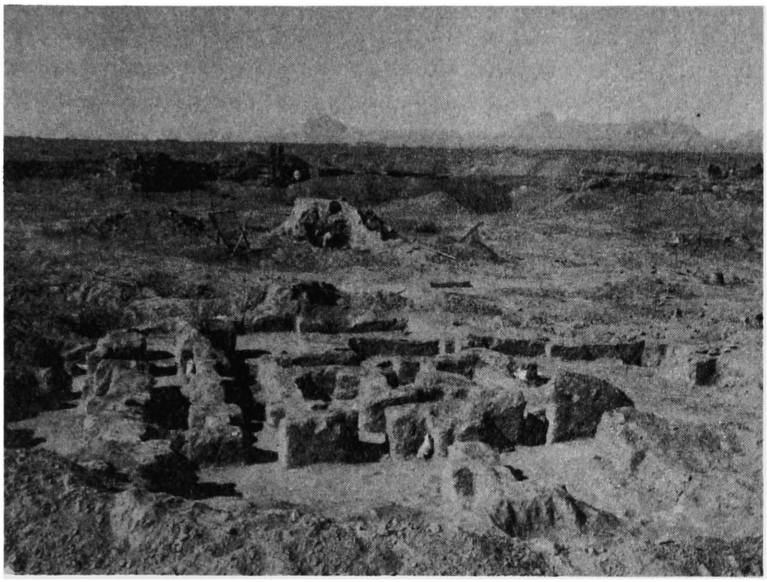
PLATE 1 AREAS D AND G

Area D: Foreground - external buttresses and large room.
Background - small rooms.



Area G: Lower left - Room 8 Upper left - Room 5
Lower right - Room 7 Middle right - Room 2

PLATE 2 - AREA F



General View

Carnelian bead

Lunate

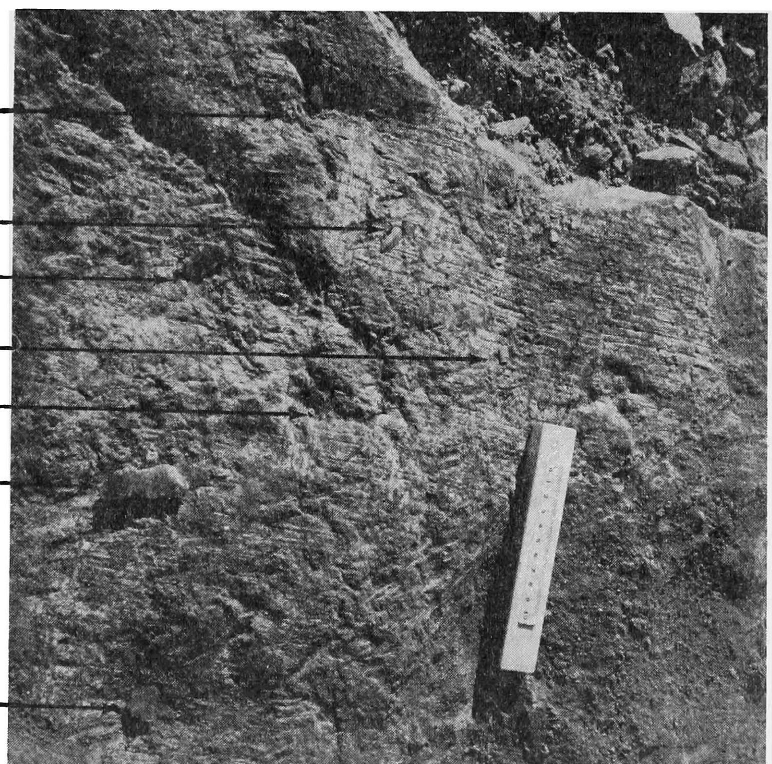
Blade

Blade fragment

Turquoise bead

Crested blade

Coarse Ware Sherd



Room 7 - Floor with mat impression

perforated top and bottom with two parallel rows of thumb-size holes. The longer the brick, the more holes it has. For example in room 10, north wall series, a brick 70 cm in length, 8 holes; 52 cm in length, 6 holes; 38 cm in length, 4 holes. House D is unique in that its walls are all a single brick in width. The walls of Houses F and G are, by House D standards, of double, even triple, thickness. Since these walls were left with the plaster intact we have virtually no information on the construction of thick walls in Houses F and G. Only in the case of House F, rooms 8-9, east wall, where some over-zealous pick work exposed a very small portion of a double row of bricks, do we have evidence of the method of thick wall construction.

Houses D, F, and G were all built on relatively level patches of ground. The material of the underlying substratum is different for each house. House D lies on virtually sterile (and possibly alluvial) sands and silts. House G rests on a sandy, garbage-laden layer with a midden type intensity of artifacts and refuse. House F was built over the remnants of an earlier house. The excellent preservation of each of these houses and the predominance of wall rubble in the fill suggests that they were partially destroyed, filled and leveled to create a suitable surface for another building. The mud bricks were set on the ground without any special foundation preparation. The bottom course of bricks in House D had no bonding holes on the underside. It appears that first the major walls were formed and then the smaller walls and doorways were built within the larger spaces. This is especially clear in House D, where the major outside walls and large room axis of symmetries are nicely aligned, while the smaller rooms are less orderly in appearance. The same slightly skewed appearance is also observable in the House F smaller rooms.

In each of the houses there is a fairly elaborate system of buttresses. (Because the excavations were limited entirely, in the cases of Houses F and G, to the insides of the structures, our information is biased in the favor of interior buttresses.) The buttresses are built of mud brick, stacked and plastered against the walls. In lieu of sound evidence to the contrary I think it most reasonable to assume that these buttresses functioned structurally -- i.e., they helped to support large roof beams or reinforce walls, or both. We lack information about wall height, wall slope, corner bonding, and roof construction that would help us confirm this judgement. For the time being we would argue that a structural purpose is best indicated by the regular alignment and spacing of these buttresses in relation to each other and to other walls. Houses F and G provide the clearest examples of this kind of pattern. House D is almost devoid of internal buttresses except in the very large room 15. However the set of small doorway walls in rooms 3-8 could have served the same purpose as buttresses. The external buttresses of House D were more substantial than any of the internal buttresses from any of the houses. This may reflect either the greater wall weight or major beams which they had to support; however since it is by no means apparent just what these buttresses were supporting, this remains pure conjecture.

Data on roofing materials is minimal, there being one recognizable roof fragment from the fill of House F, and some sizable charcoal lumps from House G, rooms 2 and 12,which might possibly be roof beams. Even if these charcoal fragments are not roofing material we have an idea of the minimum size lumber available for such purposes. The roofing fragment from House F was a fist-sized lump of chaff-tempered mud with three parallel impressions of cane or small branches, 1-2 cm in diameter. The charcoal in House G contained pieces up to 10 cm in diameter. The wood is yet to be identified. The distances between walls in the larger rooms and the lack of internal columns would seem to demand a more formidable framework than the small sticks in our lump of clay.[1] Very

1 See Caldwell and Sarraf, this volume.

tentatively, then, we would reconstruct a roof of medium size timbers, overlaid by a wattle and daub type of cover. We also suspect that the roofs were sloped to reduce the risk of collapse from the winter snow load.

Walls were plastered with the same kind of chaff-tempered mud used in the bricks and mortar. The houses were coated inside and out, and in a few cases (especially House D), they were replastered several times. Some internal walls were "painted" or smeared with a red ochre wash or powder.[1] In those rooms that have well-defined floors, the lowest floor was built up against the bottom course of bricks and rests on the same soil as the bricks. In most cases the wall plaster is feathered-out onto the floor. Subsequently accumulated or constructed floors were packed up against the older plaster surface unless a new plaster was added, as in House D, rooms 1, 2, and 12. Floors are made of two distinctly different materials. One kind, the initial floor in the majority of rooms, is a fine, silty clay. These floors, which I will call "prepared clay floors," range from 2 to 12 cm in thickness. Rarely, there is some internal stratification -- (House G, room 1; House F, rooms 7 and 10; House D, rooms 2 and 12). In these few cases the levels are recognizable only by virtue of the presence of thin lenses or red ochre and very rarely, traces of hassir (reed) matting. The most completely preserved hassir mat, House F, room 7, was irregularly covered with red ochre in a fashion suggesting broadcast sprinkling rather than a systematic rubbing or painting application method.

The other kind of floor, which I will call "Yellow and Brown Floor," is rarely the initial floor. (House D, rooms 3-8 are the only examples at hand). These floors range in thickness from a thin film to 8 cm. Until we have a thorough sedimentological and chemical analysis of these floors the actual constituents will remain somewhat a puzzle. For the present we can note the following: the colors are quite bright, most frequently a yellow to light umber brown, but also including a greenish-yellow and dark brown. The material is lighter weight than any of the other building or occupational materials at the site. The mineral content is basically clay, particle size. Yet the greater bulk of the substance is probably organic. Indeed in House G there is transition, between rooms 2 and 5, from a normal yellow and brown floor to a completely blackened and carbonized floor. There is one other obvious ingredient in these yellow and brown floors, that being a finely textured white substance which appears both as small lumps and as a film, often marking the line between floor strata. The white powder is unaffected by vinegar and still remained in the burned floor of House G, room 8 (I will tentatively call it gypsiferous).[2] While I am quite confident that the clay floors are in fact "prepared," I am of two opinions about the status of the yellow and brown floors. They could be the accumulated residue of everyday activities or, like the clay floors, they could have been purposely constructed. The great variability in thickness and the often fine interbedding speaks for a more "natural" kind of deposition. Yet the occasional clear macro-stratigraphy between yellow and brown and/or prepared floors and the uniform color and texture throughout a given room suggests a more planned product.

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1 There is in fact a fairly discrete pattern as to which rooms have red walls and those that are unpainted. For the time being "some" will continue to be used for those constructional features which have a restricted and patterned distribution. The patterns of association of these features will be outlined in the room typology section.

2 The Iblis III period yielded a gypsum-burning furnace. See Chase, Caldwell, and Fehervari this Volume.

We can only hope that the soil analysis will provide a more definite clue to the process of deposition.

This discussion of floors has temporarily led us away from the goal of this section, which is to describe the materials and processes of house construction. We have mentioned ground leveling and the construction of floors, walls, buttresses and roofing. There remain a few internal features to describe. Each of the houses had at least one fireplace (Figs. 9, 12, 16, 18). They are all virtually identical in construction. The original fireplace was a basin scooped into the floor and subfloor. The bottom of the pit was then lined with the familiar chaff-tempered mud, which was baked to a hard, red-orange surface by a fire or fires. Subsequent layers of fired plaster and burned trashy fill alternated until floor level was reached. The fireplace in House F, room 7 was a bit more elaborate than the other examples, there being a clay rim which served to expand the basin above floor level.

House D contained a number of puzzling mud brick and plaster features. No doubt, part of our confusion arises from the fact that in many cases the extreme lowness of the preserved walls and features permitted only an ankle or toe-high view of these structures. As indicated in the floor plan (Fig. 9), the feature was built of both fired and unfired bricks (which are in all respects identical to the bricks used in the walling). The occurrence of fired bricks in these houses and at this time level is unusual, yet their casual inclusion in this feature with unfired brick and the absence of completely fired brick elsewhere does not suggest that these bricks were being fired in quantity or to any particular purpose. The original height of the feature is unknown, it being preserved to the remaining wall height of the room to about 20 cm maximum. My guess is that it was a fairly low bench or platform. The crenelations were apparently of some significance, for at least one was replastered. The floor continued around the feature into what would have been an almost inaccessible corner (if the structure had been of any great height). House D, room 1,had a single plastered-over brick placed against the west wall. This brick was partially fired on its south-facing side yet the plaster itself was unburned, so that we do not seem to have here another kind of fireplace structure. House D, room 14 contained two bricks neatly placed against the wall about 25 cm apart. They were covered with the same layer of plaster which was initially applied to the wall. Again this feature is not an oven or fireplace structure and thus remains a puzzle. House F, room 10,contained a probable feature. This appeared as a slightly undulating projection built against the east wall. It was built at the same time as the first clay floor and like the other walls in the room, it had been smeared with red ochre. This is certainly a meagre repertoire of internal features when compared, say, with Area B and with other early southwest Asian architecture, but we remind the reader that in most cases wall height was very low indeed.

The picture of house construction given here is still incomplete for there are indications that these houses were subject to continued alterations. House D has a walled-in doorway between rooms 2 and 3. It is also not unlikely that room 2 was built at a later time than the rest of the house if one considers the relative floor heights (Fig. 10). House F had at least two walled-in doorways and a partition wall built following the original construction of the house. House G also contained two walled-in doorways.[1] That these houses were lived in for some lengths of time is evidenced not only in the addition of walled-in doorways and partition walls, but also in the presence of multiple floor levels

1 It is no doubt quite possible that these re-orderings of living space reflect reorganizations of social groups, but with our present knowledge this hypothesis is not amenable to testing.

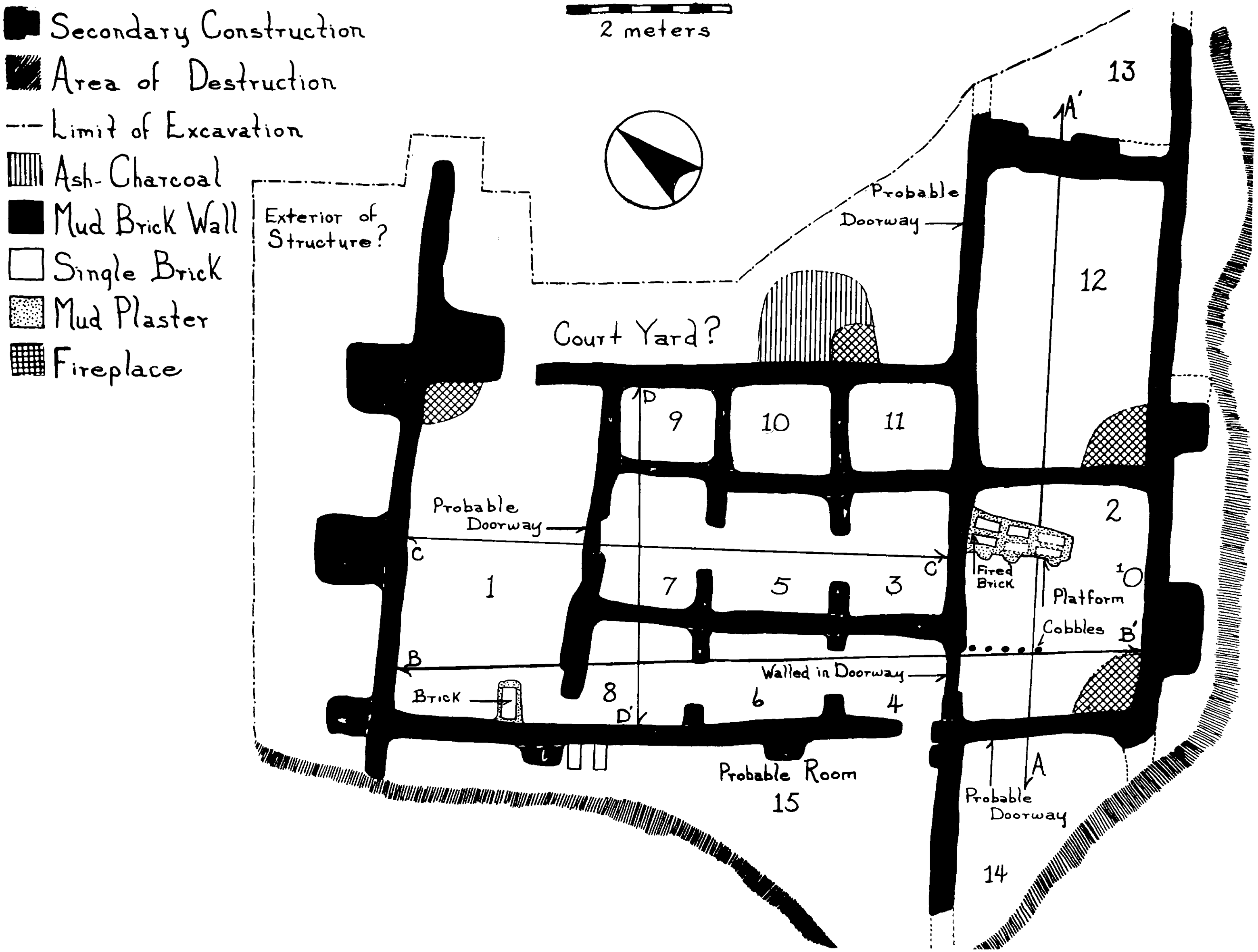


FIGURE 9. - AREA D FLOOR PLAN

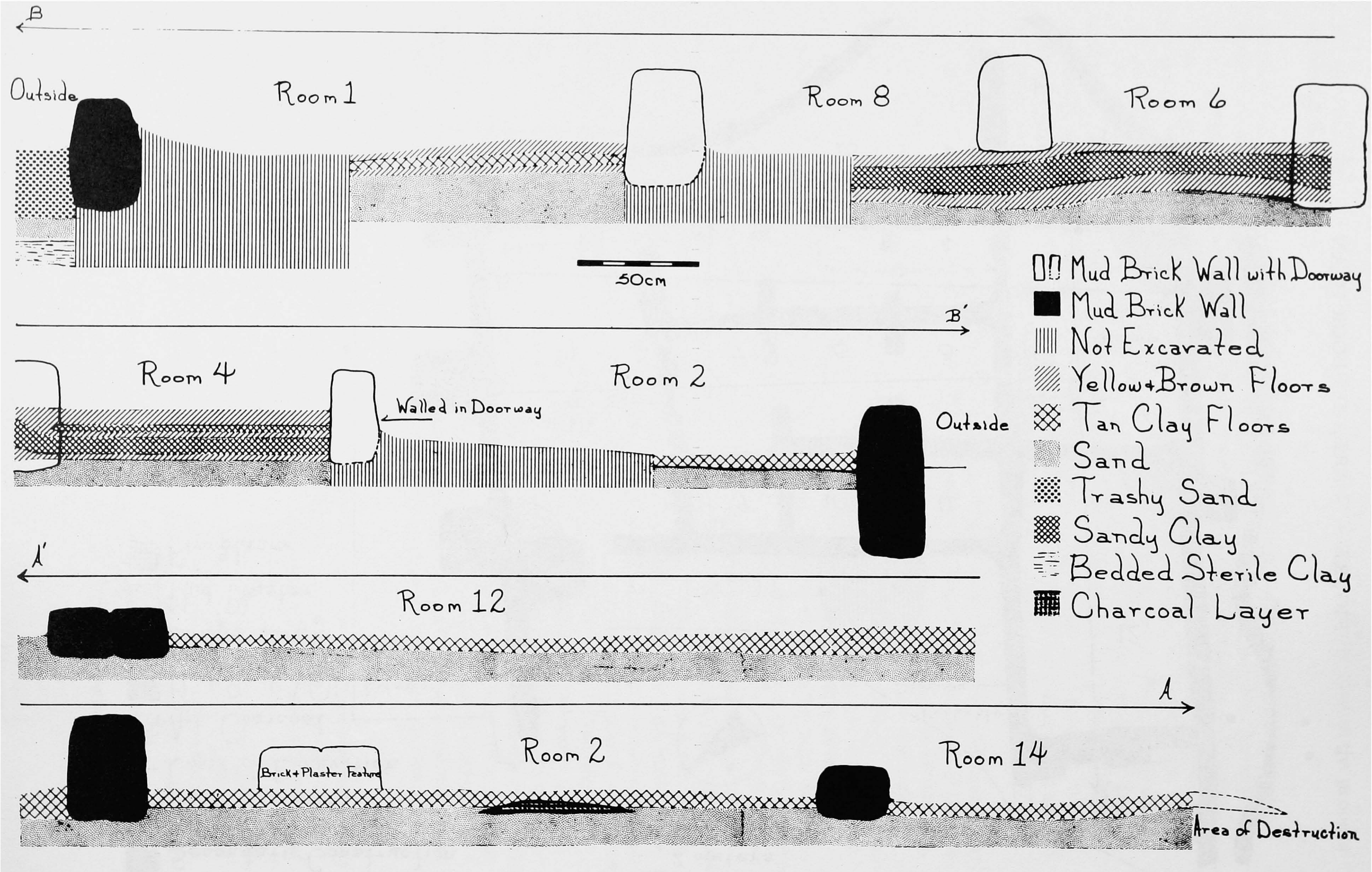


FIGURE 10 - AREA D PROFILES

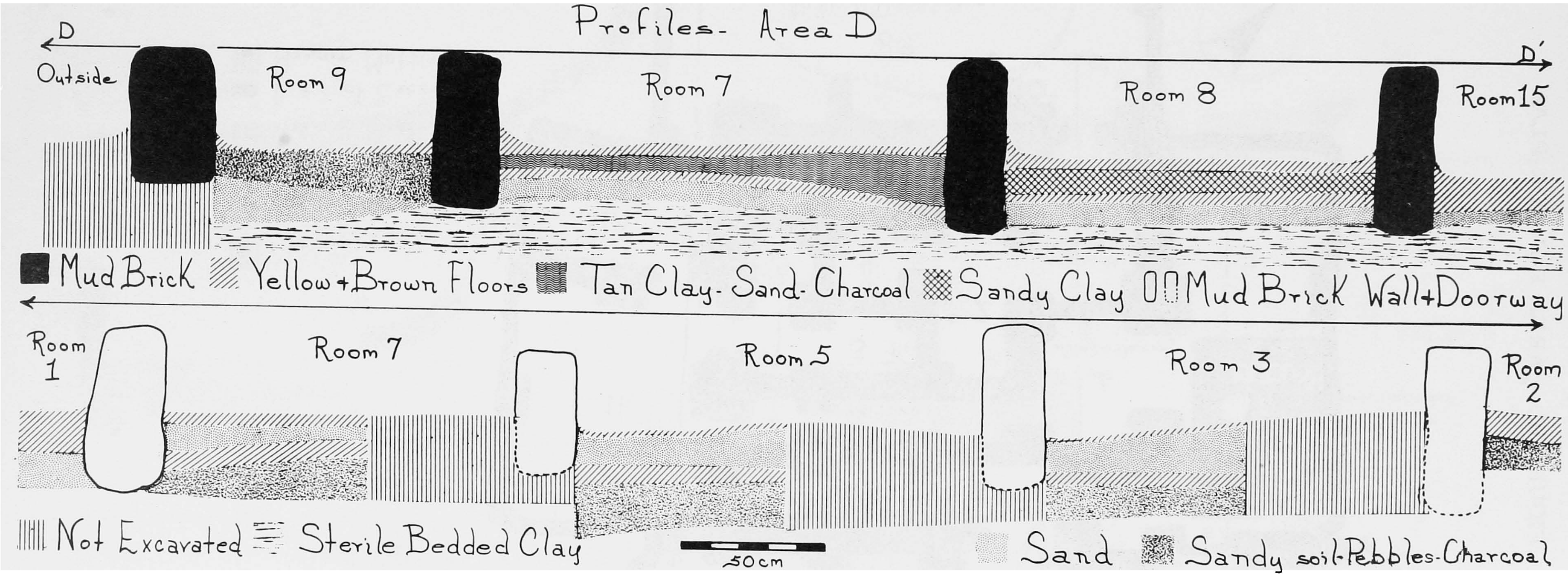


FIGURE 11 - AREA D PROFILES

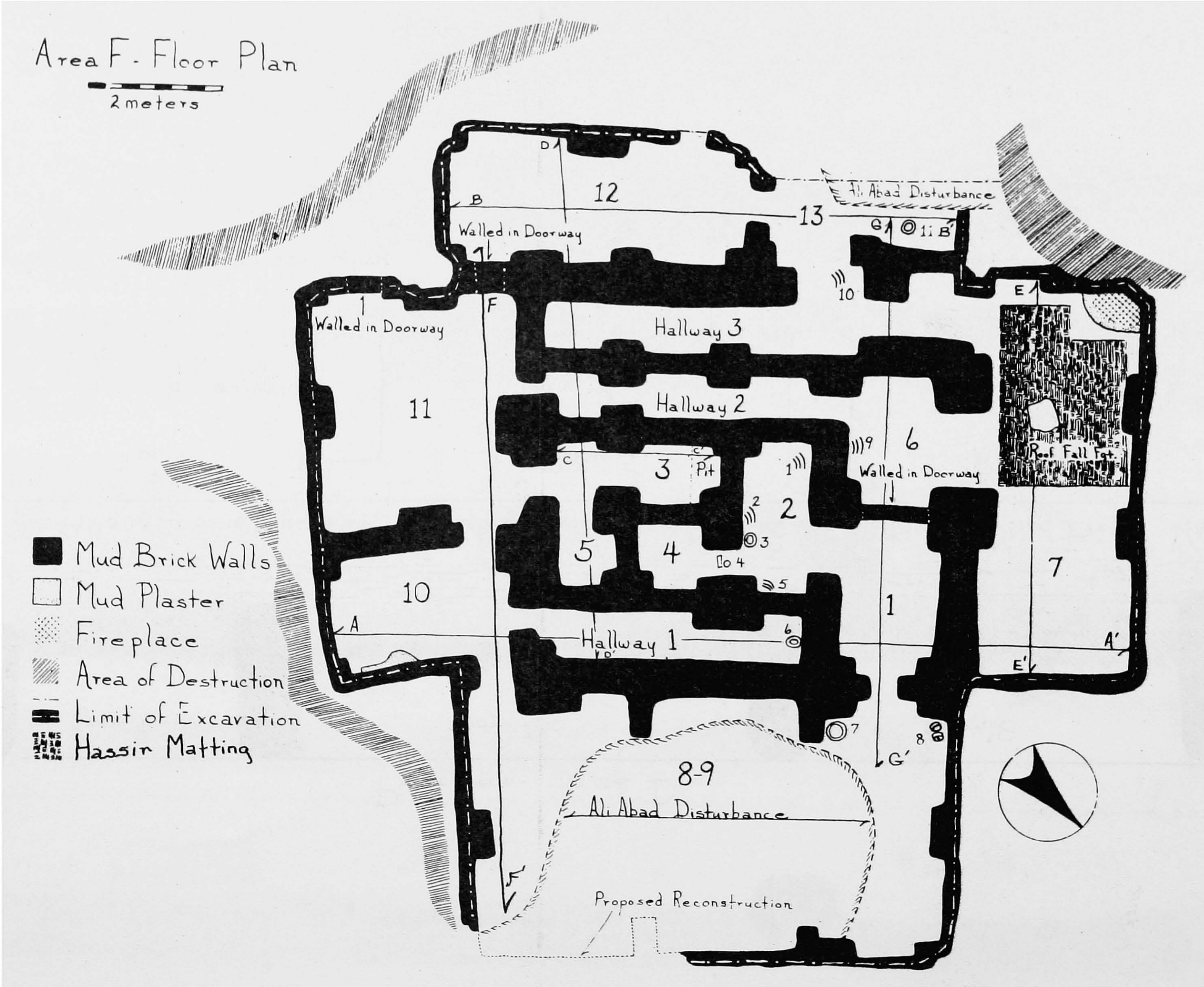


FIGURE 12. - AREA F FLOOR PLAN

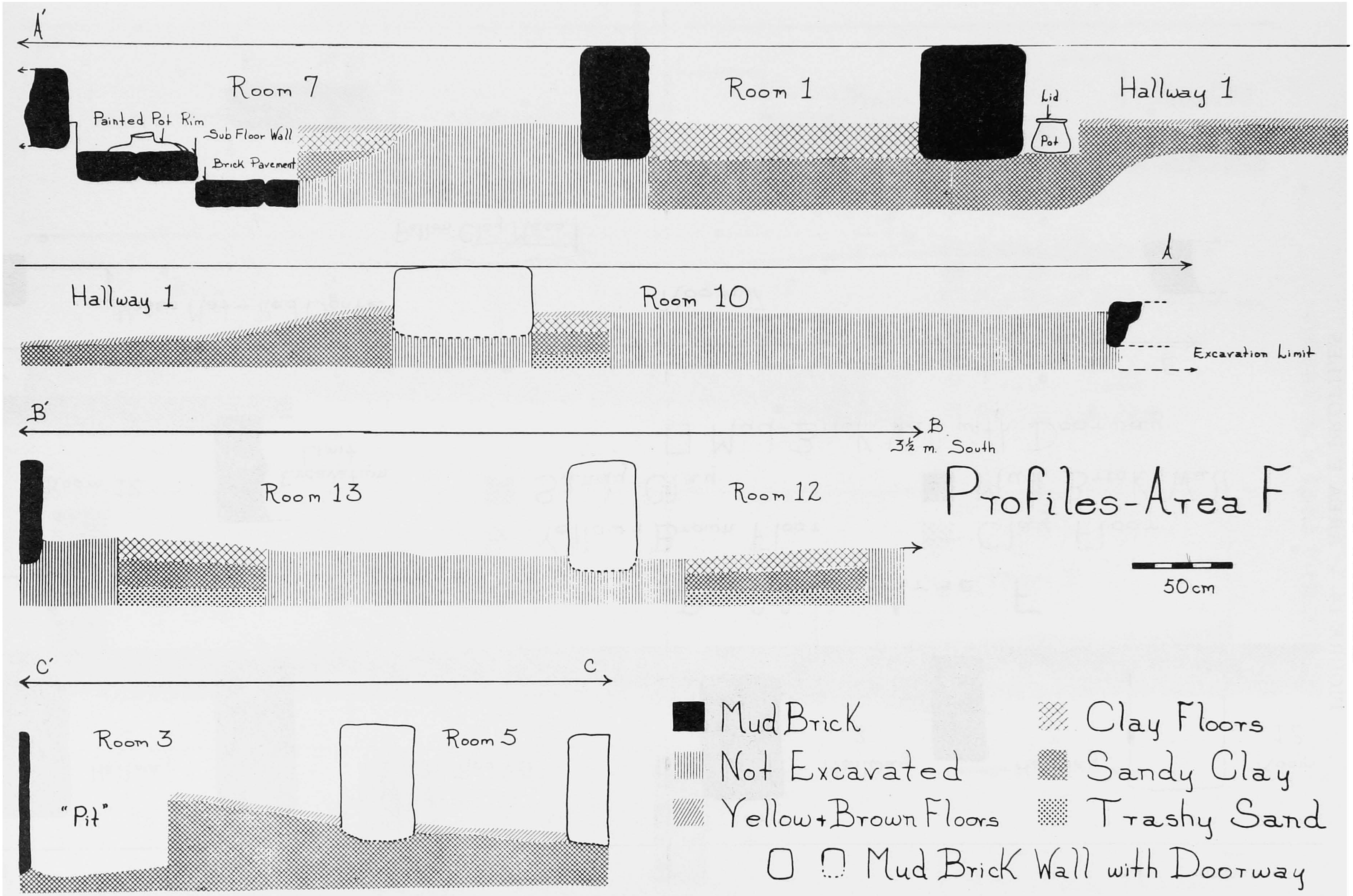


FIGURE 13 - AREA F PROFILES

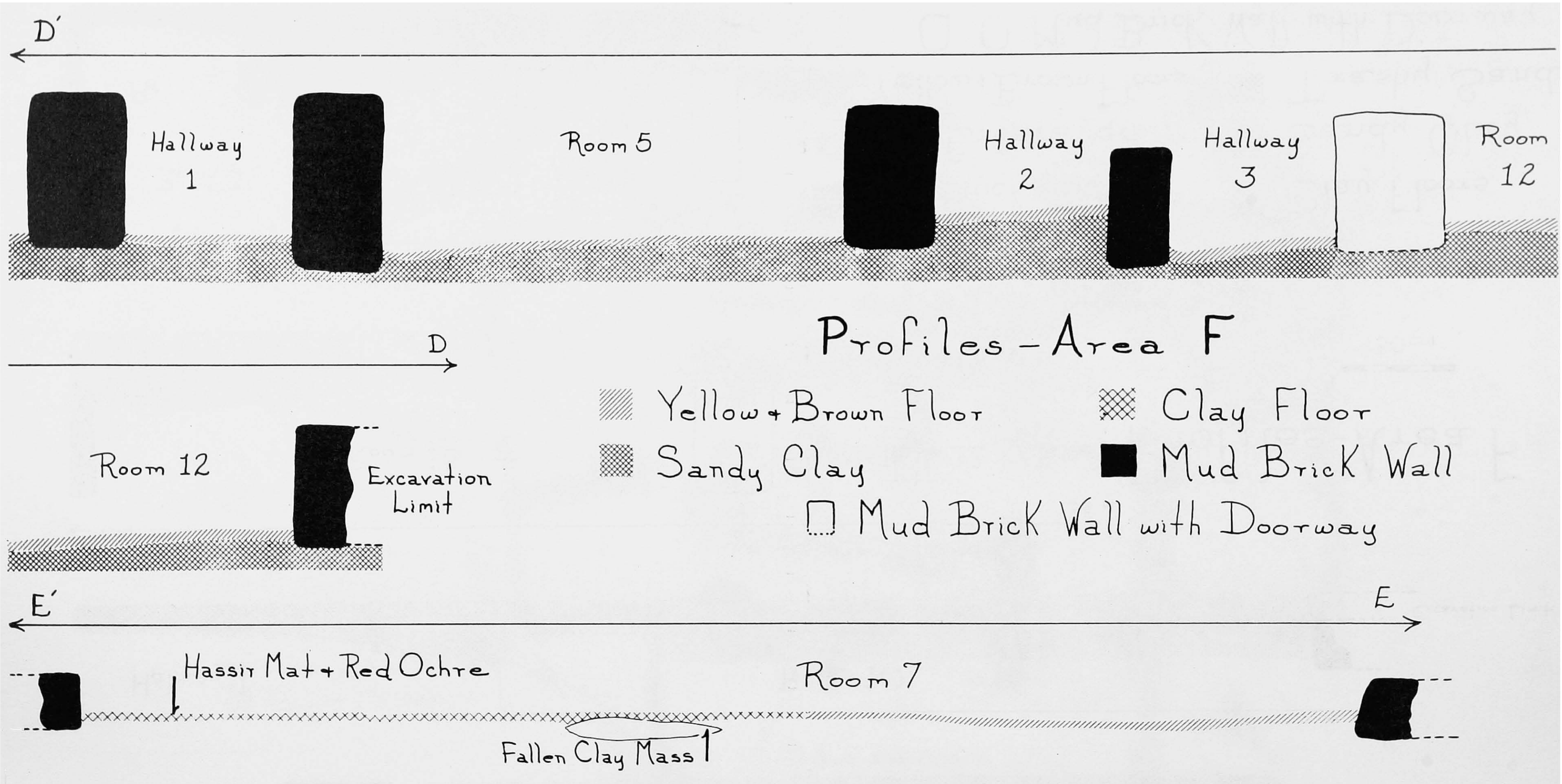


FIGURE 14 - AREA F PROFILES

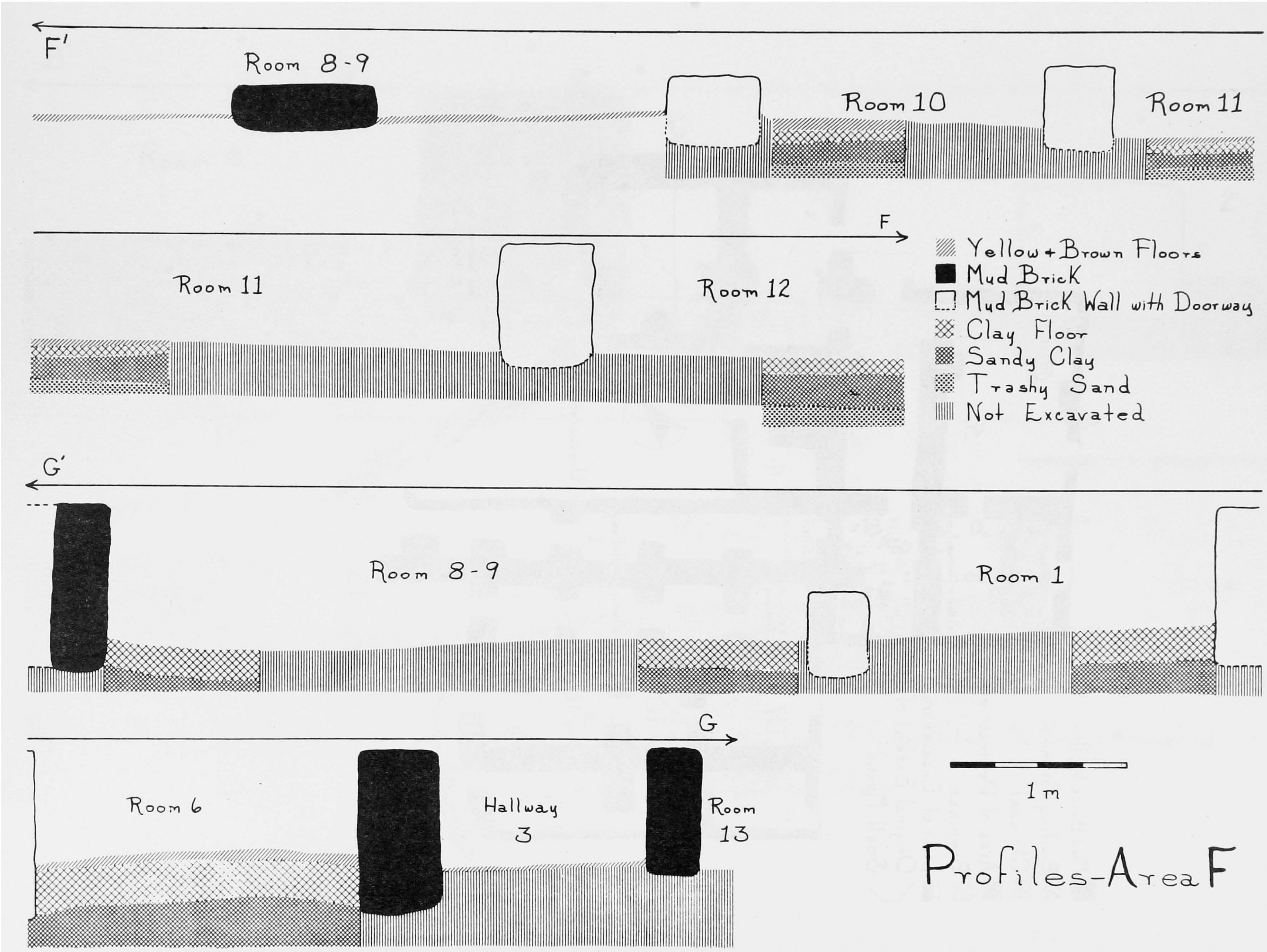
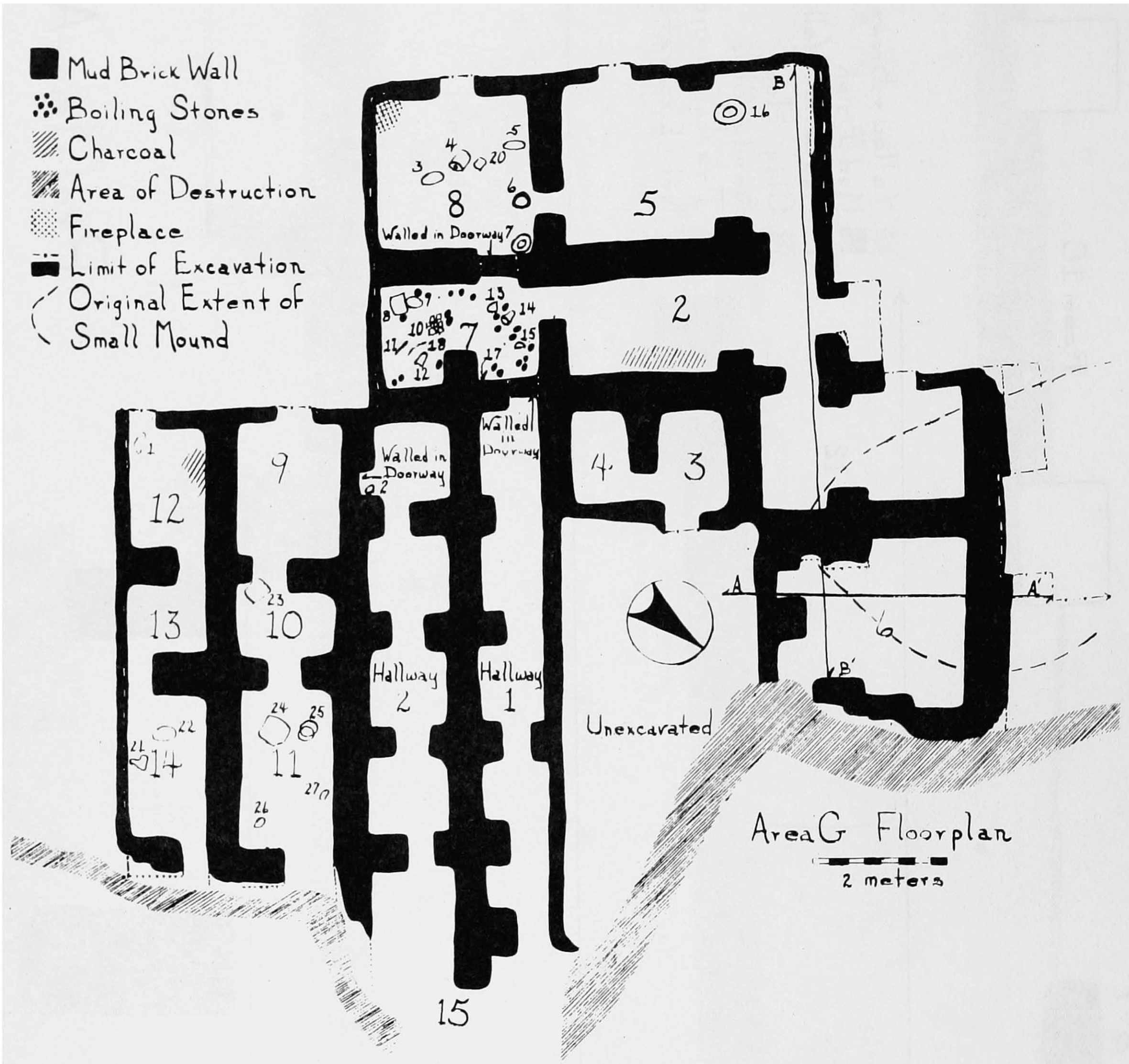


FIGURE 15. - AREA F PROFILES

FIGURE 16. - AREA G FLOOR PLAN



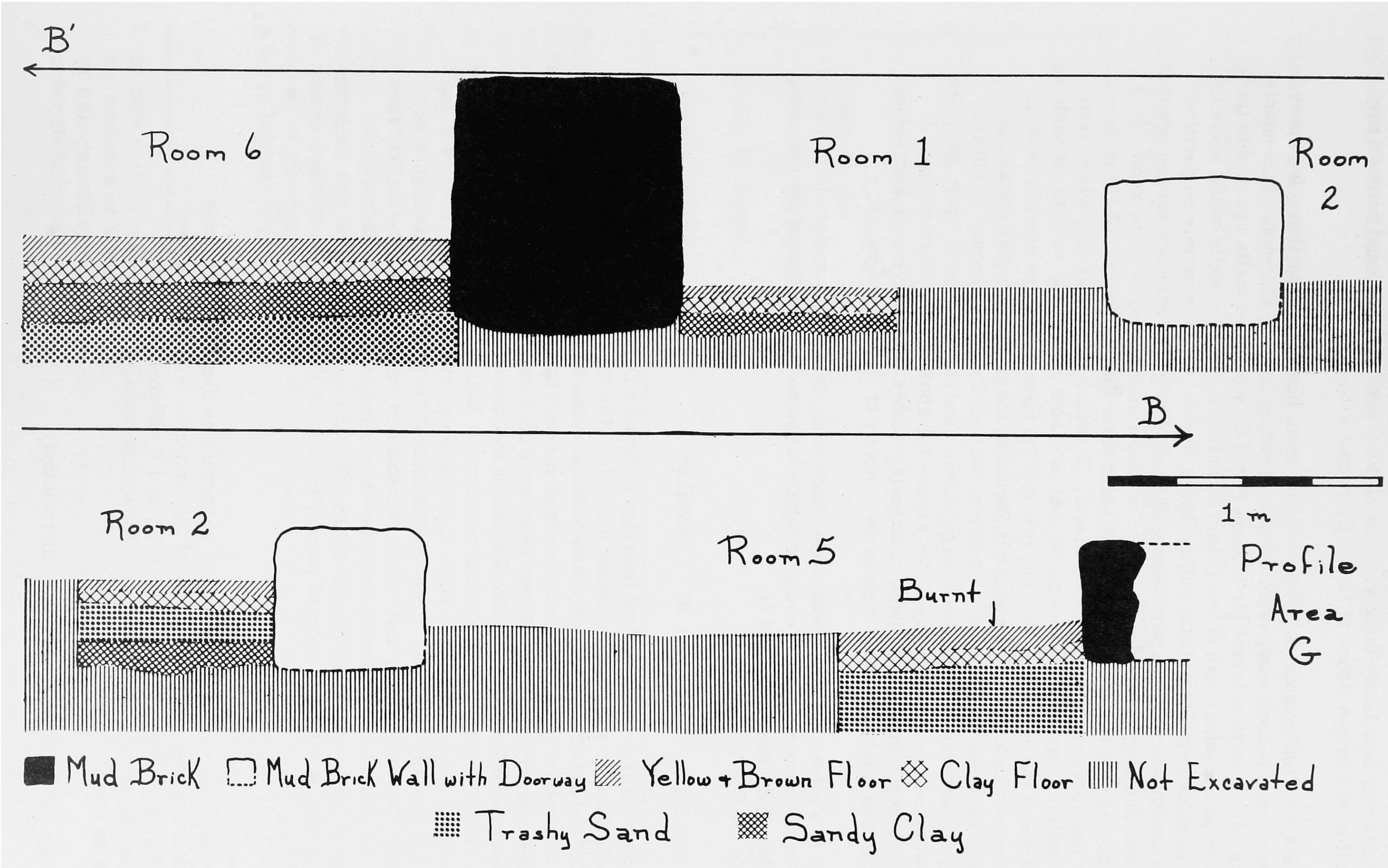


FIGURE 17. - AREA G PROFILE

of each house. House D presents the most complex set of floors, including alterations between yellow and brown floors, prepared clay floors and apparent temporary abandonment. At least this is a likely interpretation of the layer of sterile sand between two levels of yellow and brown floors in House D, rooms 3-8.

There remain two further sources of speculation about house construction. It is possible that there was a second story of an open air working area on the roof. This possibility seems particularly relevant for Houses F and G, where the walls are double thickness even though the small size of the rooms and closeness of the walls would seem to negate the need for such formidable walls. Unfortunately there is simply no positive evidence to support this logical possibility. By way of negative evidence we can add that in no case was anything resembling a ladder or step remnants found in the rooms (e.g., no post holes, no patterns on the walls). We also know that in the case of House D one could enter and leave the house at ground level. It seems likely that only when considerably higher walls, more roofing materials, and an entire house have been found shall we be able to answer the question of one vs. two-storied houses. There are alternate explanations for our lack of roofing materials including the possibility that some of the larger rooms were not roofed at all. However, we feel that the presence of internal buttresses, the general narrowness of large rooms, and the absence of finely laminated water deposited sediments on living floors argues for roofing over these rooms. It seems likely that the dry climate habit of re-using timber would have been carried on at Tal-i-Iblis and might also help explain the scarcity of roofing fragments.

This brings to a close the initial descriptive section on the building materials and architecture. We will next review the evidence which bears on the problem of the chronological positions of Houses D, F, and G.

Part III - Chronology

In our attempts to give chronological bearings to Houses D, F, and G we have at our disposal both absolute and relative dating methods. The absolute method refers to a series of C^{14} dates. The relative method is devoted almost entirely to a comparison of cultural materials. There were a number of reasons for considering the three houses to be roughly contemporary: all sherds on house floors were of the Bard Sir complex, that is, Iblis I period, and yet we also felt that some of the differences in architecture and sherd content might be chronological in nature.[1] Initially it was thought that House D was the oldest house of the three since it rested on sterile soil, while Houses F and G sat on artifact bearing deposits. House D was also of "simpler" construction, i.e., built of single thickness walls, and further it contained the most deeply stratified floors. To help answer our chronological queries we did a straightforward seriation of the sherds from the fills and floors of each house. We had reason to believe that Lalehzar Coarse ware was the oldest variety of pottery present in these areas.[2] We then made

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1 For the time being we will suspend our reservations that the differences in artifacts express only chronological differences. As of yet we have no convincing evidence that Houses D, F, and G differed in terms of economic activities or that the former inhabitants occupied diverse statuses or roles.

2 See Chase, Caldwell and Fehérvári, this volume.

the assumption that the greater the amount of Lalehzar Coarse ware on any floor or in any fill, then the older that floor or fill.[1] Ordering in this manner produced the following result, here checked against available radiocarbon determinations.

TABLE 8 - Chronological Ordering of the Floors and Fills of Houses D, F, and G According to Percentages of Lalehzar Coarse Ware

	Excavation Areas	Percent of Lalehzar Coarse Ware	C^{14} Determination 5730 Half-life
↑	House G: upper floor remnant	56.2	
	House F: fill	89.5	
"Later"	House D: upper black fill	89.8	
	House G: fill	90.9	
	House G: floors	96.0	4441 ± 130 B.C. (GX-869)
	House D: fill	96.8	
"Older"	House D: fill N. and E. of rooms	97.0	
	House F: floors	97.1	4003±160 B.C. (GX-863)
	House D: floors	99.6	3931 ± 160 B.C. (GX-866)

House D came out the "oldest," followed by Houses F and G respectively, but sad to tell, the C^{14} dates set the houses in precisely the reverse order. Since one cannot believe too firmly in either seriation or the absolute accuracy of radiocarbon dating we will suspend judgements on the matter of the delicate chronological relationships of these houses.

One of the prime considerations in attributing contemporaneity of these houses was their common orientation of walls. It seems likely that the houses were once part of larger, possibly "planned" settlement. As already mentioned, there was no overlying stratigraphy, but the greatest absolute difference in house floor depth between any of the rooms in any of the houses was 45 cm. Since the layer of clay rubble in the central part of the mound is fairly level the closeness in house floor heights is probably a fairly reliable indicator of relative age.

1 In view of the small size of our sample we decided against using either the presence or absence, or the differing frequencies of the Bard Sir or Iblis painted types or the items in the small artifact category to order these houses in time.

We decided against using the sherds and small artifacts in delineating the relative chronological positions of the three houses. However it is apparent in our treatment of this problem that we have regarded the houses as close in time. A glance at Tables 1, 2, 3, and 4 serves to illustrate the high percentage of artifactual forms which these houses share in common. In addition there are similarities in the architecture which I have mentioned, (and there are others to be described in Part IV), which argue for an approximate contemporaneity of these houses.

Houses D, F, and G also appear to belong together chronologically when they are compared to the other artifact inventories from the rest of Tal-i-Iblis. Bard Sir wares (Iblis I) were the most frequent of the fine wares in the fills of Houses D, F, and G, and although the number is very small, Bard Sir styles were the only fine ware found on house floors. On the basis of present knowledge of the stratigraphic changes in ceramic styles at Tal-i-Iblis, the placement of Houses D, F, and G in the Bard Sir period is the only acceptable choice.

By this point I hope the reader has gained some sense of the kinds of artifacts and architectual materials and procedures from areas D, F, and G. In Part IV we try to integrate some of this data in an attempt to define the nature of the houses in question.

Part IV - Room Types, Room Functions, and House Plans

In this section I will try to integrate the architectual and artifactual data in an attempt to develop a picture of Houses D, F, and G as a result of once functioning systems of behavior. Such an effort seems feasible for several reasons. The combined total number of rooms from Houses D, F, and G is 49. By most archaeological standards this is a fairly sizable sample of rooms, and even more important it is a large enough sample to allow for the use of simple statistical descriptive and analytical procedures. The decision to treat all the rooms as if they came from the same population was not only influenced by the need for as large a sample as possible but also by the fact that on visual inspection these houses appeared to share both common rooms types and a generalized floor plan. Further, our field judgement that these houses were broadly contemporary has received some support from a more detailed consideration of the evidence.

Our efforts at reconstruction are confronted by two major obstacles. A glance at the floor plans of Houses D, F, and G will show that none of these houses is complete. This is due in part to the previous destruction wrought by the fertilizer miners and partly due to incomplete excavation. The incomplete excavation of Houses F and G simply reflects our lack of time as we abandoned House F and sought to find the limits of House G in the last few days of digging. The other factor for which we can blame neither the fertilizer miners nor ourselves is the distressing paucity of in situ artifactual materials on house floors. It seems that the early inhabitants of Iblis were fairly tidy housekeepers; a fact which we can only bemoan at this point.

Our reconstruction will proceed in three stages of description and analysis. First we will describe the differences in our room sample as reflected in the differences in distributions among these rooms of architectual features (yellow and brown floors, prepared clay floors, red floors, red walls, brick and plaster features, and fireplaces), room size, and room shape. Formal room types will be defined with regard to the patterns of distribution and association of these features and the metric variables. In the framework of our methodology any such room types must tentatively be treated as if they were "real" -- that is, these types are assumed to represent (as best we can determine), the basic units which were combined to form an early Iblis house. Because our artifact yield from house floors is uneven and scanty we will not be able to use the differential distributions of these items in creating the formal room typology. However, some of the rooms contain fairly abundant and/or suggestive material. Thus we will attempt, by a series of tenuous inferences, to delineate the associations of certain activities with certain room types and hence to expand the room typology to include room functions. After this step is completed we will be able to discuss the floor plans of Houses D, F, and G as patterned structures composed of discrete and diverse parts. It follows from our treatment of rooms that we can describe any given house in terms of either the arrangement of formal room types or as a network of functionally specific rooms, depending on how far we care to stretch inferences. Let us now turn to the analysis.

It is clear that in our conception of a "room", we regard rooms primarily as activity spaces. Taking this point of view quite literally we first ordered the room sample as to approximate available floor space (room size). Room size expressed in square meters is of course a continuous variable and we could have possibly gotten a distribution of room sizes which approximated a normal curve. However the actual distribution of room sizes appears as a very skewed curve with several discontinuities and small clusters, and we decided to make the initial divisions in the room sample on the basis of what we felt to be minor modal tendencies in the distribution. The preliminary room types, sorted by floor space are as follows:

TABLE 9

1.	very small	.90	2.47 sq m
2.	small	3.25	3.92 sq m
3.	medium	4.48	6.67 sq m
4.	large	8.12	11.40 sq m
5.	very large	24.00	28.28 sq m

The rooms also showed considerable variety of room shapes. The reasons for some of the variations on room shape will be discussed shortly; now we are concerned with the kinds of shapes present in the sample. Room shape was calculated as a length:width ratio. The various ratios were then plotted on a bar graph, and, as with the room sizes, it seems possible to sub-divide the rooms into minor modal types (Table 12). The types of room shapes are as follows:

TABLE 10

1.	1.00:1.00	1.39:1.00	Symbol A
2.	1.40:1.00	1.59:1.00	B
3.	1.70:1.00	1.99:1.00	C
4.	2.00:1.00 and above		D

TABLE 11 - Room Size (in square meters)

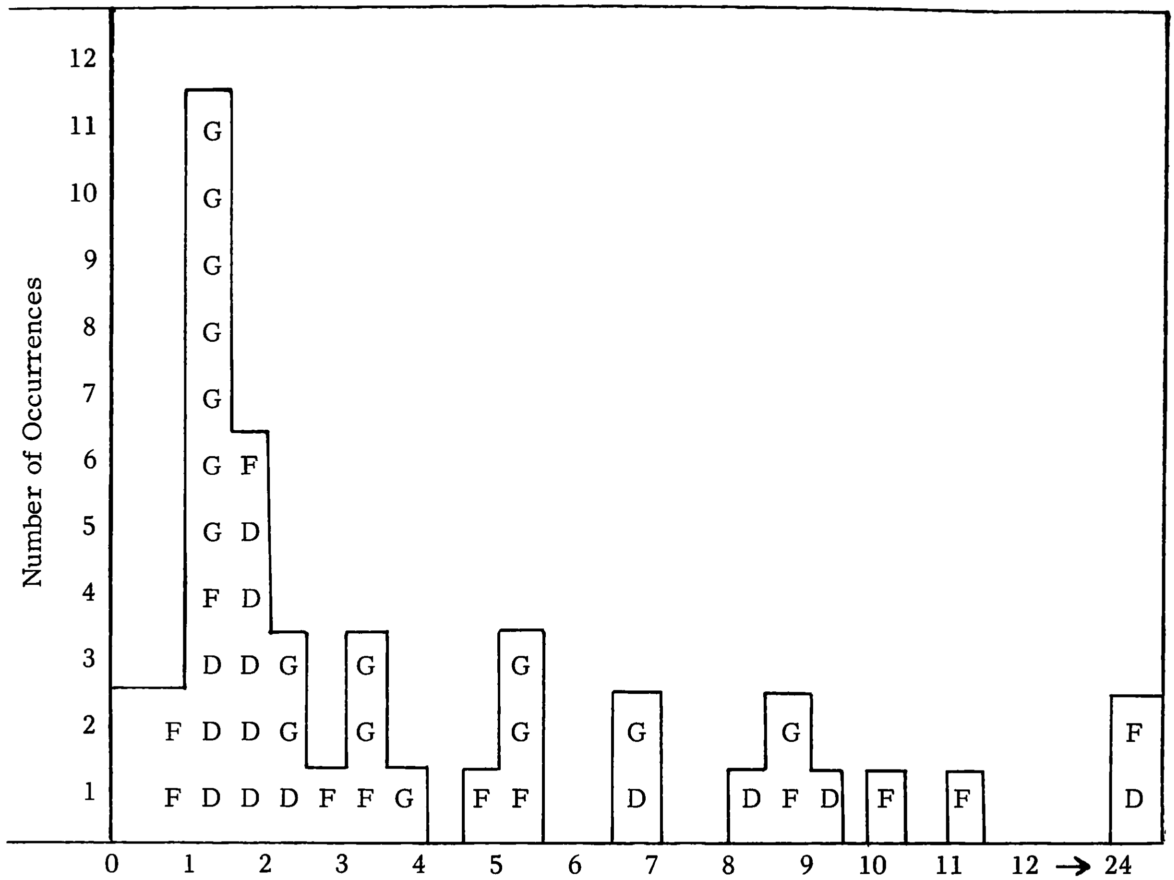
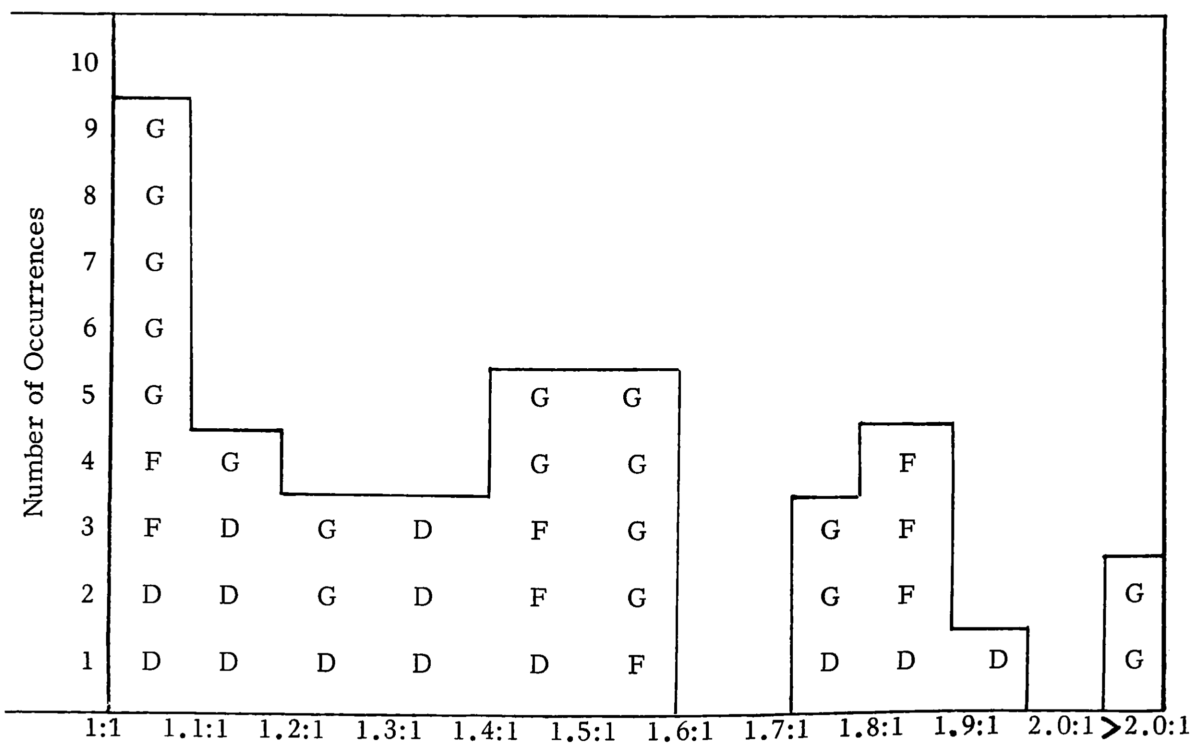


TABLE 12 Room Shape (length to width ratios)



Visual inspection suggested at least one of the following relationships between room size and room shape might hold true: 1. As room size increases there is a tendency for room shape to become more elongated; 2. Smaller rooms tend to be more square while bigger rooms show great variation in room shape. To test these possible relationships, a series of Chi square tests for independence and Phi coefficient tests for correlation were run on the following combinations of room size and room shapes:[1]

TABLE 13 Chi Square and Phi Coefficient Tests of Room Sizes and Shapes

1

Room Size	Room Shape: A	B, C, D	
very small and small	15	13	28
larger	4	8	12
ϕ = .19; X^2 = 1.37	19	21	40

2

Room Size	Room Shape: A	B, C, D	
very small and small	14	8	22
larger	5	13	18
ϕ = .25; (X^2 = 5.09)	19	21	40

3

Room Size	Room Shape: A, B,	C, D	
very small and small	25	3	28
larger	6	6	12
ϕ = .30	31	9	40

4

Room Size	Room Shape: A, B	C, D	
very small and small	21	1	22
larger	10	8	18
(ϕ = .47)	31	9	40

3a.

Room Size	Room Shape: A, B	C, D	
	17	11	28
	6	6	12
X^2 = .78	23	17	40

4a.

Room Size	Room Shape: A, B	C, D	
	18	4	22
	10	8	18
(X^2 = 3.08)	28	12	40

1 The reader is referred to Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences, New York, McGraw Hill, 1956, for a discussion of these tests.

Table 13: 3 and 4 had to be reordered to allow for valid X^2 tests (the expected frequency in some boxes was 5 or less, which nullified the utility of the tests). Thus Table 13: 3a and 4a represent less extreme cases than the actual samples. Even so, 4a still produced a X^2 value with a level of significance between .10 and .20 and therefore I have bracketed that value. They all show a strong tendency for the smaller rooms to be square, and to a lesser degree, 1 and 2, for larger rooms to be rectangular. Boxes 3 and 4 illustrate the tendency for larger rooms to encompass a greater range of sizes than smaller rooms, but without a strong tendency for either particularly square or particularly rectangular shapes.

The results of these tests all point with varying degrees of strength towards the acceptance of a non-random distribution and of a positive association of different room size and different room shape. The reasons for this are by no means self-evident. The tendency for larger rooms to be narrow seems to reflect the architectual layout, (large rooms often span the combined length of two or more smaller rooms), and possibly the engineering limitations of roof construction where either the proper techniques and/or the necessary lumber were lacking. This is of course pure speculation, and the fact that there are several not so narrow larger rooms would suggest that other factors were at work. That very small rooms should not be proportionally narrow is only reasonable if normal size adults were to fit into these spaces.

This demonstration of the relationship between different room sizes and room shapes is perhaps the least important aspect of the formal room typology, and it is rather the patterns of distribution of the varieties of floors, walls and internal features that provide the most significant sorting criteria in the typological system. By and large the divisions in the typology reflect the mutually exclusive distribution of certain of these architectual variables as they associate with each other and the initial room types based on room size. Table 14, in the form of a Guttman Scalogram, presents the results of the formal room typology. To briefly sum up the results:

1. Very Small Rooms - 23 total, with one exception are all either "A" or "B" shaped. There are 11 rooms with yellow and brown floors; 12 without yellow and brown floors. There are 2 and probably 5 with prepared clay floors which we have designated as a sub-type Very Small Rooms_2, (see discussion below).

2. Small Rooms - 6 total, 3 with yellow and brown floors and 3 without yellow and brown floors, all with prepared clay floors.

3. Medium-large Rooms - 12 total, 10 with yellow and brown floors, 2 without yellow and brown floors. All with prepared clay floors, all with red floors. 7, possibly 10, with red walls. 4 with fireplaces, 3 with internal brick and plaster features.

4. Very Large Rooms 2 total. See comments below.

5. Very Narrow, Long Rooms or "Hallways" (not listed in the Guttman Scalogram), 4.5 to 8.5 m in length, .7 to .9 m in width, 3 with traces of yellow and brown floors.

TABLE 14 - Room Types

House & Rm. No.	Room Size	Room Shape L:W Ratio	Room Shape Symbol	Yellow & Brown Floors	Prepared Clay Floors	Red Floors	Red Wall	Internal Feature (brick or plaster)	Fireplace
F, 5	.90		A	+					
F, 4	1.00	1.00:1	A						
D, 9	1.08	1.32:1	A	trace +					
F, 3	1.10	1.42:1	B	+					
G, 13	1.20	1.20:1	A						
G, 4	1.22	1.50:1	B						
D, 4	1.31	1.19:1	A	+					
G, Hall 2a	1.34	1.07:1	A						
G, Hall 2c	1.42	1.02:1	A						
G, Hall 2b	1.44	1.00:1	A						
G, 3	1.45	1.45:1	B						
G, 10	1.45	1.45:1	B						
D, 10	1.47	1.12:1	A						
G, Hall 2d	1.50	1.04:1	A						
F, 2	1.50	1.50:1	B	trace +					
D, 11	1.52	1.12:1	A						
D, 8	1.62	1.02:1	A	+					
D, 6	1.65	1.36:1	A	+					
D, 3	1.87	1.30:1	A	+	(+)*				
D, 7	1.88	1.48:1	B	+	(+)				
G, 12	2.12	1.54:1	B	trace +	+				
D, 5	2.13	1.08:1	A	+	(+)				
G, 14	2.47	1.89:1	C		+				
F, 6	2.54	1.50:1	B	+	+				
G, 9	3.28	1.28:0	A	trace +	+				
F, 1	3.30	1.48:1	B		+				
G, 11	3.36	1.75:1	C		+				
G, 7	3.52	1.56:1	B		+				
G, 2	3.92	1.86:1	C	+	+				
F, 10	4.48	1.86:1	C	+	+	+	+	+	
F, 13	5.04	1.56:1	B	+	+	+			
G, 8	5.06	1.02:1	A		+	+			+
G, 1	5.25	1.71:1	C	+	+	+	+		
G, 6	6.58	1.19:1	A	+	+	+	+		
D, 2	6.67	1.26:1	A	+	+	+	+	+	+

* Provisional - see text for explanation.

TABLE 14 Room Types (Continued)

House & Rm. No.	Room Size	Room Shape L:W Ratio	Room Shape Symbol	Yellow & Brown Floors	Prepared Clay Floors	Red Floors	Red Wall	Internal Feature (brick or plaster)	Fireplace
D, 12	8.12	1.79:1	C		+	+	+		+
F, 12	8.51	2.49:1	D	+	+	+	+		
G, 5	8.64	1.50:1	B	+	+	+	(?)**		
D, 1	9.24	1.91:1	C	+	+	+	(?)	+	+
F, 11	10.24	1.02:1	A	+	+	+	+		(+)***
F, 7	11.40	2.55:1	D	+	+	+	(?)		+
D, 15				+				+	
F,8-9	28.28			+	+	+	+		

** Probable but field notes unclear. *** The S.W. corner of Room 11 was blackened but there was no fireplace in uppermost floor.

The list of room types is largely self-explanatory, but a few additional comments are needed for each category. Very small rooms have been defined on the basis of their shape, and the absence of any other floors, walls, or features. However there is a good deal of internal variability in this type. For instance, we could have divided the rooms into those with yellow and brown floors and those without, but because these floors do not appear to be correlated with either differences in room size or shape within the very small category we decided to let things stand. There are five rooms at the upper limits of the very small room type which we feel probably belong in the small room category. Rooms 12 and 14 from House G, formally resemble in every respect except size the small rooms 9 and 11 from the same House G. The "absence" of prepared clay floors in House D rooms 3, 5, and 7 is a reflection of our earliest stages of observation and recording when we failed to differentiate between solid layers of yellow and brown floors and yellow and brown floors which appeared as thin films on prepared clay floors. We think, if our memory serves us correctly, that the floors in rooms 3, 5, and 7 were of the second variety; however we can not be sure. In sum, with regard to the very small rooms, we feel that the five largest rooms in this category should probably be regarded as small rooms, and we will refer to them as "very small $rooms_2$" in the course of the paper. As the reader will see later there are other reasons for justifying this designation. Most of the members of the small room category come from House G, but if the revised very small $rooms_2$ are considered to belong to this type then representation is much more balanced. The medium-large category combines two of the initial types made on the basis of size alone. When tested with a Fisher Exact Probability Test the differences in the distribution of internal features and fireplaces between medium and large rooms proved not to be significant (i.e., there is a very great probability that the observed distribution could occur by chance). In fact the level of significance was too small to be included in the tables for the test as given in Siegal. Thus we felt obliged to treat medium and large rooms as a single type. Our sample of very large rooms was partially destroyed. Thus it is on the basis of size rather than on the presence of a unique feature or cluster of features that we have isolated this type. There is an obvious sub-division in the long, narrow rooms or "hallways."[1] Some of these rooms

1 Because of their distinctive shape, these rooms were not felt to be typologically discrete and were not included in the table. Indeed because they are so distinctive, it was felt that they might confuse matters if they were figured in with the room size calculations.

lack a doorway at one end. Others are open at both ends and do in fact appear to be something like passageways.

The mention of suggested room functions leads to the next part of the discussion of room types; that is, the expansion of the formal room typology to include a consideration of room functions. We mean by "room function" the use or uses to which a room was put, or in other terms, the activities which were performed in a given room. The activities performed in a given room can only be inferred from the artifacts found on room floors. There are at least two analytical procedures which can be employed in inferring either activities and/or room functions. If one cares to speak of activities then one has to decide on the behaviorial meaning of the artifacts. There is an alternate procedure which need not involve references to the specific use of artifacts. What is necessary is a formal typology of artifacts, and a way of indicating that the patterns of distribution of certain types of artifacts with certain types of rooms are not due to differences in time, or due to chance factors. The most direct way to determine the role of chance in any distribution is the use of statistical tests designed to deal with such problems. In some cases patterns of differential distribution are so clear-cut that statistical tests are unnecessary. If neither variability in time or chance can explain the differences in observed patterns of artifact distribution, then the only reasonable explanation must lie in the culture patterns of the Bard Sir period. We feel certain that the patterns of occurance of certain artifacts reflects the culturally selected areas where these artifacts were either manufactured, used, and/or discarded.

Needless to say the strongest reconstruction of the patterns of room functions involves both of the above mentioned methods of analysis, and we will use both methods where possible. However, we are obliged to be particularly cautious when speaking of rooms as areas for the manufacture, use, and/or discarding of certain artifacts and hence as the loci for certain activities. We are in no way certain of the specific behavior meaning of many of our artifacts and pottery. Nor can we put to good use the abundant negative evidence with which we were blessed. Further, it is clear that the range of materials recovered from the floors of Houses D, F, and G is only a small portion of the total artifact inventory as represented in the fills of these same houses and as recorded from contemporaneous floors in area B and the dumping areas of E and A.[1] Finally, we have no way of directly illuminating indoor activities by contrasting indoor and outdoor artifact areas.

As previously mentioned, artifactual materials in situ on house floors are extremely modest in Houses D, F, and G. However there were some minor disasters -- a fire in House G, rooms 2, 5, 7, and 9, and some premature roof fall in House F, room 7, which trapped a few artifacts before the Iblis folk could carry them away. House F, room 2, also contained a fair amount of material lying on what was interpreted as a kind of accidental floor surface of a very dense, reddish clay, thinly and irregularly spread about the room. Elsewhere, sherds, ground stone and chipped stone rarely occur in sufficient quantities to be of much use in inferring activities. With this list of caveats in mind we can now proceed to suggest, albeit gingerly, some relationships between the formal room types and certain activities.

Table 15, based on the descriptive categories used in section I, lists the total artifactual content of each room. There is an obvious temptation to label all the very

1 See Caldwell and Sarraf for area B, and Chase, Caldwell and Fehérvári for area E, this Volume.

TABLE 15 Artifact Content on Floors

AREA D

Room 1. Medium-large with a fireplace

55 Lalehzar Coarse	3 - used blades	1 poor blade core
1 awl, tip fragment	1 - dubious blade	
	3 - unused blades	
	1 - unused flake	

Room 2. Medium-large with a fireplace

76 - Lalehzar Coarse	1 - lunate	
1 smoothed and red stained metamorphic cobble	2 used blades (1 with sickle sheen)	
	1 - unused blade	
	1 - dubious flake	

Room 3. Very Small[2]

8 Lalehzar Coarse	1 - unused flake	

Room 4. Very Small

17 Lalehzar Coarse	3 - used blades	1 - rind removal flake
1 - small milling stone fragment	1 - dubious blade	
1 - turquoise bead		
1 - white stone bead		

Room 5. Very Small[2]

18 - Lalehzar Coarse		1 - rind removal flake
1 clay bead		1 - crested blade

Room 6. Very Small - empty

Room 7. Very Small[2]

28 - Lalehzar Coarse	1 - lunate	
	1 - used blade	

Room 8. Very Small

104 Lalehzar Coarse	2 - used blades	1 - rind removal flake
1 - steatite bowl, rim fragment	2 - dubious blades	1 - crested blade
1 - clay disk "pot lid"	1 - unused flake	

Rooms 9, 10, and 11 - all Very Small rooms with no doorways -- clean

TABLE 15 Artifact Content on Floors (Continued)

AREA D

Room 12. Medium-large with a fireplace

31 Lalehzar Coarse	1 - lunate blade	2 - blade cores
	6 - used blades	1 - crested blade
	4 dubious blades	

Room 13. Medium-large (incomplete)

42 - Lalehzar Coarse	2 - used blades	
1 - overfired Bard Sir Plain	2 - dubious blades	
	2 unused blades	
1 - pestle	2 - unused flakes	

AREA F

Room 1. Small

1 - turquoise "pebble"	1 - drill blade	
	3 - used blades	
	2 dubious blades	
	1 - unused blade	
	2 - used flakes	
	1 - dubious flake	

Room 2. Very Small

49 Lalehzar Coarse (see floor plan for distribution)	1 - used blade	1 rind removal flake
	3 - dubious blades	1 calcite bowl rim fragment
1 Bard Sir Red Slipped		
1 overfired Bard Sir Red Slipped		
1 "pot lid" shaped from Lalehzar sherd		

Room 7. Medium-large with a fireplace

36 - Lalehzar Coarse	2 drills	1 blade core
1 Bard Sir Painted	2 lunates	2 rind removal flakes
1 Bard Sir Red Slipped	10 - used blades	2 crested blades
1 turquoise bead	5 - dubious blades	1 - platform renewal
1 carnelian bead	4 - unused blades	
1 - awl mid-section fragment	1 - used flake	
	6 - unused flakes	
	1 unused chunk	

Rooms 8-9. Very Large (incomplete)

1 - base to hip of Lalehzar Coarse small base pot	1 complete Lalehzar Coarse drum-shaped pot	

TABLE 15 Artifact Content on Floors (Continued)

AREA F

Hallway 1. (Dead-end)

1 complete narrow-mouthed Lalehzar jar.
(buried in the floor)

AREA G

Room 1. Medium-large

2 shell beads	1 - lunate	2 - cores
2 small sandstone slabs, stained red	1 - drill, with notch	2 - rind removal flakes
	11 used blades	1 - rind removal blade
	6 - dubious blades	

Room 2. Small

39 - Lalehzar Coarse

Rooms 3 and 4. - clean

Room 5. Medium-large

36 Lalehzar Coarse	2 lunates	1 - core
1 Lalehzar Coarse, small base to hip pot	4 used blades	1 - clay animal figurine
2 Bard Sir Painted small	1 dubious flake	1 - clay aurochs [1]
1 sandstone slab stained red	1 unused flake	1 - clay "nail"

Room 7. Small

54 Lalehzar Coarse (including two "cup" fragments)	2 used blades	11 ground stone ax
1 - Bard Sir Painted	1 used flake	1 - pestle
		1 - complete small milling stone
		2 incomplete small milling stones
		2 - possible hammer-stones
		21 - "boiling stones"

1 Paper XIV, Fig.3

TABLE 15 - Artifact Content on Floors (Continued)

AREA G

Room 8. Medium-large with a fireplace

36 - Lalehzar Coarse	4 used blades	1 - rind removal blade
1 - complete Lalehzar Coarse small base pot	4 dubious blades	
1 - base to hip ogee curve pot	2 - retouched flakes (notched; denticulate)	
1 - complete inverted rim pot	3 dubious flakes	
1 "mano"	2 unused chunks	
1 calcite bowl fragment		
2 - complete small milling stones		

Room 9. Small

(record on Lalehzar sherds was lost)	2 lunates	1 - rind removal flake
5 - Bard Sir Painted	2 - used blades	1 - crested blade
	2 dubious blades	
	1 - unused flake	

Room 10. Very Small

1 - large Lalehzar Coarse sherd	1 large unworked sandstone slab

Room 11. Small

11 Lalehzar Coarse	1 - large unworked sandstone slab
2 possible hammer-stones	2 - small milling stones (from a matched set)
	2 possible hammerstones

Room 12. Very Small[2]

17 - Lalehzar Coarse	2 lunates	1 blade core
1 Bard Sir Painted	5 used blades	
1 - sandstone knife	2 dubious blades	
	1 unused flake	
	2 - unused chunks	

Room 13. Very Small clean

Room 14. Very Small[2]

3 large Lalehzar Coarse sherds	1 used blade
1 small milling stone	1 - dubious blade
1 large pestle	1 unused blade
	1 unused chunk

small rooms as "storage rooms." However, as is described in the following paragraph there are differences between the very small rooms which argue against such a function for a good half of the sample. House F, room 2 contained fairly abundant and not too badly broken sherd material from perhaps four or five different Lalehzar Coarse ware small base pots. The sherds were generally concentrated along the walls or in the corners. My impression is that this distribution represents a combination of scattered refuse and pots broken in situ. House F, room 4, contained a pit with three sides defined by the walls of the room and the fourth bricked-in, up to the floor level. Unfortunately the pit was quite free of artifacts or macro-plant remains. The very small rooms of House G were essentially empty -- this is not only a function of the absence of floors but also reflects the lack of materials on the sandy clay underlying the fill. House D, rooms 9-11 were empty and what is perhaps more significant,they were missing doorways. No other small rooms from Houses F or G completely lacked doorways but several were served by a single entrance. More than any other factor this disposition of entrance ways to rooms would seem to speak for a storage type area. The entire floor space would have been available for "storage" without need to provide for a pathway. Furthermore the rooms are almost too small to accommodate an adult. If the negative evidence means anything at this point we would also like to offer that the scarcity of artifacts is indicative of a lack of a more "energetic" (i.e. manufacture or processing) activity being carried out in these rooms with limited access. Large coarse ware pots are not limited to very small rooms but seem to be best suited for use as storage vessels since among other things they seem too bulky and too fragile to be easily carried about and actively used. Thus we tentatively label this sub-type of very small room with limited access as a "storage facility." In doing so there remains a series of very small rooms, some with, and some without yellow and brown floors, for which we have not postulated room functions. Let it suffice for the moment to suggest those very small rooms from House G without floors resemble most the "storage rooms" and that those with the yellow and brown floors from House D are most akin to the small, medium, and large rooms with similar floors.

The most convincing evidence for the function of small rooms comes from area G, in particular room 7. The artifacts and sherds of House G, room 7, are scattered about the floor in no easily definable clusters. The sherds belong primarily to the body and rim sections of two large Lalehzar Coarse ware pots and to a small coarse ware cup or bowl. One small "Bard Sir Painted" rim, a partially ground and partially flaked ax, three pieces of utilized chipped stone, two possible "hammerstones" and a badly burned goat horn core and rib constitute the minor elements in the room. The stone ax and the bone are "unique" finds in the house floors from Houses D, F, and G. However, the artifacts of particular interest in this room are: (1) a large number of "boiling stones" and (2) a good sample of small scale grinding and pulverizing tools. Similar small scale grinding equipment is a fairly common occurrence in the other small rooms of House G (including rooms 11 and 14). These other rooms also contain a sprinkling of large coarse ware sherds and chipped stone. The distribution of small scale grinding tools is not limited to the small rooms, as they occur in medium-large rooms. What is noteworthy about the grinding tools from small rooms is that they lack the red ochre staining so prevalent on similar tools from larger rooms. We tentatively suggest that small rooms are primarily mealing and grinding areas with some auxiliary storage. The curious group of artifacts from House G, room 7, may reflect some other kind of food preparation and/or cooking, quite possibly of meat, but again one can only hazard a guess. In the sample of 12 medium-large rooms, 4, all from House F, were absolutely clean. Of the remaining 8 rooms, House G, room 8; House F, room 7; and House D, rooms 2 and 12 contain the most abundant materials. The contents of House G, room 8 included one complete large Lalehzar Coarse ware small base pot, the bottom of a similar pot, a complete drum shaped coarse ware pot, and two small grinding tools, (one convex, one concave), and a "mano" which was stained with red ochre. There was also a sprinkling of sherds and chipped stone. Although House D, room 2 did not contain milling stones or complete pots, the presence of a smooth, red stained stone of metamorphic rock, and the density of chipped stone and sherds make this room most similar to House F, room 8. House F, room 7 did not contain any large items but it did have a large portion of hassir matting with a considerable number of small artifacts resting on it, apparently left in situ as the result of a premature roof fall. By far the most frequent item in this room was chipped stone in all stages of manufacture and use. It seems reasonable to assume that chipped stone was being worked in this room. House D, room 12 also gives convincing evidence in the form of a core and two blades of the same material, that chipped stone was being manufactured indoors. Although the evidence is less persuasive than that just presented, the tendency for chipped stone to be more frequent in medium-large rooms than in any other type of room also lends itself to the contention that chipped stone working was an activity distinctive to medium-large rooms.

None of the "internal features" in Houses D and F are similar to each other and one of these features is easily interpretable. The fireplaces are more amenable to a functional interpretation. The location and construction of these fireplaces do not seem optimal if they were intended solely to provide heat. Their presence in House F, room 7, and House D, room 12, both of them rooms in which chipped stone was being manufactured, may mean that flint was pre-heated in these fireplaces to improve the workability of the material. It seems just as likely that these fireplaces were used in food preparation even though there is no unequivocal evidence to this effect.[1] The contents of House G, room 8 (which has a fireplace), especially the milling stones and the drum shaped vessel, could have possibly been used in the final stages of food preparation and cooking. The presence of Lalehzar Coarse ware pots, either whole or fragmentary, in almost all the medium-large rooms suggests that dry foods were also stored in these rooms.

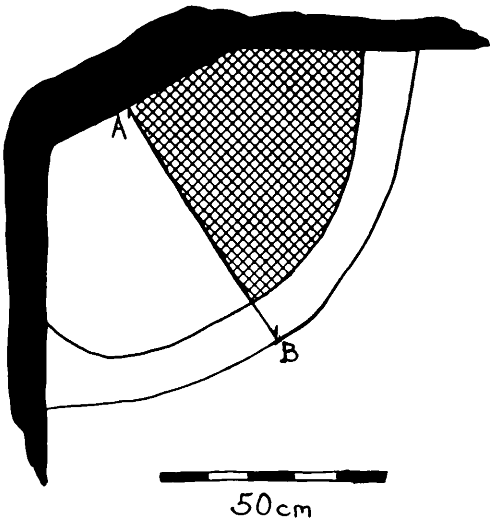
There are some problematic small artifacts which were found on the floors of the medium-large rooms. These include the clay figurines from House G, room 5, two sandstone slabs and two shell beads from House G, room 1, two stone beads from House F, room 7, and an awl fragment each from House D, room 1 and House F, room 7. The distribution of such small items is restricted almost entirely to medium-large rooms. Rather than simply saying that small items tend to be lost in medium-large rooms, I think the more positive alternatives of manufacture and/or use provide a better explanation for the restricted distribution of these artifacts. There are some suggestive co-occurrances of artifacts which also lend support to this hypothesis; these include the co-occurrance in House G, room 1 of shell beads with the ends ground down and sandstone slabs with smoothed and striated surfaces, and in House F, room 7 drilled beads and chipped stone drills occur on the same floor.

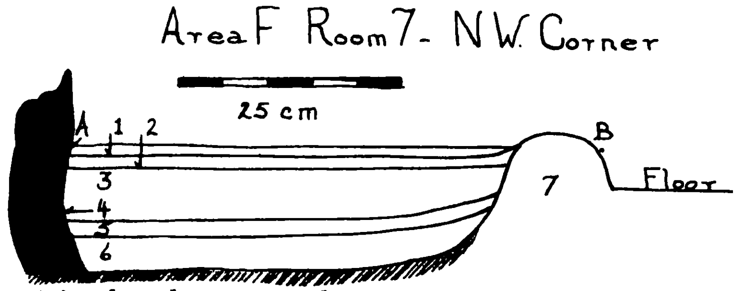
The large size of these rooms must reflect to some extent the capability, (or more positively, the purpose), of medium-large rooms to accommodate several persons. Taken as a whole the small artifacts suggest that medium-large rooms may have served as the areas for a number of domestic crafts and maintenance activities. We also suggested that the medium-large rooms with fireplaces also served as areas for final stage food preparation and cooking.

We are hard-pressed to find activities distinctive to the very large rooms. We have already remarked that these rooms suffered from earlier destruction, leaving very little undisturbed floor space. The two coarse ware pots, one a drum shaped type, the other a very large small base vessel fragment, found in House F, rooms 8-9, were of the same types found in House G, room 8, a medium-large room. The utility of the brick features in House D, room 15, remain a puzzle. The great size, and at least in the case of House F,

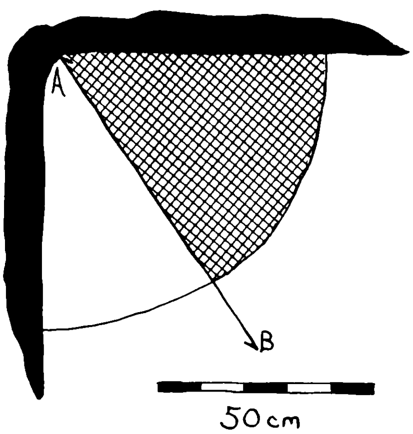
1 See Caldwell and Sarraf, this volume.

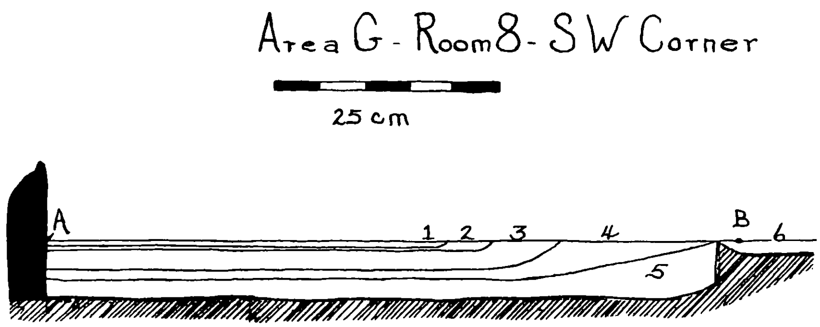
FIGURE 18. - HEARTHS OR OVENS



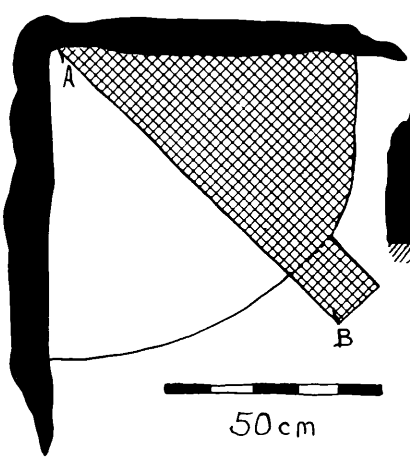


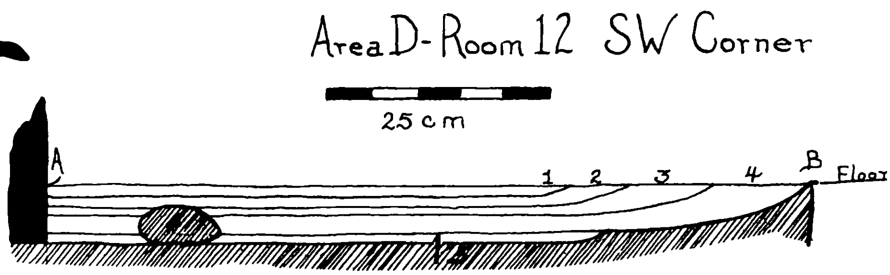
1 - Fired red-orange plaster
2 - Fired red-orange plaster
3 - Trashy sandy fill shading downward from brown to gray
4 - Fired red-orange plaster
5 - Fired red-orange plaster
6 - Sandy fill shading from black-brown to unaltered clay



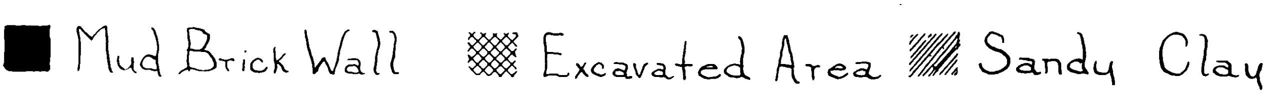


1 - Fired red-orange plaster
2 - Fired red-orange plaster
3 - Fired red-orange plaster
4 - Burnt black-brown sandy clay, sherds, "boiling stones"
5 - Burnt gray sandy clay with sherds and some "boiling stones"





1 - Fired red-orange plaster
2 - Fired red-orange plaster
3 - Fired red-orange plaster with white specks
4 - Sandy clay, charcoal, sherds
5 - Light tan unburned clay
6 - Rodent hole



the logistic location of the very large rooms suggest that these rooms were meant to accommodate all the inhabitants of a given house. Beyond this general statement we offer no further suggestions concerning very large rooms.

We are now left with the last room type, "hallways." The dead-end variety of "hallways" would seem to be a curious kind of room for any "active" activity for much the same reasons that we offered for the very small rooms. In light of this similarity to very small rooms it is noteworthy that House F, hallway 1, contained a coarse ware jar buried in the floor, covered by a simple sherd lid that was visible at the floor level. The jar was empty except for a bit of powdery soil which is yet to be analyzed. If either the gross or micro-analysis of the soil can identify the original contents of the jar, then perhaps we can say something more definitive about the use of dead-end "hallways." On the other hand, we are quite confident that the double, open-ended "hallways" are just that. Clearly we are not basing our inference on artifactual content, but rather on the shape of these rooms and their placement with regard to the other kinds of rooms in a given house.

This brings us to a consideration of the floor plans of Houses D, F, and G as the arrangements of different kinds of room types. If we speak in terms of the formal room typology we can produce a model house plan along the following lines: very small and small rooms occur in clusters or rows around which are placed medium-large rooms, and very large rooms. Hallways serve to connect groups of medium-large and large to each other. This model is sufficiently generalized to apply empirically to each of three houses.[1] The reasons for such a general arrangement should be best explained in terms of room functions. However it is just at this point that we are somewhat thwarted by two problems, both of which the reader is already aware: these are the lack of completely excavated houses, and the very tentative nature of our functional room types.

Thus we are obliged to speak more hypothetically for the moment. In light of our proposed functional room types and using a simple efficiency model (based on the principle of least effort), we postulate a pattern of room contiguities as follows: very small -- storage rooms should be contiguous to small -- grinding, second stage storage rooms, which should in turn be contiguous to medium-large -- final stage preparation, and cooking rooms. This is a minimal model; since there are some formal rooms for which we have proposed no particular function it is difficult to place these in a functional floor plan model. At best we can suggest that they should not intervene between the contiguities proposed in the minimal scheme.

A look at some of the data will help to establish the empirical status of the functional house plan model.

The very small rooms in House D are all contiguous to a row of very small rooms, which in turn lead into a medium-large room with a fireplace. In House G there are two very small rooms each flanked by two small rooms. The rooms to which these small rooms lead are either incomplete or unexcavated. However, even though the room adjoining House G, rooms 11 and 14 is partially destroyed, it is clear that it is at least a medium-large size room. House F, which we feel is more nearly complete than either houses D or G, provides the best example of a coherent house plan.

House F was originally divided into two halves and apparently expanded at a later date.

1 House D is an exception in that it has no hallway, although rooms 4, 6 and 8 may have originally served this purpose.

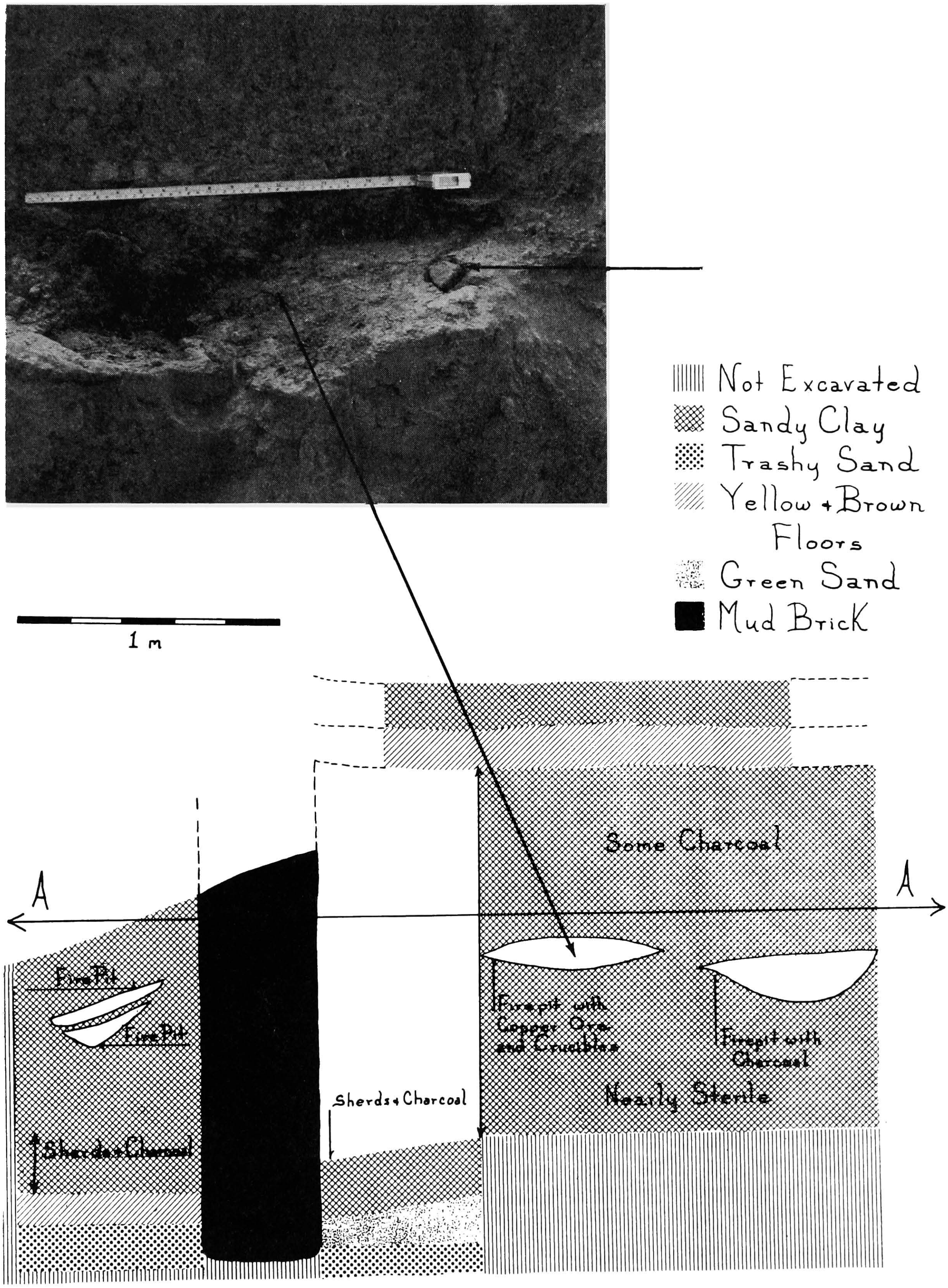
Rooms 12 and 13 are the likeliest candidates as more recent additions in view of the walled-in doorways between rooms 11 and 12, and the thin, relatively unstratified floors of rooms 12 and 13. If these two rooms and the secondary wall between rooms 1 and 6 are removed,the result is a perfect bi-partite division of room types in House F. This bi-partite division is reflected in the grouping and differential accessibility of the very small storage rooms; the placement of Hallway 2,which runs between two complexes of medium-large rooms; in the placement and differential accessibility of Hallways 1 and 3; and finally in the disposition of the very large room which is easily accessible from both of the blocks of the medium-large rooms. Yet in terms of the minimal functional model there are some curious aspects of the actual pattern of room contiguities. For instance, the storage rooms open out into medium-large rooms, not into the "predicted" small type of rooms. And, if we consider the final arrangement of rooms, with the walled-in doorways and secondary wall, much of the bilateral symmetry disappears. However the house does assume an equitable tri-partite division of medium-large rooms. There are two ways of explaining this discrepancy between the model and the actual floor plan of House F. It is possible that the minimal functional model is too limited and rigid to fit all the empirical data; we could either alter the model or dismiss it entirely. Since the model does work in both Houses D and G,it seems best to look again at House F, the medium-large rooms in question, and then re-examine some aspects of the room typology. Rooms 10 and 1-6 fall in the lower limits of the medium-large category. On this count alone they resemble small rooms. In the discussion of small and medium-large rooms we suggested that they shared common activities. We also made a functional distinction in the medium-large category between those rooms with fireplaces and those without. Neither of the medium-large rooms in question have fireplaces and in this respect they are similar to small rooms, none of which have fireplaces. The effect of this is to point out what we have noted before, that the room typology based on formal architectural and metric variables is not by any means perfect. In the case of House F, the revised evaluation of the function of rooms 10 and 1-6 must take into account the fact that these rooms are formally similar to rooms in the small rooms category. The very fact that rooms 10 and 1-6 are flanked on one side by very small storage rooms and on the other by medium-large rooms with fireplaces makes it probable that these rooms served as mealing and grinding areas.[1]

From area G we have some information on copper technology. Our initial interest in this area was provoked by the presence of a shallow firepit which contained among other items,a crucible fragment and many small fragments of oxidized copper. The relative stratigraphy of this firepit is quite well-documented (Fig.19). It lay in a light clay fill between the floors of House G and the remnant of a higher yellow and brown living floor. The fill and floor of House G belong to the Bard Sir period, but the pottery types and their relative frequencies in the remnant of the yellow and brown floor appear to fall in an early stage of the Iblis II period. There is a high percentage of Iblis painted ware, (32.5%), but there is a possibility that the Bard Sir painted ware (11.2%) was still being used. The remaining sherds are of Lalehzar Coarse ware.

Because this was the only in situ occurrance of copper ore, and a crucible in association with a fireplace, we felt that it constituted an important source of information on early smelting operations at Iblis. We reconstruct the firepit and its contents as follows. A shallow, roughly circular pit was excavated into the compact soil; there appears to have been no special lining. Subsequently, crucibles filled with copper ore were placed in the pit and packed in a matrix of charcoal. Contents were then covered with a mass of

1 Room 11 did not have a fireplace in the uppermost floor but the southwest corner of this room was heavily blackened from a fire or fires.

PLATE 3 - AREA G PROFILE SHOWING HEARTH WITH COPPER OXIDE AND CRUCIBLE FRAGMENT



chaff-tempered clay, [1] presumably for a bellows or to allow for oxygen to enter and hot gases to escape.[2]

There were three other firepits that lay in approximately the same level as the pit with the copper ore (see Plate 3). These other pits are remarkably similar to the copper bearing pit except that they were free of any definite evidence of copper smelting. (They contained only bits of charcoal). However the morphological similarity of these firepits and their vertical and horizontal proximity suggests that they all might have been used for the same purpose -- that of smelting copper ore. These pits did not lie in a well-defined floor surface of the type that we are familiar with from houses. Thus we presume that the firepits were used in a courtyard or some other outdoor area.

Even on the basis of one firepit with a few bits of copper ore and a crucible fragment we feel that the following tentative conclusions can be reached concerning early metallurgy at Tal-i-Iblis. Both the context of the pit and the technology and scale of the operation suggest that smelting could well have been a "backyard" production. The deposits in areas A, C, and E where most of the crucible fragments from the Bard Sir and Iblis periods were found appear to be dumping places for "domestic garbage, " as they were full of sherds, discarded artifacts, and broken bones. The small size of the firepit also suggests that the yield of copper per pit, per operation was small. The kind of copper artifacts, mostly small pins and beads, found at the same general time levels at Iblis also point to similar conclusion. Copper working appears to have been one of several household crafts. One does not have to posit a group of copper working craft specialists at Iblis.

Conclusions and Evaluation

The purpose of this paper has been to delineate as best we could the patterns and variations of the material culture content of three early houses at Tal-i-Iblis. We began with a description of the small artifacts. Our typology of small artifacts was based first on the diverse raw materials and secondly on the morphology of the artifacts. Some of the morphological types carried with them inherent assumptions about the uses of certain artifacts. When possible, we noted features of manufacture or wear which helped to provide clues as to the use of certain artifacts. Next we "reconstructed" an early Iblis house, using our knowledge of the building materials and the micro-stratigraphic sequences of floors, buttresses, plastered surfaces, and the like. In Part III, the artifacts, architecture, and C^{14} dates were considered from the point of view of culture chronology. We decided that the three houses were roughly contemporaneous, and they all fell into the "Iblis I period, " the earliest so far distinguished at Iblis. Finally we attempted to define the composition of the houses in terms of room types, room functions, and floor plans. The reader may have questioned the validity of our room typology and the

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1 A small superstructure seems more likely to me. (Ed.)

2 We noted in the introduction that Prof. Smith, after experimenting with a very similar kind of firepit, decided that it seemed a very unproductive method for the amount of human energy expended and the quantity of charcoal that was consumed. However Prof. Smith felt that the ore he used (a few lumps from the surface of Iblis), was probably not of the highest quality. One might also consider that since the ore was unused, the Iblisis had found it lacking some way. We must also mention the possibility that the early Iblis firepit, with its clay covering may have been superior in design to the open pit that Prof. Smith used in his experiment.

associated room functions, and the way we have used these types to discuss the floor house plans. We share many of the reader's qualms, and we have already indicated some of our reasons for not believing too blindly in the typology. Let us briefly summarize some of these reasons and the results of this paper.

It appears that room size, while it is generally a good indicator of room type, is not an infallible guide. We were obliged to sub-divide the very small category into two sub-types. We suggested that the five rooms in the upper limits of the very small room category be moved into the small room column. The division between medium and large rooms did not seem valid when the distribution of associated features was considered. In the consideration of the original floor plan of House F, there were two medium-large rooms which were probably functionally equivalent to small rooms. We also suggested that there might be a major functional difference (in the medium-large room category) between rooms that had fireplaces and those without fireplaces.

In the discussion of room functions we stressed the lack of in situ artifactual materials. We were hard put to attribute differences in room functions of different room types when there were overlapping distributions of certain kinds of artifacts (especially Lalehzar Coarse ware pots and chipped stone materials). That there were overlapping distributions of some materials is not surprising; there is no particular reason why certain activities could not have been carried out in different size rooms. For this reason we did not seek entirely unique clusters of activities for each room type, but rather we sought one or two activities distinctive to a given room type. We suspect that one of the sources of difficulty in isolating activities distinctive to a given room type, in particular the larger rooms, was the number of "invisible activities" carried on in these rooms. General socializing, sleeping, and any task involving perishable tools and/or materials would leave virtually no evidence.

Our attempts to pry some kind of culturally patterned, behavioral meaning from the data may have seemed both circuitous and guarded. At times some of our suggestions are probably drawn out beyond the limits that the data permit. We remind the reader that our sample of houses and rooms is relatively small, and that in addition to all the above-mentioned difficulties, we had no real guarantee that the three houses were part of the same universe. In other words, there may have been too much variability in our sample to allow us to isolate meaningful patterns of cultural materials. Nonetheless, we feel that on one level of analysis, that of the formal room typology, we were moderately successful in defining significant differences in the sample of rooms. We are hesitant to claim equally well-defined patterns of different room functions and house plans. However, we did find that room types for which we had suggested diverse functions appeared in arrangements which largely coincided with our proposed "minimal functional model" of room contiguities. Still, we feel that this work is best viewed as a series of tentative models which need to be tested with data from further excavations at Tal-i-Iblis.

XII

THE CHIPPED STONE INDUSTRY OF IBLIS I

Daniel Evett

This report presents a qualitative and quantitative description and analysis of the chipped stone industry of the Bard Sir period as represented by a 50% sample from the dump partially excavated in area E.[1] As in any other discussion of a given chipped stone industry, the description is carried on within the framework of a typological system. The typology used in this report, even in its present generalized form, encompasses all the materials pertaining to the chipped stone industry and attempts to provide precise definitions of mutually exclusive categories and types.

Part I

These categories were derived from considerable inspection of the materials in question. In general the categories seem satisfactory, for there is rarely any doubt about the proper place of any given piece; yet it would be presumptuous to regard the categories, the definitions, or the number of pieces in each category as immutable. The definitions which follow are fairly detailed. This serves the dual purpose of removing ambiguities that might exist due to my bias or ignorance, and of providing clarity if certain terms were otherwise left undefined.

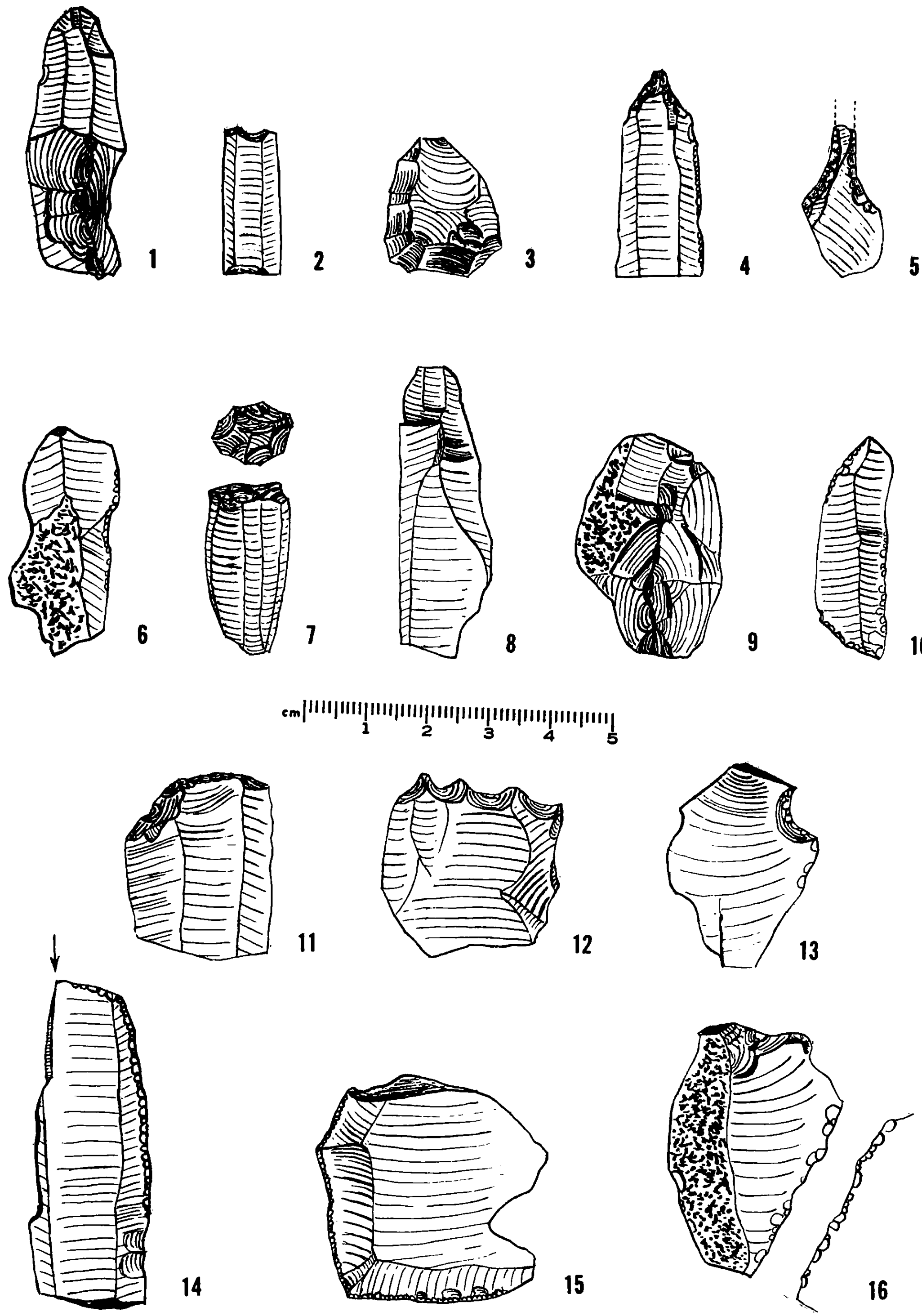
TABLE 1 - Types of Chipped Stone Materials

BLADES		FLAKES		MISCELLANEOUS	
Retouched	180	Retouched	18	Chunks	116
Other	630	With Rind	167	Cores & Semi-cores	36
Rind Removal	23	Other	456	Prepared Core	1
Crested	41	Crested	18	Flake Cores	4
Face Cleaning	27	Face Cleaning	32	Blade Cores	38
		Platform Renewal	33		
Totals	901		724		195

TOTAL PIECES: 1820

1 Area E probably belongs to the later part of the Bard Sir period. See Chase, Caldwell and Fehérvári, this volume. Iblis I period and Bard Sir period are synonomous. (Ed.)

FIGURE 1



1. Crested Blade 2. Double Truncated Blade 3. Platform Renewal Flake 4. Bec 5. Drill 6. Rind Removal Blade 7. Blade Core 8. Face Cleaning Blade 9. Crested Flake 10. Lunate 11. End Scraper on Blade 12. Denticulate Flake 13. Notched Flake 14. Burin on Truncation (Blade) 15. Used Flake (Nibbled wear) 16. Used Flake (Bifacial wear type in text)

There are, of course, samples of chipped stone from each of the other excavation areas, and from all the early culture periods at Iblis. A variety of circumstances has obliged me to limit this report to the materials from area E. However in a later footnote (p.270), I will say a few words about chipped stone from the other areas and culture periods at Iblis.

Four basic distinctions in the chipped stone materials are made in this report: blades, flakes, chunks and cores.

I. Blades: These pieces have a small platform, often only a tiny nib, which, at a point just below the bulb of percussion, forms a 90 to 80° angle with the ventral surface. The bulb of percussion is small and shallow. Blades carry scars which are the result of platform preparation. These scars appear as small nibbling and tiny hinged bladelets on the proximal dorsal surface and less frequently as nibbling on or about the platform itself. At Iblis, complete blades are also almost uniformly long, narrow, parallel-sided pieces with roughly parallel scars on the dorsal surface.[1] The axis of a blade (derived from a line perpendicular to the surface of the platform) is coincident with the axis of maximum length.

II. Flakes: As a group, flakes tend to exhibit more formal variability than blades; however the following features are characteristic of flakes. Flakes have a fairly large, smooth platform, which forms an angle of anywhere between 45 and 75° with the ventral surface.[2] The bulbs of percussion on flakes are large, usually extending halfway down the ventral surface. Pieces with the above attributes also tend to carry non-parallel scars and to have approximately equivalent length to width ratios. There is a greater variability in the relationship between the axis of flake lengths and the axis of the flakes, than in blades. Finally, there is a fairly large number of hinged-out flakes, in contrast to blades.[3]

III. Chunks: These pieces lack either a bulb of percussion or a distinct ventral surface. They also do not carry the type of scars which would identify them as cores or core fragments. Many chunks have been produced by fire fracture and are consequently covered with small heat popped craters.

IV. Cores: Cores are those pieces from which blades and/or flakes have been removed, and are not themselves a blade or flake (and thus a retouched piece by definition). Cores carry two or more negative bulbs of percussion.

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1 Exceptions are rind removal and crested blades.

2 There is one exception to the characterization of flakes as having smooth platforms. See the definition of platform renewal flakes.

3 I hope the definitions of blades and flakes have made it clear that there is a distinct difference between the two kinds of products. I am of the opinion that this difference is due to the kinds of techniques used to produce these pieces; i.e. blades are thought to have been produced by pressure, or possibly indirect percussion, and flakes are regarded as the products of some kind of direct percussion technique.

IV a. Blade Cores: These pieces are characterized by the unidirectional removal of two or more blades from a single prepared platform. The platforms are shaped by the multidirectional removal of flakes of various sizes. Blade cores also carry on the core face, at the junction of the platform and the core face, the same nibbling and bladelet scars which have already been noted for blades. Blade cores which did not suffer some mishap in production and which are free from structural defects tend to assume a polyhedral, conical shape (Fig. 1:7).

IV b. Flake Cores: The sample of flake cores is so small that to characterize them is probably premature. Those cores which are available are all multidirectional and multiplatformed. However, they lack the prepared platforms which are typical of blade cores.

IV c. Semi-cores and Core Fragments: This is a residual category which needs further subdivision. Obvious blade core fragments are rare. However, there is a fair number of pieces whose status as true cores or core fragments is doubtful and which I have called here "semi-cores." These pieces are essentially chunks of modest size (3 to 5 cm surfaces), from which one to four blades or flakes have been removed. Semi-cores lack platform preparation and the blades and flakes were removed from convenient edges.

IV d. Unfinished Blade Core: There is only one example of what is probably an unfinished and unused preshaped blade core. The piece has the typical conical shape of the "better" blade cores, yet this form was largely achieved by the removal of flakes. Only a small portion of the core face carries blade scars.

Blades, flakes, chunks, and cores are all potentially subject to further modification by retouch, use, and/or naturally produced wear. The recognition and distinction of the modifications produced by these diverse processes has become in recent years a subject of controlled experiment and study (Ascher 1963; Crabtree and Butler 1964; Keller 1966; Seminov 1964). The four levels of modification -- retouched, used, dubious, and unused -- which are distinguished here draw on the results of the above mentioned studies and on my own elementary experiments and observations.

Retouch: Retouch implies that some kind of purposeful shaping of a piece, presumably to enhance its utility, has taken place. The criteria used in the recognition of retouch are too numerous to enumerate here, but they involve the repeated appearance of a given tool form and an opinion about the kinds of edge alterations that can be produced by intentional retouch. Retouch patterns at Iblis are essentially of three kinds: steep and continuous (whether shallow or deep), steep and discontinuous -- i. e. notched and/or denticulate, and burinations.

Wear or Use: Three major types of edge wear patterns due to use have been recognized. The patterns are described as seen by the unaided eye; they are patterns of macrowear.[1]

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1 For the time being the treatment of edge wear patterns must remain qualitative, for used pieces have not been sorted according to edge wear patterns.

TABLE 2 - Retouched Pieces

	Total	% of Total Retouched Pieces (203)	Blades	% of total Retouched Blades (180)	Flakes	% of Total Retouched Flakes (18)			% of Total Category	No. of Chalcedony Pieces	% of Chalcedony Pieces
Lunates	96	47.3	96	53.3	-	-	mic.	11	11.5	1	9.1
							mac.	86	89.6	-	-
Drills	17	8.4	16	8.9	1	5.6					
Becs	11	5.4	9	5.0	2	11.0					
Burins	26	12.3	25	13.9	1	5.6					
Notches	16	7.9	12	6.7	4	22.2					
Denticulates	9	4.4	5	2.8	4	22.2					
Backed	9	4.4	9	5.0	-	-					
Truncated	2	1.1	2	1.1	-	-					
Scrapers	15	7.3	4	2.2	6	33.3	mic.	7	6.5	6	85.7
							mac.	100	93.5	1	1.0
TOTALS	203		180		18		mic.	18	8.8	7	38.9
							mac.	185	91.1	1	.5

Micro-macro - not figured separately for each type other than lunates. Figures below refer to retouched blades other than lunates.

1. A wavy edge produced by continuous removal of minute nicks. The majority of scars are on one surface, but there is always some bifacial wear.

2. Edges with even, continuous unifacial nibbling. The angle of this unifacial nibbled wear initially follows that of the surface of the tool, but becomes progressively steeper as the edge is worn away. This kind of wear never becomes as steep (or as deep), as the steep and continuous retouch. Nibbled wear often appears in isolated patches on the edges of blades and flakes.

3. Smoothed edges. Pieces with smoothed edges almost always show "sickle sheen." They also carry some bifacial nicking of the same type, but less intense, as noted above in wear pattern number 1.[1]

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1 One explanation for the rarity of pieces with "extreme use" is found in Keller's article on edge wear (Keller, C. M. "The Development of Edge Damage Patterns on Stone Tools," Man, n. s. Vol. 1, No. 4, pp. 501-511, 1966). The efficiency of a tool edge is effected by removal of tiny flakes during use, and use beyond a certain stage does not look like edge wear.

TABLE 3 - Used, Dubious and Unused Pieces

	Total	% of total pieces (1820)	% of total blades (901)	% of total flakes (724)			% of total category	No. of chalcedony pieces	% of chalcedony pieces
Used Blades	460	25.3	51.1	-	mic.	125	27.2	48	38.4
					mac.	335	72.8	21	6.3
+ core treatment blades	47								
Sub-total	507	27.9	56.3						
+ retouched blds	180								
T. Used Blades	687	37.7	76.2						
Dubious Blades	134	7.4	14.9	-	mic.	54	40.3	22	40.7
					mac.	80	59.7	12	15.0
+ core treatment blades	34								
T. Dubious Blades	168	9.2	18.6						
Unused Blades	36	1.4	4.0	-	mic.	18	50.0	5	27.8
					mac.	18	50.0	1	5.6
+ core maintenance blades	10								
T. Unused Blades	46	2.5	5.1						
Used Flakes	191	10.5	-	27.9	mic.	14	7.3	4	28.6
					mac.	177	92.7	5	2.8
+ core maintenance flakes	16								
Sub-total	207	11.4	-	28.6					
+ retouched flakes	18								
Sub-total	225	12.4	-	31.1					
Used Flakes with Rind	30	1.6	-	4.1	mic.	2	6.7	1	50.0
					mac.	28	93.3	1	3.6
T. Used Flakes	255	14.0	-	35.2					
Dubious Flakes	162	8.9	-	22.4	mic.	22	13.6	8	36.4
					mac.	140	86.4	15	10.7
+ core maintenance flakes	41								
Sub-total	203	11.2	-	28.0					
Dubious Flakes with Rind	79	4.3	-	10.9	mic.	6	7.6	6	100
					mac.	73	92.4	10	13.4
T. Dubious Flakes	282	15.5	-	39.0					

TABLE 3 - Used, Dubious and Unused Pieces (Cont'd)

	Total	% of total pieces (1820)	% of total blades (901)	% of total flakes (724)			% of total category	No. of chalcedony pieces	% of chalcedony pieces
Unused Flakes	103	5.7	-	14.2	mic.	36	35.0	15	41.7
					mac.	67	65.0	6	9.0
+ core maintenance flakes	26								
Sub-total	129	7.1	-	15.1					
Unused Flakes with Rind	58	3.2	-	8.0	mic.	5	8.6	5	100
					mac.	53	91.4	11	20.8
T. Unused Flakes	187	10.3		25.8					

Dubious: These pieces have only a few and/or very small, discontinuous scars, which could have been produced by very light or limited use, or by having been accidently crunched by humans or animals.

Unused: The edges of unused pieces appear (macroscopically) to be unmodified, except for an occasional nick or two.

TABLE 4 Totals of Used, Dubious and Unused Pieces

	Blades	% of total blades (901)	Flakes without rind	% of flakes without rind (539)	Flakes with rind	% of flakes with rind (167)	All flakes	% of all flakes (724)	Totals per type of wear category (including 116 chunks)	% of total pieces (1820)	% of total flakes & blades (1625)
Retouched	180	20.0					18	2.5			
Other Used	507	56.3	207	38.4	30	18.0	237	32.7			
TOTAL USED	687	76.2					255	35.2	949	52.1	58.4
Dubious	168	18.6	203	37.7	79	47.3	282	39.0	450	24.7	27.7
Unused	46	5.1	129	23.9	58	34.7	187	25.8	342	18.8	21.0
TOTALS	901		539		167		724				

V. Products of certain distinctive core preparation and core rejuvenation procedures.

V a. Pieces with Rind (or Cortex): The dorsal surface of these pieces are totally or almost totally covered with the original weathered, patinated surface of the cobble.[1]

V b. Crested Blades and Flakes: These pieces have a ridge, or crest, formed by the removal of flakes from one or "ideally" both sides of the crest. This ridge forms an angle of 90 to 100°.

V c. Face Cleaning Blades and Flakes: These pieces carry on their dorsal surface a major defect other than rind, defined in terms of some natural imperfection in the stone (i. e. crystal, cleavage plane, etc.), or in terms of "mistakes" in the production of flakes or blades which have created a core face with a hinge or great undulation. These pieces tend to be large and thick so as to completely remove the defect from the core.[2]

V d. Platform Renewal Flakes: These pieces are distinguished from other flakes on the basis of the following criteria. The platform is "faceted" as a result of its having been on the face of a blade core. The dorsal surface is covered with multidirectional, hinged flake scars. The most readily identifiable platform renewal flakes are those which include the entire platform and hence display a cross section of a blade core.

TABLE 5 - Results of Core Preparation

	Used	Dubious	Unused	Total per Category
Crested Flakes	5	9	4	18
Crested Blades	22	17	2	41
Rind Removal Blades	11	7	5	23
Platform Renewal Flakes	1	13	19	33
Face Cleaning Flakes	10	19	3	32
Face Cleaning Blades	14	10	3	27
TOTALS	63	75	36	172

1 In Tables 1, 5, and 9 blades with rind are called "rind removal blades."

2 The potential trouble created by a badly hinged or uneven core face in removing further flakes or blades was explained to a group of students and staff of the Field Museum's Southwestern Expedition, Vernon, Arizona, by Mr. Donald Crabtree, in the summer of 1966. Mr. Crabtree demonstrated that a single hinge, if not removed properly by a large, thick blade, will produce further hinged and/or badly undulating pieces.

VI. Retouched Pieces:

VI a. Lunates: There is considerable morphological variety in this group, ranging from the "ideal" pieces which are completely backed and rounded, and bilaterally symmetrical, to those which have only a single rounded corner. It is the presence of at least one rounded corner which defines a lunate. The decision not to subdivide lunates into further subcategories was made because, within the range of lunates as defined, almost all had the same wear pattern: sickle sheen with smoothed and lightly nicked edges.

VI b. VI c. Pieces with Tip Attention (Drills, VI b, and Becs, VI c): These items have a distinct point shaped by unifacial, bilateral, steep, continuous retouch. Drills are those pieces with long, narrow bits, and becs are those pieces with short bits (2 to 4 mm).

VI d. Burins: Burins are made on breaks, occasionally on retouched truncations. Many of the burins from Iblis are not very convincing; rarely is there more than one burination on any given burin. However, rather than ignore the presence of pieces with "burin scars," I have given all such pieces status as true burins.

VI e. Notches: These are produced by the removal of a single flake and when used, the edge of the notch carries small wear scars.

VI f. Denticulation: Two or more contiguous notches on a tool qualifies it as a denticulate piece.

VI g. Backed and Partially Backed Blades: One edge or a portion of one has been altered by steep, continuous retouch. Backed pieces always have a used edge opposite the backed edge.

VI h. Truncations: Blades with straight or concave distal, steep, continuous retouch are called truncated.

VI i. Scrapers: Blades with steep, continuous retouch creating a convex distal end, and other pieces with a convex edge created by similar retouch are called scrapers.

Part II

Tables 1-8 summarize all the quantitative information from which I will attempt to characterize the Bard Sir industry. Table 9 is a conversion of data from Tables 1-8 into an attempted step by step chronological reconstruction of the process of core preparation, the removal of various kinds of flakes and blades, and their "destiny" as retouched, used, dubious, and unused pieces. Much of this discussion will be carried on without regard to the different raw materials which are found in the Bard Sir industry. However, I will frequently mention the quantitative and sometimes qualitative differences in the production and use of these diverse raw materials.

The raw materials used in the Bard Sir industry have been divided into three categories: fine grained flints, translucent chalcedony, and coarse grained chert. The flints, small to medium size cobbles about 5 to 10 cm in diameter are not found locally, but their exact sources are not known.[1] The chalcedony was found in the form of small geodes, 2 to 4 cm in diameter, and is also an imported material whose geographic provenience is unknown. The coarse grained cherts can be found locally in stream beds and on desert pavement surfaces. It also comes in medium size cobbles.[2]

The initial step in core preparation certainly involved the removal of the rind. The number of flakes with rind is nearly eight times that of the number of blades with rind, and this leaves little doubt of which kind of technique was used at this stage of core preparation. The presence of some rind removal blades seems to indicate that not every core was completely trimmed before the removal of blades was begun. Since the number of flake cores is very small (five at the most), I also feel that most of the other flakes, aside from platform renewal flakes, were removed in the process of blade core preparation. A simple calculation in which the number of crested blades and flakes (59) is multiplied by a rough average of five flake scars per piece, yielding 295 flakes, accounts for over half of the remaining flakes without rind.

It is more difficult to ascribe a technical function to the crested blades and flakes themselves. Evidence from the one prepared core suggests that such pieces were removed as part of the process of creating a "clean face." This core has only a small portion of smooth core face bounded on each side by two crests, which if removed would have approximately trebled the available core face. In contrast there were several very much used cores which still had one or two crested areas flanking the core face. However, because of some defect, natural or man-made, these cores had not been completely worked as polyhedral cores. The final bit of relevant evidence is that the ratio of cores to crested pieces is 1 to 1.65. I think the evidence, as limited as it is, points to the conclusion that crested blades and flakes were kinds of pre-shaped pieces which facilitated the preparation of large areas of smooth core face. It is certain that leaving crested areas on cores restricted the amount of available core face, and we can also note that because of their ridged prominence, crested areas on a core would have been easy to remove.

It is also difficult to decide at just what stage the first platform appears. The category of platform renewal flakes, by definition, contains only pieces which are already part of a prepared platform of a blade core. The initial platform preparation flakes are probably indistinguishable from a multitude of other flakes with rind. We know from the presence of crested blades and rind removal blades, that blade cores had a prepared platform before the final prepara-

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1 The small size of the raw material no doubt accounts for much of the microlithic quality of the Bard Sir industry. The greatest recorded blade width in the sample was 3.6 cm; it was unique for no other blade measured more than 2.5 cm, and the great majority of blades ranged between 2.0 and 1.0 cm. Please note that the distinction between macrolith and microlith is based on an arbitrary dividing line of 1.0 cm. Blades wider than 1.0 cm are macroblades, and flakes with either width or length of less than 1.0 cm are microflakes.

2 The local chert forms a very minor component in the Bard Sir industry and is dealt with separately in the appendix.

tion of the core face. Our "sample" of one prepared core has a fully worked platform (i. e. shaped by multi-directional flakes). It is most likely that platform preparation proceeds coincidently with the rest of core shaping, and at the point at which a core was ready to be treated as a blade core it already had a pre-shaped platform.[1]

Rind removal blades, face cleaning blades, platform renewal flakes, and presumably face cleaning flakes are all thought to be the results of core working after a blade core had been formed and used. The case has already been stated for platform renewal flakes and rind removal blades. Face cleaning pieces should have resulted whenever a defect appeared, but this was apparently not always so. In fact, many of the cores appear to have been abandoned at the point where a combination of small size and an accumulation of hinges and/or structural obstacles made it impossible to remove further pieces.

It is interesting to contrast the amount of material which resulted from the initial core preparation procedures (flakes with rind and all other non-specialized flakes - 623) with the final stage preparation materials (rind removal blades, crested blades and flakes - 82), and the products resulting from core maintenance (platform renewal flakes, face cleaning blades and flakes - 92). It is clear that the greatest amount of material was expended in creating the rough core form, while final preparation and maintenance were relatively efficient operations.

In regard to the different raw materials, it should be noted that the flint cobbles and the chalcedony geodes appear to have been worked in the same fashion. All the core preparation and core renewal products can be found in both materials. There is a slightly higher percent of pieces with rind (16.5% to 11.8%) and core treatment products (12.8% to 9.6%), in the sample of chalcedony than in the sample of flint. This is probably a reflection of the difference in the nodule size and structure. The smaller chalcedony geodes, which are often marred by crystals and cleavage planes, required more preparation per "clean blade" than the larger and generally purer flints.

Blades are certainly the heart of the Bard Sir industry. There are more blades than flakes, and approximately eight times more blade cores (38) than flake cores (5). Both the absolute number and the relative percent of used blades (687 or 76.2% of all blades), is considerably greater than the number of used flakes (255 or 35.2% of all flakes). Further, the number of retouched blades (180) is more than nine times that of the number of retouched flakes (18).

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1 There are at least two platform renewal flakes which provide definite evidence that some cores were subjected to "heat treatment." The benevolent effects of a slow and moderate cooking of flints was explained and demonstrated by Mr. Crabtree. Proper heat treatment can significantly improve the workability of most flints, cherts, and even quartzites. Pieces which have been removed from the outside of cooked cores have a lustrous ventral surface and a duller dorsal surface, i. e. the original patina. Pieces removed from the interior of such cores will have the same kind of glossy luster, but of course there will be no contrasting surface. The two platform renewal flakes in question have contrasting surfaces.

Retouched pieces can, of course, be thought of as the end product of a given industry, but I prefer to consider them as special members of the larger category of used pieces. As was just mentioned, retouched pieces in the Bard Sir industry are predominantly blades. Precisely 20.0% of the total blades are retouched. Of the retouched blades, 53.3% are lunates, 27.8% are pointed pieces (notches, denticulates, and scrapers). The range of retouched flakes is restricted to a very few pointed pieces (4) and a few heavy duty pieces(14). Despite the small number of retouched flakes, the heavy duty flakes constitute almost two-fifths (37.8%) of the total number of such pieces.

There are relatively few retouched microblades (10.0% of all retouched blades) and no retouched microflakes. This may be compared with 27.0% microblades among the other used blades. Related to this low percentage of micropieces is the very small number of retouched pieces of chalcedony (4.4% of the total retouched blades, and 0% of the retouched flakes). It appears that large size, flint blades were the preferred item for producing retouched pieces, but not to the total exclusion of flakes, micropieces, or chalcedony.

TABLE 6 - Used, Dubious, and Unused Flint vs. Chalcedony, Micro- and Macroblades.

	Flint Macroblades	% ot total flint Macroblades (399)	Flint Microblades	% of total flint Microblades (122)	Chalcedony Macroblades	% of total chalcedony Macroblades (34)	Chalcedony Microblades	% of total chalcedony Microblades (75)
Used	314	78.7	77	63.1	21	61.8	48	64.0
Dubious	68	17.0	32	26.2	12	35.3	22	29.3
Unused	17	4.3	13	13.9	1	2.9	5	6.7
TOTALS	399		122		34		75	

Note: This chart excludes core maintenance blades.

The pattern just noted in the retouched pieces is also apparent, but to a lesser degree, in the category of used pieces, excluding for the time being the retouched members of this category. I have already mentioned that there are over twice as many used blades as used flakes. This is not due to the greater number of blades alone, for the numbers of dubious flakes (282) and unused flakes (187) are greater respectively than the number of dubious blades (168) and unused blades (46). It is noteworthy that within the class of used flakes, flakes with rind were used less frequently (30, or 18.0% of the total flakes with rind) than flakes without rind (207, or 38.4% of the flakes without rind). This is only to be expected since many of the flakes with rind lack clean edges. There are not many microflakes (85), and of these only 16 (6.8% of the total used flakes) were definitely used. On the other hand, 63.5% (125) of the total microblades (197) were used.

One of the contributing factors to this high percent of used microblades is the fairly large number of used chalcedony microblades (48, or 37.4% of the total used microblades). 64.0% of the chalcedony microblades were used, while 53.1% of the flint microblades were used. Pointing in the same direction is the smaller percent of unused chalcedony microblades (6.7% of the total chalcedony microblades), compared with 10.7% unused flint microblades.

TABLE 7 - Used, Dubious and Unused Chalcedony vs. Flint.

	Chalcedony Blades	% of total chalcedony Blades (109)	Flint blades	% of total flint Blades (521)
Used	69	63.3	391	75.0
Dubious	34	31.2	100	19.2
Unused	6	5.5	30	5.8
TOTALS	109		521	

In light of the data on the retouched pieces, the high percent of used microblades, and especially chalcedony microblades, is somewhat a surprise. It is clear that chalcedony blades, despite their generally small size (68.8% of the chalcedony blades are microliths), were not ignored, indeed they seem to have been "preferred"(in terms of relative percentages) to some extent over flint microblades. Although I have no real way to prove it, it seems likely that chalcedony occupied a special position in the Bard Sir industry. [1]

TABLE 8 - Used, Dubious and Unused Micro- vs. Macroblades.

	Macroblades	% of total Macroblades	Microblades	% of total Microblades (197)
Used	335	77.4	125	63.5
Dubious	80	18.5	54	27.4
Unused	18	4.2	18	9.1
TOTALS	433		197	

1 There are two kinds of information which might explain the position of chalcedony. Our distributional control is probably too weak (5 by 5 m squares and 20 cm levels) to be of use and at the moment the data from the Bard Sir houses are not available to me. Secondly we need a study of the edge wear patterns. The most powerful evidence for a special function of chalcedony would be a pattern co-variation between distributional clusters and a particular edge wear.

I have mentioned so far that flakes, and especially flakes with rind, were "less desirable" than blades; i. e. flakes were used less frequently than blades. There is another possible ancillary explanation for the differential use between flakes and blades. Assuming for the moment that the step by step reconstruction is reasonable valid, then it is also true that the progression from "less used" to "most frequently used" is chronological.[1] However, I think this is more of a coincidence than a real explanation. Even among the "contemporaneous" core maintenance products, blades were used more (77, 56.1% of the total core maintenance blade products) than flakes (15, or 30.0% of the crested and face cleaning flakes).

TABLE 9 - Chronological Reconstruction of the Process of Core Preparation.

Flake Cores (5)

Retouched flakes (18)

Exhausted blade cores (38)

Retouched blades (180)

	Flakes with rind (167)	Flakes without rind (456)	Chunks (116)	Rind removal blades (23)	Crested flakes (18)	Crested blades (41)	Platform renewal flakes (33)	Face cleaning flakes (32)	Face cleaning blades (27)	All other blades (630)	Semi-cores and core fragments (36)
Used	30	191	7	11	5	22	1	10	14	460	2
Dubious	79	162		7	9	17	13	19	10	134	
Unused	58	103	109	5	4	2	19	3	3	36	34

There is little more that need be said about the Bard Sir industry from area E. At this point I would like to summarize some of the more salient aspects of this industry. The materials from area E can be most succinctly described as a

1 It is also that there are horizontal distributional differences between flakes and blades, and again some better controlled distributional data might be revealing. It is my impression that the chipped stone materials from the house floors of areas D, F, and G contained a smaller percent of flakes and a higher percent of retouched and used pieces than the sample from area E.

blade industry in which the blade cores were prepared overwhelmingly by a flake technique; these cores were maintained by a combination of flake and blade techniques. The small size of the raw material gives the industry a strong microlithic aspect. There is not a great variety of retouched tools, but there is a fairly high number of retouched blades, of which the most frequent items are lunates, the great majority with sickle sheen. Equally important as the retouched pieces in the characterization of the industry is the fact that almost two-fifths of the total flakes and blades were definitely used, and only 14.4% were definitely not used, thus leaving approximately 56% in the dubious category. Large flint blades were the favored pieces for manufacturing retouched tools, but this is true to a much lesser degree in the non-retouched, used blades. There is a large number of used microblades, and within this category of used microblades there appears to have been a positive selection for chalcedony. Flakes were used far less frequently than blades, and there is doubt that they formed a significant part of the tool kit.

It is difficult to judge whether the percentage of used tools in the Bard Sir industry is exceptionally high, for there are, to my knowledge, no published Old World blade industries in which used pieces are tabulated. In lieu of comparative material, I can only suggest that one of the distinctive features of the Bard Sir industry is the high percentage of used pieces. The only "explanation" for this lies in the fact that good raw material was not abundant in the immediate area. If I have perchance failed to mention an important feature of the industry, hopefully it can be found in the tables. Further excavated materials and study will undoubtedly alter some aspects of this report, but it is hoped that the basic characteristics of the Bard Sir industry as outlined here are reasonably valid, and will stand the test of future scrutiny.[1]

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1 The reader is reminded that this report concerns only the sample from area E. The samples of chipped stone material from the other areas at Iblis that made their way back to the United States are too small to permit meaningful detailed analysis. However the following general observations seem safe to state at this moment. The chipped stone from the Iblis period is a blade industry similar to that of the Bard Sir period. I do not know whether there are any pieces of chipped stone from the Dashgar period. In the Aliabad levels chipped stone was very rare. Accompanying this apparent reduction in chipped stone production, was a change from a blade industry to a flake industry and a switch from the fine grained imported flints and chalcedony to the local coarse grained cherts. I have no data relating to chipped stone from levels more recent than the Aliabad strata.

Appendix

The table below of the chipped stone products in the local cherts, as limited as it is, shows a set of very different patterns than those found in the flint and chalcedony materials. Flakes are the most common product in the local chert, yet they were largely ignored as useful tools. Blades, although rare, were used for the most part. There is a relatively large number of chunks; again many of these have been produced by fire fracture. There is nothing that can be called a core.

The problem is where these materials fit into the industry as a whole. It does not seem wise to label these items as intrusive for two reasons: first, despite the small total number, these pieces appear quite regularly in the sub-proveniences of area E; and second, the presence of blades indicates the same technical competence found in the finer grained materials. The products in the local chert do not seem to be a "special purpose" subindustry, if the very small percentage of used pieces is an indicator. Some other possibilities come to mind: the local chert may have been a kind of practice or training material; or, local cobbles were occasionally worked in the hopes of finding high grade flint; and so on and so forth. Of course none of the hypotheses are testable at the moment and probably never will be. Only further excavation will provide some clues.

TABLE 1 - Chipped Stone Products in Local Cherts.

	Blades	Flakes	Chunks	Total
Used	11	2		13
Unused	2	42	15	59
Totals	13	44	15	72
% of Grand Total (72)	18.1	61.1	20.8	

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XIII

EXPLORATION OF EXCAVATION AREA B

Joseph R. Caldwell and Mohammad Sarraf

On the northern periphery of the mound the profile exposed by the fertilizer diggers showed some kind of burned feature which we thought might be part of a building. Hans and Hildegard Wulff were visiting us at the time and Dr. Wulff kindly agreed to begin an excavation in this place. He first cut a clean profile going deeply below the fertilizer diggers' excavation to a point at which pottery fragments and other cultural material ceased to be found.

The upper portions of this profile appeared as plain sand, without any signs of stratification or banding, to a maximum of 1.40 m below the surface of the mound at this point (Fig.1). Below this were parts of standing walls reddened and blackened by fire. Under the deepest of these walls was a midden deposit 10 cm thick. Below that were alternate layers of clay and wind-blown grit, the latter precisely like surface deposits of the surrounding desert today. It apparently contained no cultural material of any kind.

We suppose the upper sand to have been wind deposited during a very short time. It contained a grand mixture of potsherds and artifacts of all periods. Perhaps the latest object was the iron dagger, probably Achaemenian[1], shown in Fig.2 which came from deep in the sand just above a ruined wall of a much earlier time. Among the pottery from the sand were many sherds of a wheel-made ware which had not previously occurred anywhere but on the surface, and nowhere as abundantly as in this spot (Pl.1). Characteristic of this type was an incised wavy-line decoration. There are indications that this dates about the beginning of the 1st millenium B.C.

Guided by the profile faces, Dr. Wulff removed the upper sand down to a large fragment of floor, and below that to wall remains standing to a meter or less. At the east end of the profile there appeared a small chamber which we presently learned was part of a pottery kiln.

Structure B 1 A Pottery Kiln of About 1100 B.C.

The floor of the chamber was rectangular, 1.70 by 1.60 m with rounded corners. The sides curved slightly inward and upward to a preserved height of 1.10 m. The inside of the walls had been plastered with mud and then fired red and orange. Transecting this

1 According to Miss Elizabeth Carter, Oriental Institute, University of Chicago.

FIGURE 1 - NE PROFILE OF AREA B BEFORE EXCAVATION

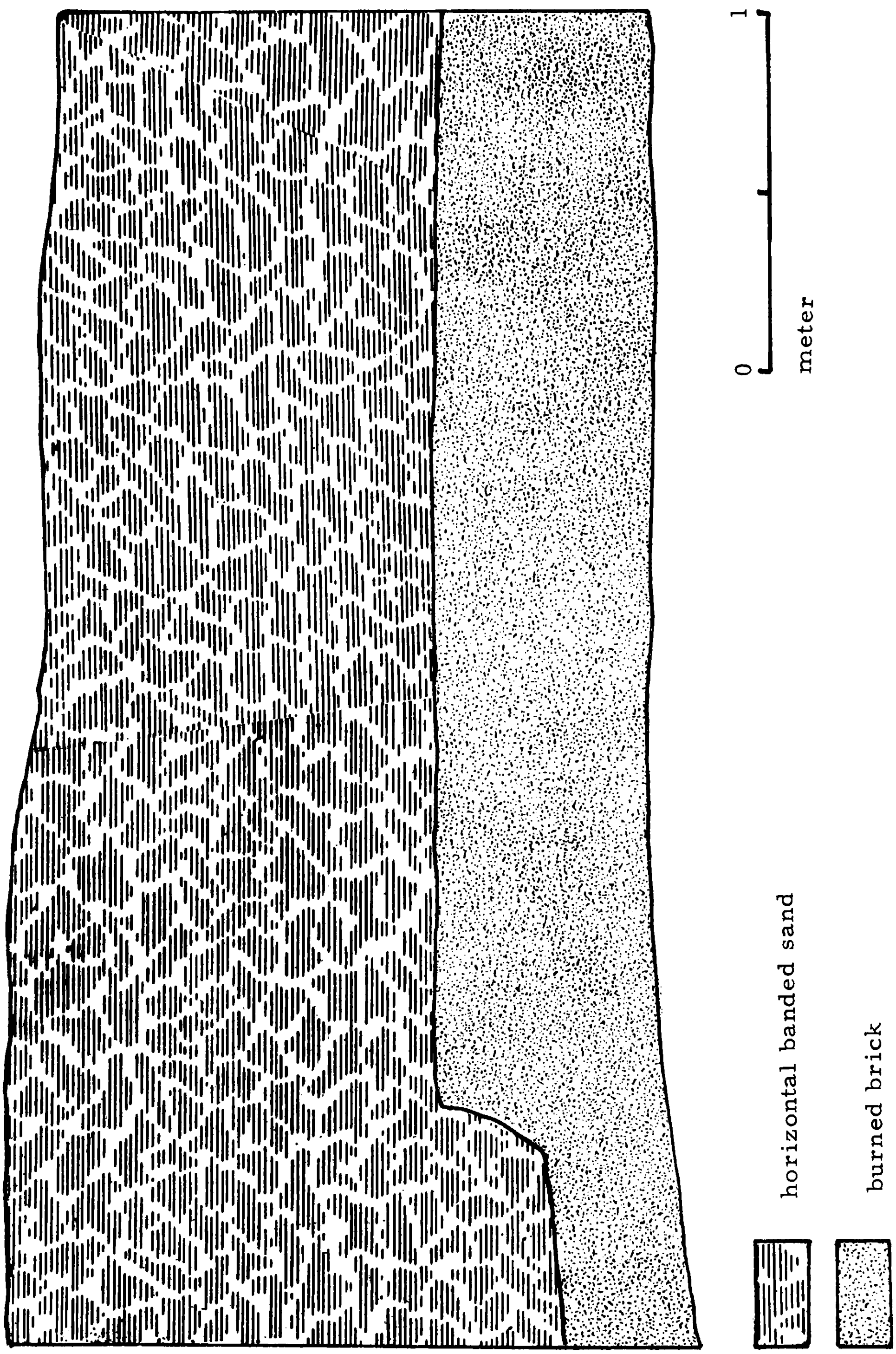
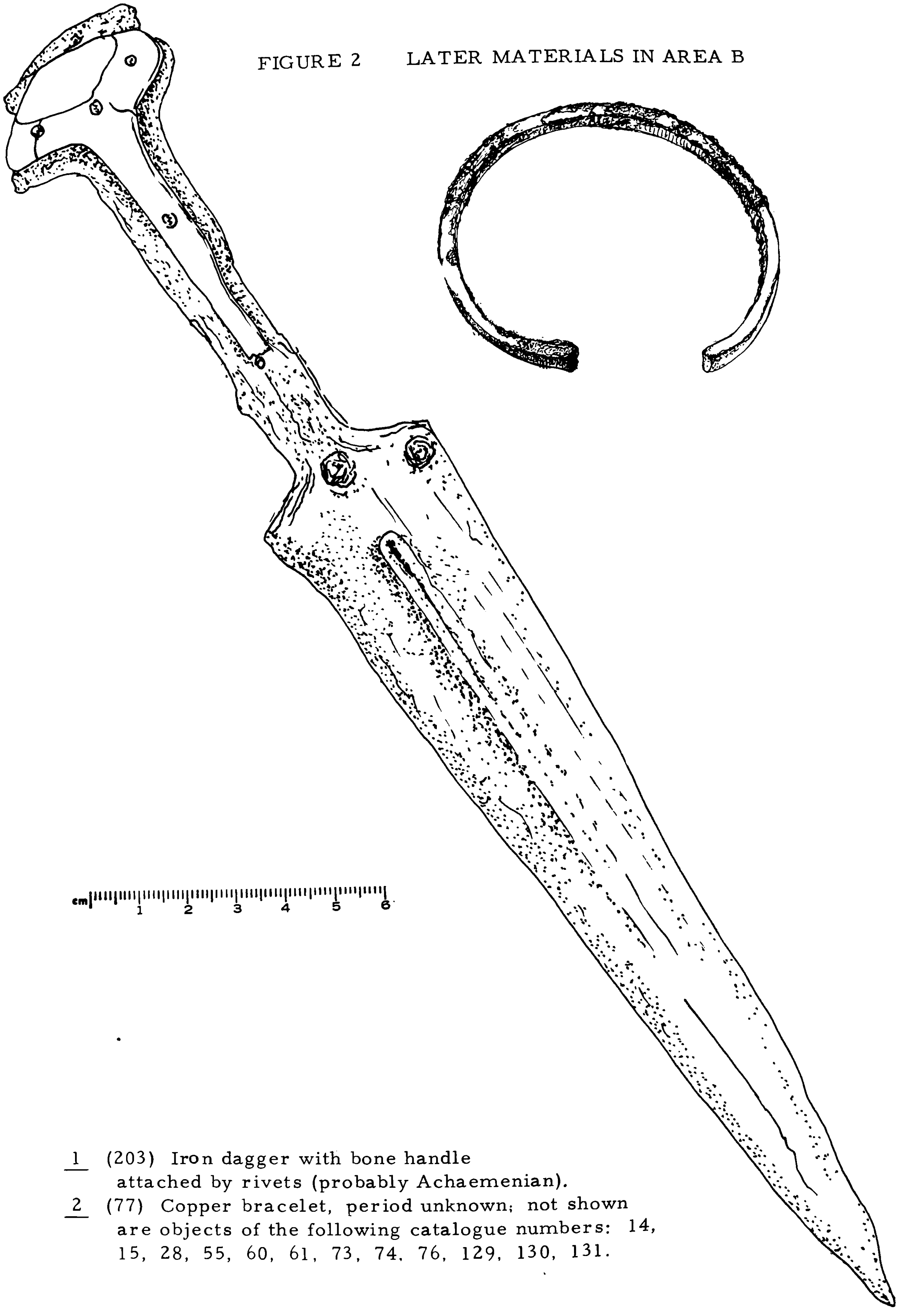


FIGURE 2 LATER MATERIALS IN AREA B



1 (203) Iron dagger with bone handle attached by rivets (probably Achaemenian).

2 (77) Copper bracelet, period unknown; not shown are objects of the following catalogue numbers: 14, 15, 28, 55, 60, 61, 73, 74, 76, 129, 130, 131.

interior was a thin wall of sun dried bricks -- made later -- which clearly had nothing to do with the original purpose of the structure. The bricks were large, flat, and set on edge one above another with no signs of mortar. We cannot imagine why this was built, unless by children at play. Carefully -- carefully -- we cleaned this thin wall for a photograph. But instead of taking the picture we stepped back to admire our handiwork and with a great whoosh the wall collapsed unphotographed. So goes pride before the fall.

Shortly after we regretfully saw the Wulffs depart on their own researches. From then on the excavation was continued by Mr. Sarraf and Dr. Caldwell. It was Mr. Sarraf who, in the course of cleaning the floor of the chamber, discovered that it was not a floor but a clay grate with regular perforations to allow hot gasses to come up from a firebox below. A few days later he discovered the opening to the firebox outside the north wall of the chamber. What we had here was a vertical pottery kiln preserved in nearly all details. We estimated that only the uppermost .60 m of the dome was missing (Fig.3).

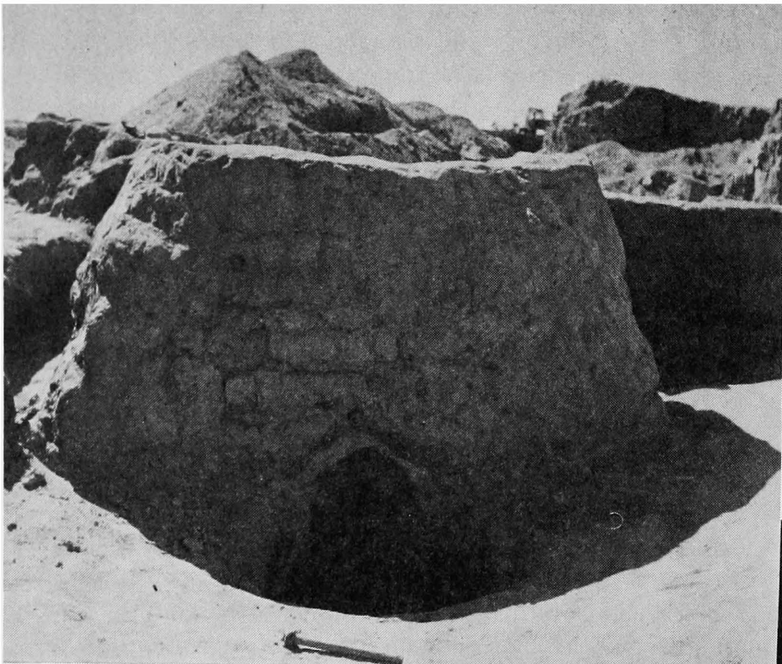
The firebox contained much sand intermixed with layers of charred wood. None of the pieces was very large and a great many of them appeared to be parts of twigs and small branches. 15.5 gr of charred wood from the firebox was later made the basis of a radiocarbon determination of 1130 $^+$ 120 B.C. (GX 862) (5730 $\pm$ 40 half life). An indication that this date may be approximately correct was given by a burned fragment of pottery from the firebox with a wavy-line incised ornament similar to some of the pottery from the sand layer above. Such pottery postdates the entire Iblis sequence as it is known so far, and since the wavy-line sherd had been burned in the kiln, the latter must be younger than the sherd.

Inside the firing chamber were a few other fragments of pottery. A few of these were clearly older, of the type Lalehzar Coarse ware, others were without any distinctive features. It did not appear that any of these had been fired in the kiln and most were certainly out of context.

In the construction of the kiln the first step had been to make an excavation for the firebox: 3 m long, 1.80 m wide, and 1.40 m deep. This excavation was situated close to an earlier standing wall, part of which was incorporated in the firing chamber of the kiln. The firebox was dug well below the base of this wall and the clay grate or floor of the firing chamber was at about the level of the base of the earlier standing wall.

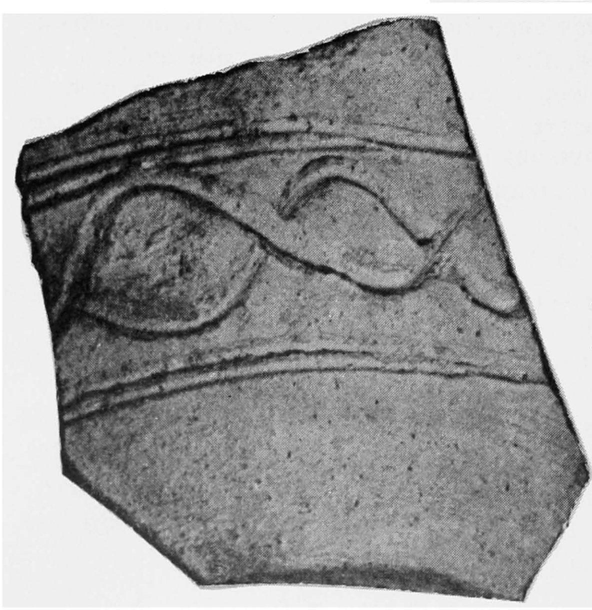
Inside the excavation for the firebox were built a number of transverse arches to support the grate. Our examination of these arches was superficial. We were not ready to pick away at them to see how they were constructed, for we have some hopes that the kiln might eventually be preserved in situ. Moreover, every time we examined these arches it meant getting bodily inside the firebox with uncertainty as to whether the upper structure might collapse into it. So at the moment we are unable to say whether the arches were constructed of mud or of plastered brick. Each transverse arch was separated from the next by 10 cm, and it was the area under the series of arches which constituted the firebox proper. Starting at the entrance,the first arch was higher than the others, forming a kind of antechamber. The lower sides of this were each faced with two bricks. From there on up to the top they were plastered. Brick sizes were 43 by 40 by 10 cm. This first arch seems also to have supported the north wall of the firing chamber. Beyond this were three more arches supporting the grate proper. The first two of these were each 55 cm in thickness which, be it noted, is greater than any brick we were able to measure. We did not go far enough in the firebox to measure the thickness of the third arch, and hence we were also unable to determine whether there may have been still another arch beyond to support the south wall of the firing chamber. Probably there was, for the sandy soil into which the firebox had been dug,would have required some kind of footing.

PLATE 1 POTTERY KILN OF ABOUT 1100 B. C.



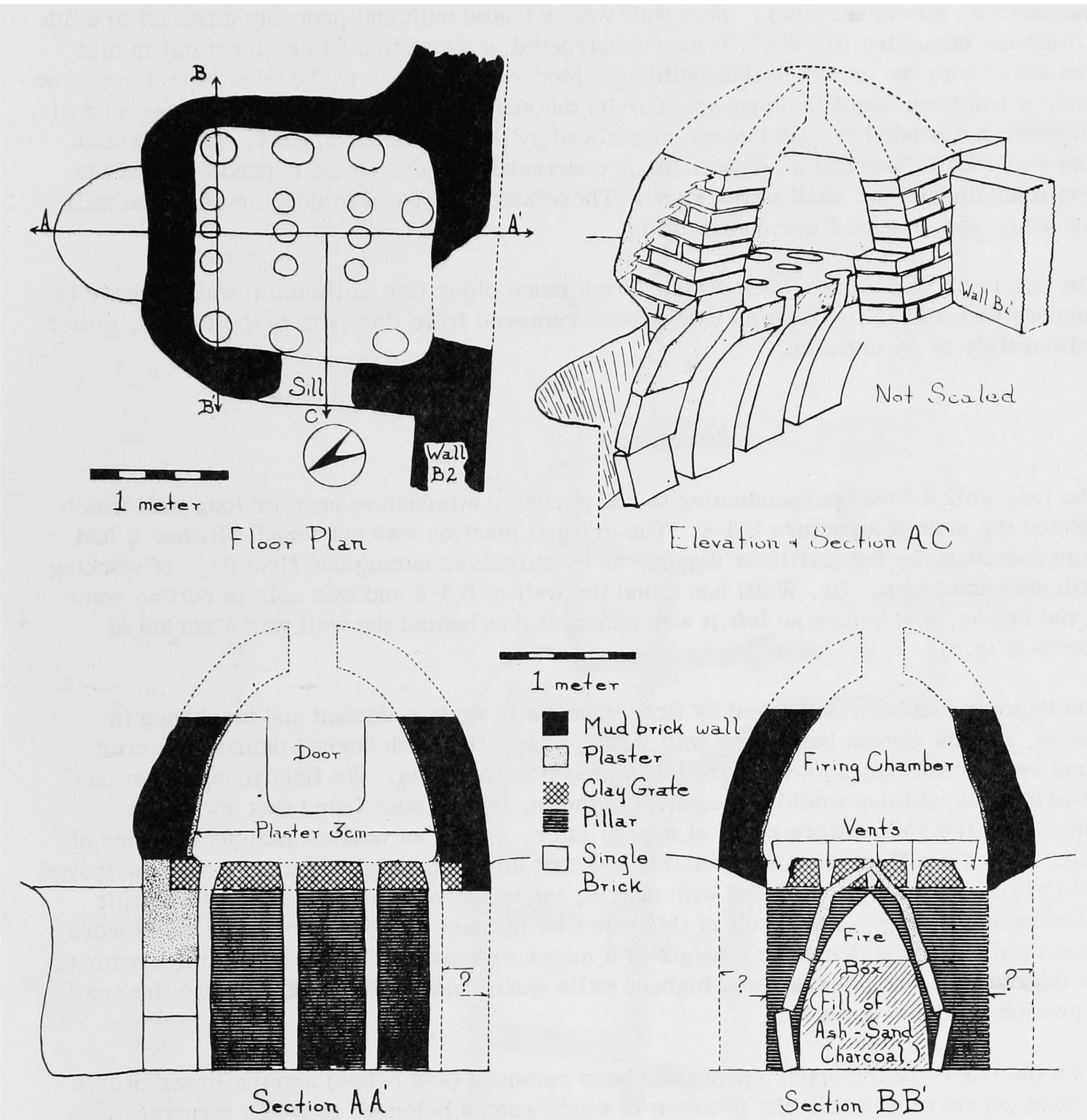
View of kiln showing opening to firebox below. Some of the plaster has been removed to show bricks.

View of firing chamber, showing vent openings from firebox. Door to chamber in background.



Fragment of pottery believed to be of the same type as the burned specimen found in the firebox. The original is in Tehran.

FIGURE 3 - POTTERY KILN OF ABOUT 1100 B. C. AREA B.



On top of the central arches the grate was built,and the 10 cm intervals between the arches allowed the transmission of hot gasses from the firebox to the perforations in the grate and thence into the firing chamber.

Long Wall B 2 (Fig.4)

Now we come to a puzzle. The kiln was attached to a long wall which, according to all indications, was much older. This wall was oriented with and probably attached to a 5th millenium structure (B 3-8).[1] It was constructed of sun-dried bricks identical in size and shape with the bricks of that building. Moreover, just as in the case of that construction, it had been burned. Perpendicular on the south side of this wall was a fragment of another, not bonded to it and nearly destroyed by the fertilizer diggers. It is possible that these walls bounded a large room or courtyard, but due to the depredations of the fertilizer diggers we shall never know. There were traces of midden south of the wall but none, and no good floor, north of it.

For our later kiln to have been attached to a much older (5th millenium) wall we have to suppose that all the intervening levels were removed from this part of the mound, either deliberately or by erosion.

Structure B 3-8

The long wall B 2 was perpendicular to and probably attached to another long wall which formed the side of structure B 3-8. The critical junction was not found. Either it had been destroyed by the fertilizer diggers or by ourselves during our first days of working with untrained men. Dr. Wulff had found the wall of B 3-8 and was able to outline some of the bricks, and before he left,it was apparent that behind the wall was a series of rooms (Fig.5).

The building had been destroyed by fire. The walls were reddened and blackened in places, and the rooms behind the wall were partly filled with burned debris, charred wood and burned clay showing parallel impressions of poles. We first thought that uncovering this building would be relatively simple, but we soon found that above the remains of the rooms were parts of upper, later, rooms as well as various sections of wall. Our overall impression, finally, was that after the original building was destroyed and the rooms were partly filled with debris, the whole was smoothed over to permit subsequent building. The result of this was that in many places the original walls were preserved under the debris to a height of a meter or more. These walls being harder to the degree they were burned, the highest walls were those in the rooms where the conflagration had been hottest.

When the traces of the upper rooms had been removed (see below) and the lower ones cleaned out,there was still the problem of which rooms belonged to which structures, and whether some rooms might not be courtyards and alleys. For this it was necessary to distinguish exterior walls. A glance at the plan of structure B 3-8 suggests that the northwest and southwest walls are exterior, the former probably facing a court (area 9)

1 Because of the complexity of rooms encountered in Area B, we could not use the simple system of Evett where each of his excavation areas could be treated as a single building. In Area B, rooms 3, 4, 5, 6, 7, 8, belonged to one building, other rooms to other parts of buildings. Hence this structure of rooms 3 to 8 is designated structure B 3-8.

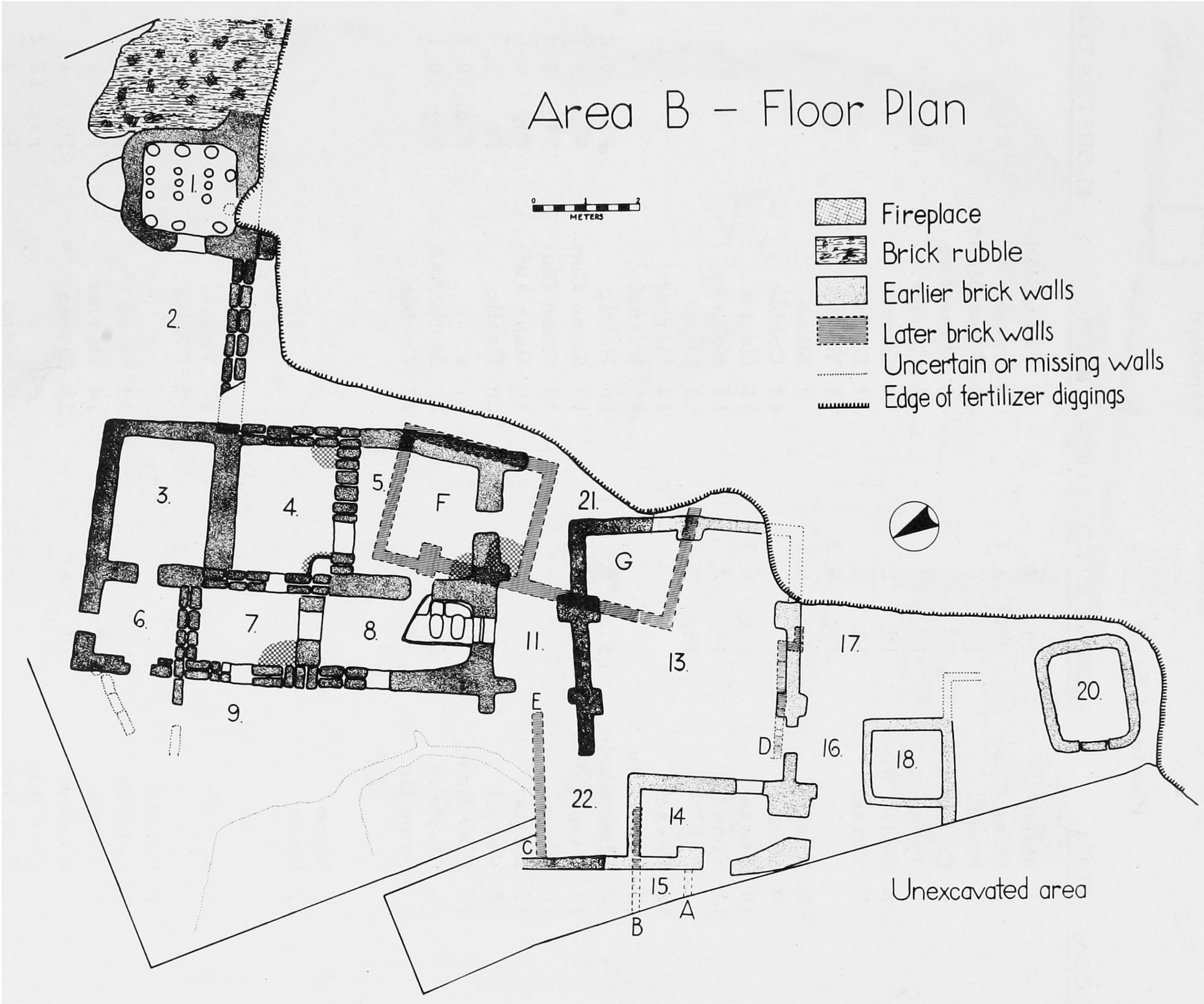


FIGURE 4 - PLAN OF EXCAVATION

FIGURE 5 - AREA B, PARTIAL RECONSTRUCTION OF STRUCTURE 3-8

Hassir Mat

Clay Roof

Hearth

Single Brick, Plaster Removed

Plastered Brick

ROOM	ITEM	ILLUSTRATED	ROOM	ITEM	ILLUSTRATED
4	1 Mano	Pl. 2	5	1 Flint Blade	
	2 Stone Cup	Fig. 8.3		2 Stone Cup	Fig. 9.2
	3 Mano			3 Flint Blade	
	4 Cobble			4 Stone Axe	
	5 Twigs	Pl. 2		5 Cobble	Pl. 3
	6 Bread Wheat	Pl. 2		6 Quern	
	7 Vessel	Pl. 2,		7 Cobble	
		Fig. 6.2		8 Vessel	
	8 Vessel	Fig. 6.1		9 Mano	
	9 Mano			10 Cobble	
	10 Vessel	Fig. 6.3		11 Quern	
	11 Vessel	Pl. 2,		12 Cobbles	
		Fig. 7		13 Mano	
	12 Vessel			14 Mortar	
	13 Malachite			15 Vessel	
	14 Flint Blade	Fig. 8.10		16 Pestle	Fig. 10.2
	15 Copper Pin	Fig. 8.4		17 Stone Cup	Fig. 9.1
	16 Mano			18 Stone Cup	Fig. 9.4
	17 Mortar			19 Bone Awl	Fig. 9.6
	18 Vessel			20 Pestle	Pl. 3,
	19 Clay Box				Fig. 10.3
	20 Clay and	Pl. 2		21 Stone Axe	Fig. 10.1
	Stone Bin			22 Cobble	
7	1 Mano				
	2 Mano				

Cont'd.

ROOM	ITEM	ILLUSTRATED	ROOM	ITEM	ILLUSTRATED
8	1 Mortar	Pl. 4,	8	11 Vessel	Pl. 4
		Fig. 11.2		12 Pestle	Pl. 4,
	2 Cobble				Fig. 12.3
	3 Cobbles			13 Mano	Pl. 4
	4 Vessel			14 Mortar	Pl. 3
	5 Window	Pl. 4		15 Quern	Pl. 4,
	6 Clay Box				Fig. 12.2
	7 Clay Box			16 Mano	Pl. 4
	8 Quern	Pl. 4		17 Mortar	Fig. 11.1
	9 Quern	Pl. 4		18 Mortar	Pl. 4,
	10 Cobble				Fig. 12.1
				19 Mano	

FIGURE 5 - PARTIAL RECONSTRUCTION OF STRUCTURE 3 - 8. AREA B

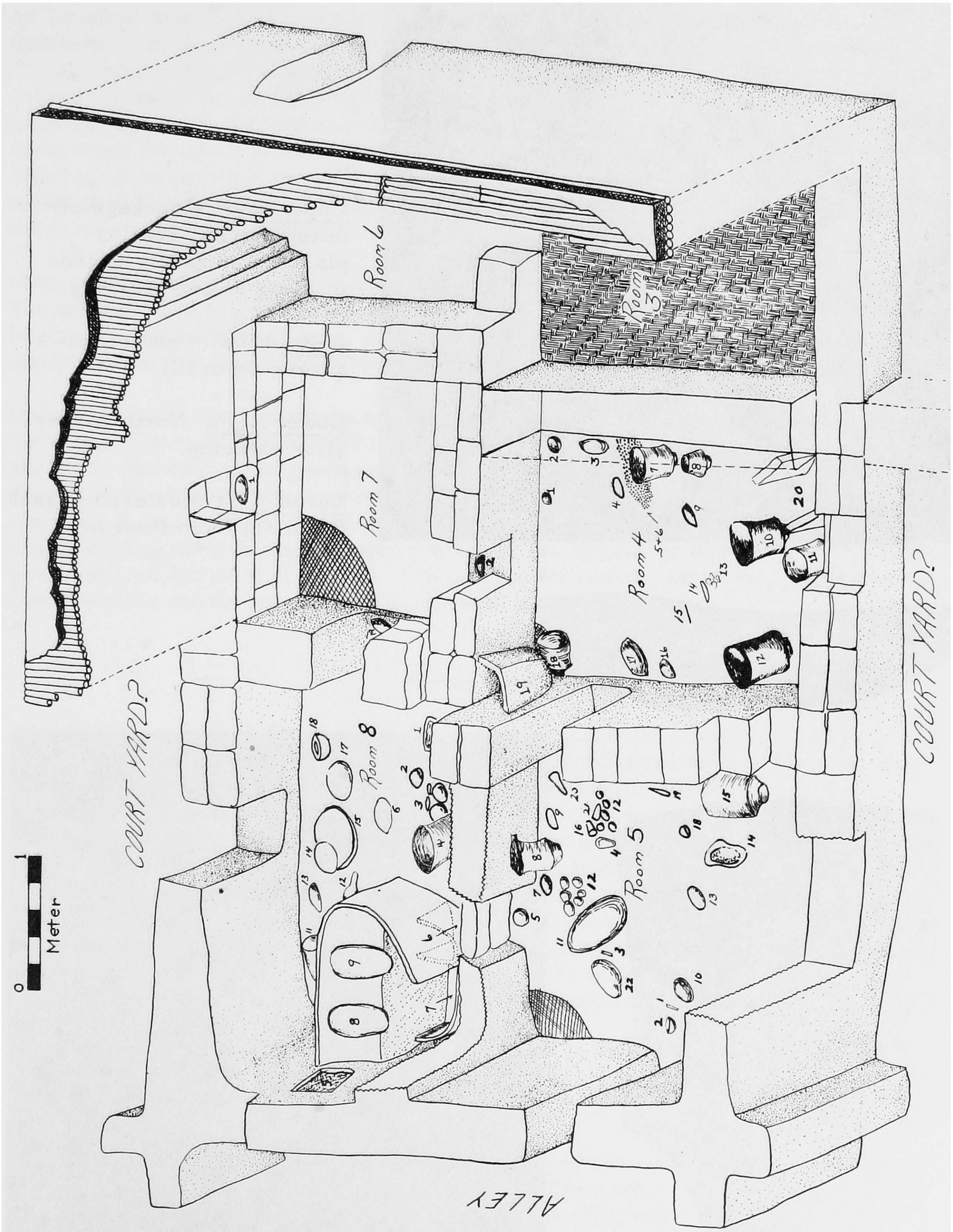


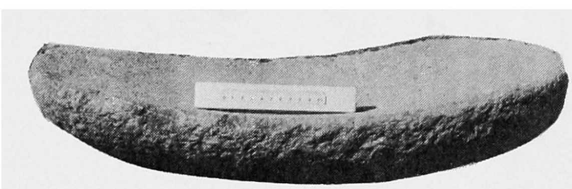
PLATE 2 ROOM 4

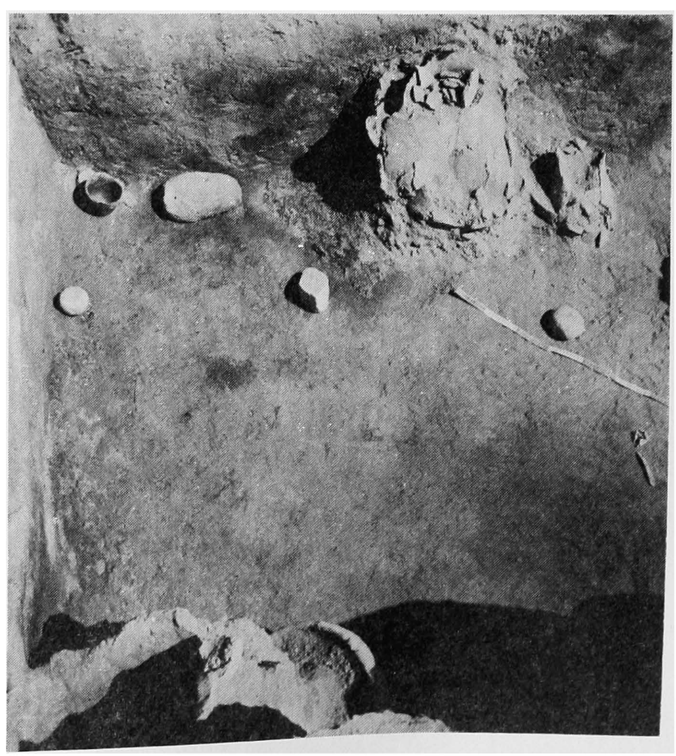
Upper left: Wreckage of fallen bricks, roofing plaster and saddle querns in room before clearing.

Left: View of one of two querns from fill.

Lower Right: North corner after clearing.

Lower Left: Restored vessel (item 11) from floor.





and the latter facing an alley (area 11) which separates this structure from structure B 13, 14, 22. Probably the southwest wall was also an exterior wall bounding a courtyard south of B 2 and corresponding to area 9 on the other side. We are completely at a loss as to whether the north wall of the 3-8 complex was an exterior wall or not. It is possible that some additional rooms lay north of it.

As for other observations -- walls were almost uniformly 40 cm thick. Bricks were handmade, with most walls two bricks thick except when bricks were laid transversely. The histograms (Fig.18) based on the bricks from room 7, suggest that bricks were fairly uniform in thickness and moderately uniform in width, but non-modular in length. We have the impression that either bricks were not made prior to construction (but each tailor-made for its place in the wall) or else there was a great deal of comparing and selecting of bricks while the walls were being built. What does hold true for most bricks of this period, however, is a thickness of 14-16 cm, a width of 16-20 cm and a length which may vary from 24-60 cm.

Many bricks showed deep finger depressions on one side for better bonding of the mortar. The number was 4 to 8 depending on the size of the brick. In bricklaying the side with finger depressions seems always to have been placed downward. All walls were plastered inside and out with mud 1-2 cm thick. The sides of doors and windows were also plastered.

None of the walls were preserved to their full height. Our reconstruction (Fig.5) sets the height of the roof as just sufficient for a fairly tall man to get about without banging his head. Innumerable fragments of burned, fallen, roof plaster were found in the rooms. Each of these showed one smoothed side and one side with parallel impressions of poles averaging 5 cm in diameter. The plaster itself was about 10 cm in thickness. It appears that in building the roof many slender poles were laid across the tops of the walls. These were close set and parallel. These were then plastered with mud on top. Other constructional features are described in connection with each room below.

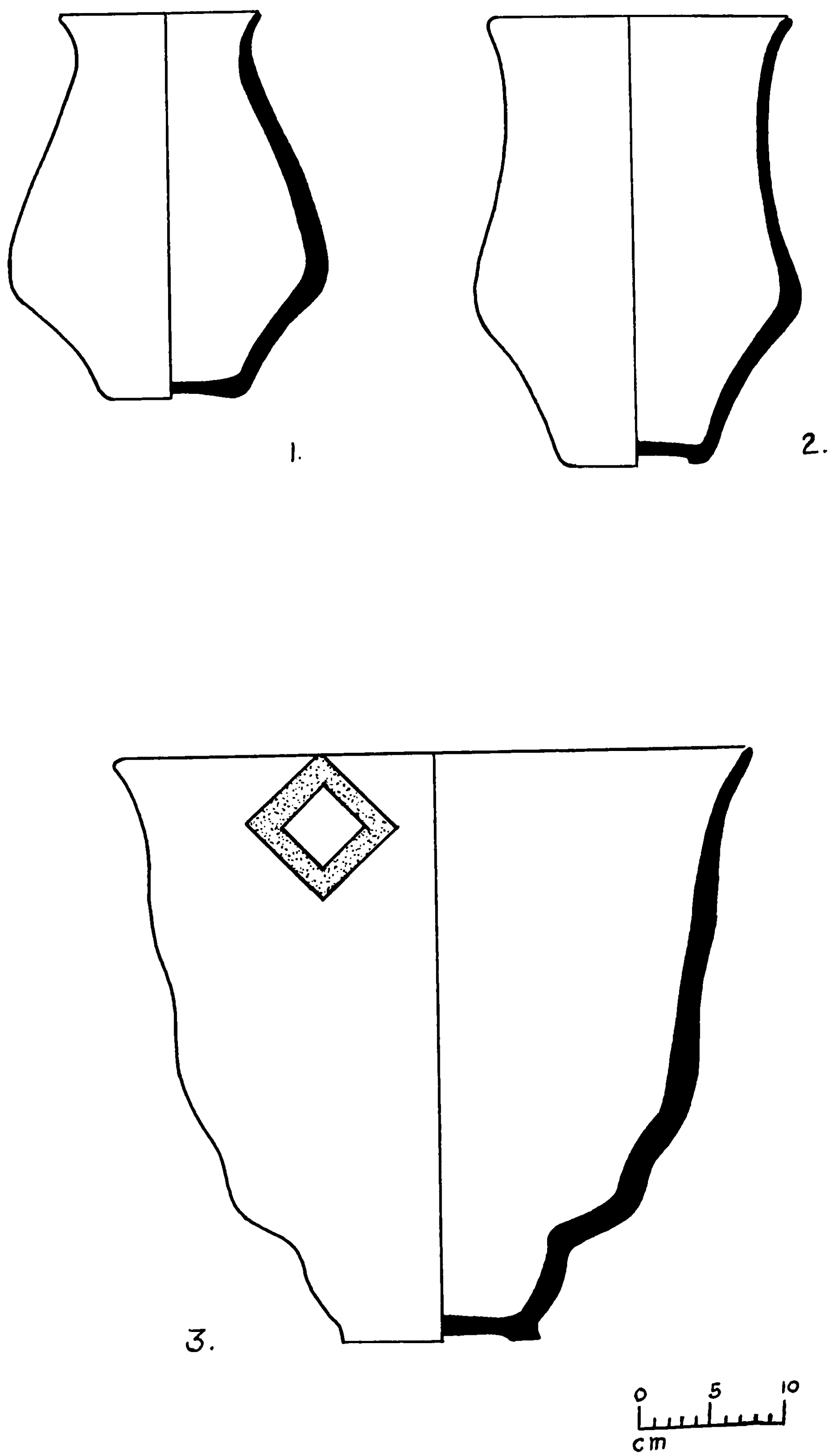
Rooms 3 and 6

The interior measurements of room 3 were 2.25 m by 1.70 m; of room 6, 1.60 by 1.30 m. These rooms were connected by a doorway 40 cm wide but there were no doorways from these rooms to the adjacent rooms on the south where the fire had been much more intense. The lesser intensity of burning in here may account for poorer preservation of the walls, and also for the fact that these rooms were practically bare of artifacts. The inhabitants may have had time to remove their possessions after the fire began. Everywhere on the floor of room 3 were silicified impressions of hassir matting which could be traced by flicking up a layer of clay on the floor. Above the clay were many charcoal fragments but not so much burned roof plaster as occurred in several of the other rooms. None of the hassir matting had been burned or it would have been preserved as charcoal. It is as if the mat had been covered by a layer of mud before the fire occurred; conceivably the room had already been abandoned.

Room 4

This room, measuring 2.30 m by 1.80 m, was connected by doorways to rooms 5 and 7. Unlike the doorway between rooms 3 and 6, each of these had a threshold one brick high. This room had been subjected to intense heat and was filled with fallen bricks and roof plaster, in some places a half meter high. Scattered in the fill were some Lalėhzar Coarse sherds and half a dozen flint blades. A more surprising occurrence was two heavy saddle querns -- the sort of thing one would not hang from a ceiling. Where had

FIGURE 6 - LALEHZAR COARSE VESSELS FROM ROOM 4



1 Item 8   2 Item 7   3 Item 10 (with red painted decoration)

FIGURE 7 - LALEHZAR COARSE VESSEL (ITEM 11) FROM ROOM 4.

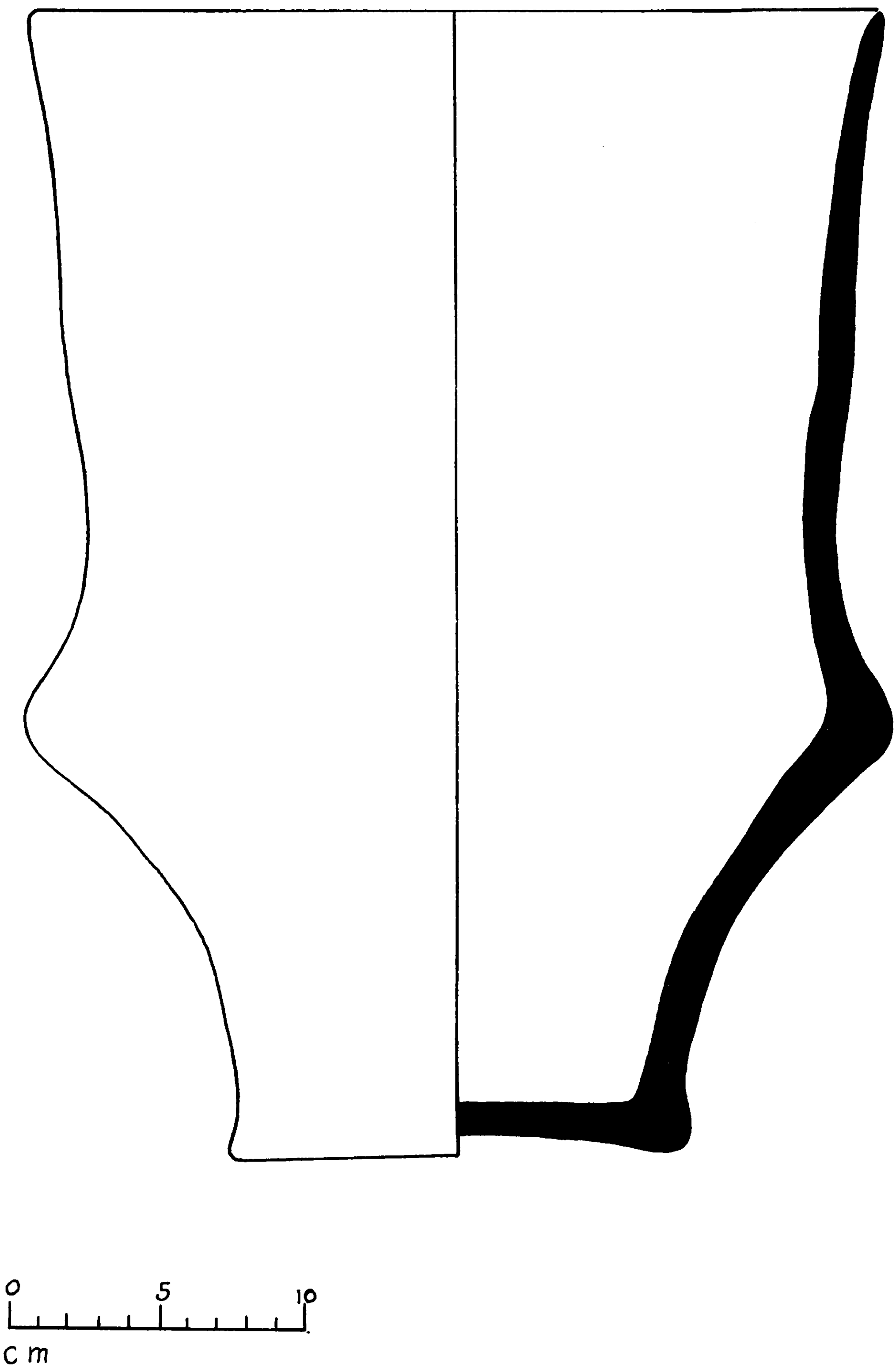
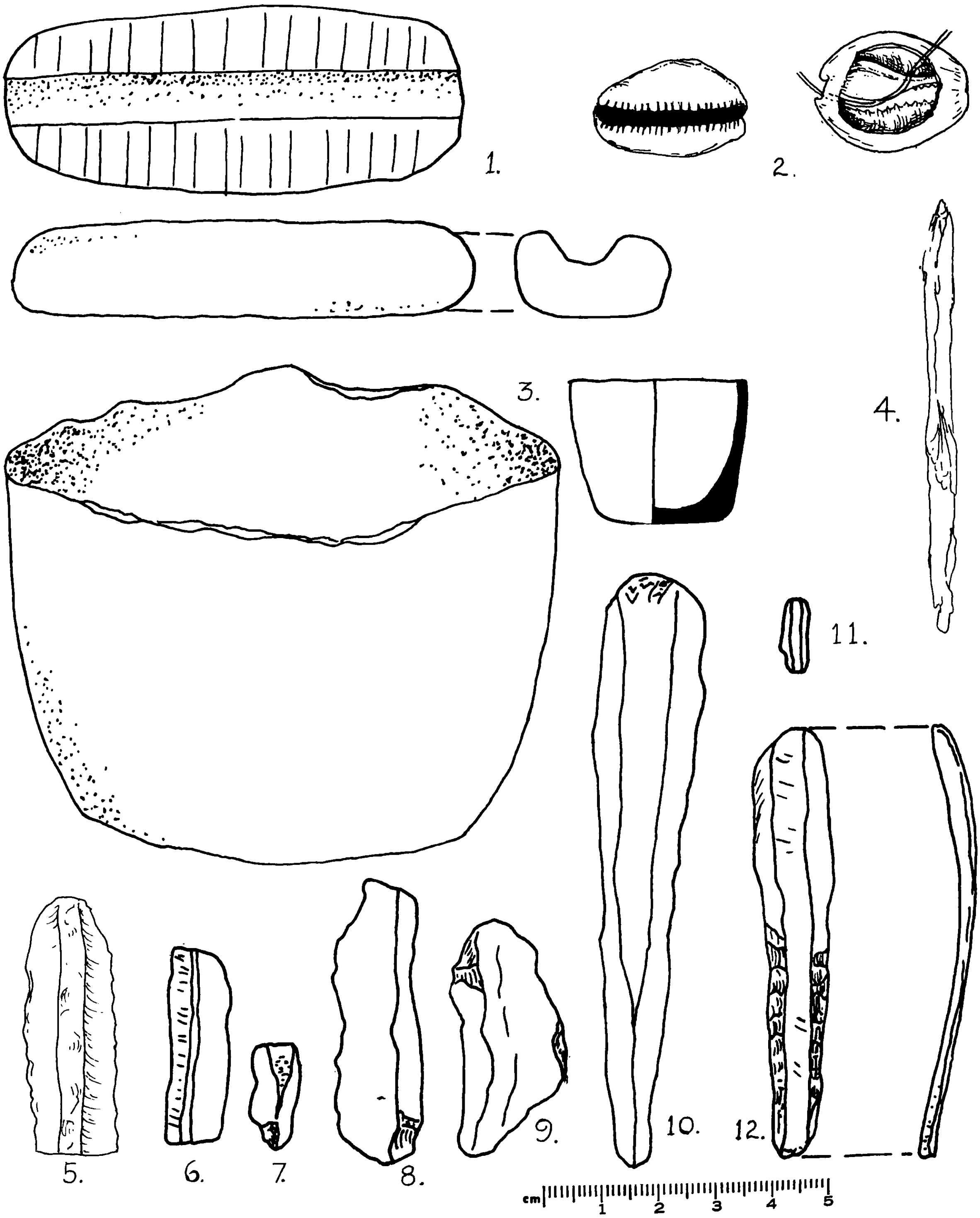


FIGURE 8 - OBJECTS FROM ROOM 4



1. (80) Stone arrow shaft smoother (?) high in fill against wall. 2. (59) Cowrie shell bead from fill. 3. (81) Dark gray stone vessel from floor. 4 (75) Copper pin from floor. 5. (57) Chert blade from fill. 6. (69) Tan flint blade from fill. 7. (72) Flint blade from fill. 8. (70) Red chert blade from fill. 9. (71) Light tan chert flake from fill. 10. (78) Gray chert blade from floor 11. (67) Clear chalcedony (?) blade from fill. 12. (68) Gray chert flake object from fill. Not shown are (79) fragments of malachite found on the floor.

they fallen from? The slim impressions of poles in the roof plaster do not indicate sufficient strength for much activity to have been carried out on the roof.

In the east corner was a rough construction of upright bricks and slabs as shown in Fig.5. In the course of clearing the room this was inadvertently removed and it was somewhat more complex. Close by on the southeast wall was a niche, one brick long, made by using one extra wide brick instead of two narrower ones. In the south corner of the room was probably a fireplace -- a reddened area depressed 10 cm below the general floor level. In the west corner of the room, attached by mud plaster, was a clay box 55 cm high, 46 by 39 cm across, and with walls 4 cm thick. The bottom of the box was rounded and was only 6 cm above a fireplace filled with charcoal and cobbles. In the very bottom of the box was a fused mass of friable silvery material, identified, according to Cyril Smith, as hematite. It is difficult to explain the box and fireplace as other than somehow connected with pyrochemistry, and the hematite will be subjected to careful study by Professor Smith.

Various objects were found on the floor, pointing to a hasty evacuation of the room. There were five upright Lalehzar Coarse vessels which tended to be along the walls rather than in the center of the room. They contained nothing but dust and it seems strange that these were not knocked over during the collapse of the roof. By the northeast wall was a small store of wheat identified by Professor Stewart as breadwheat, Triticum aestivum L. Some intermingled fragments of charcoal may have been part of a basket or wooden container. Also tending to be along the walls were an overturned stone mortar, several manos, a stone cup and several cobbles. Toward the central part of the floor was some malachite broken into several fragments; a copper pin, and a flint blade (Figs.6, 7, 8;Pl.2).

Room 7

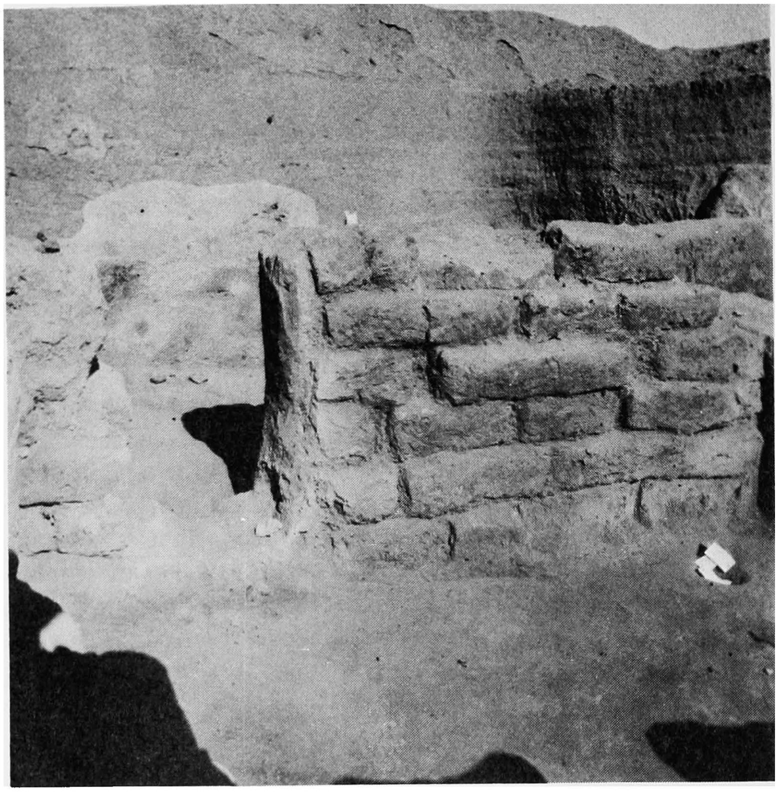
This room measured 1.82 m by 1.36 m. It was connected by doorways to rooms 4 and 8 and there was a window looking outside into area 9 which we have supposed to be a courtyard. Both doors had thresholds one brick high and the bottom of the window was raised two bricks. These doorways of room 7 were of two kinds (see Fig.5). On the threshold of one door lay a stone mano and another mano lay on the windowsill. In the east corner was a small pile of rounded pebbles, perhaps cooking stones. In the west corner was a fireplace. Considerable amounts of broken Lalehzar Coarse pottery, and many bricks and fragments of roof plaster lay above the floor, but no artifacts were found on the floor itself.

Room 5

Although this room was not foursquare, its dimensions may be given as 2.46 m by 2.20 m. Originally there were three doorways -- one to room 4, another to room 8 and one to an alley outside (area 11). Later, the door to room 8 was blocked with crude bricks -- probably because the construction of a large mealing bin in room 8 already made it virtually unusable. This doorway, incidently, was one of the best preserved, but is not completely rendered in Fig.5 in order to show the mealing bin in the next room.

While cleaning the debris from this room it appeared to us that there might be two floor levels separated by 10 cm, but they were not well developed and may simply represent some kind of differential filling of the room with debris during and after the fire. If these do represent successive occupation floors, it also becomes difficult to account for the fact that some of the artifacts on the lower level also show signs of burning. The lower level

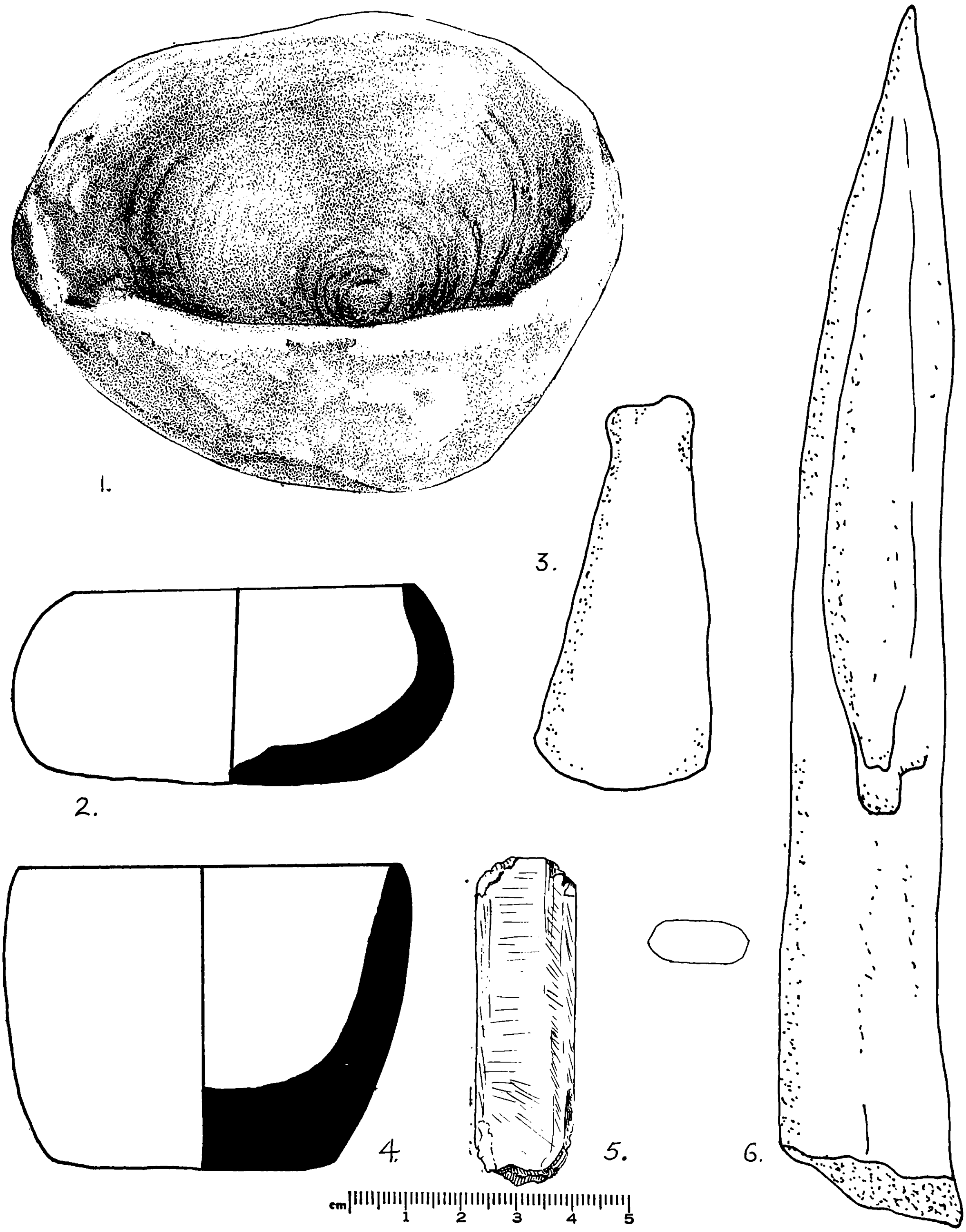
PLATE 3 - ROOM 5



Upper: Northeast wall of Room 5 showing brickwork and heavily plastered doorway.

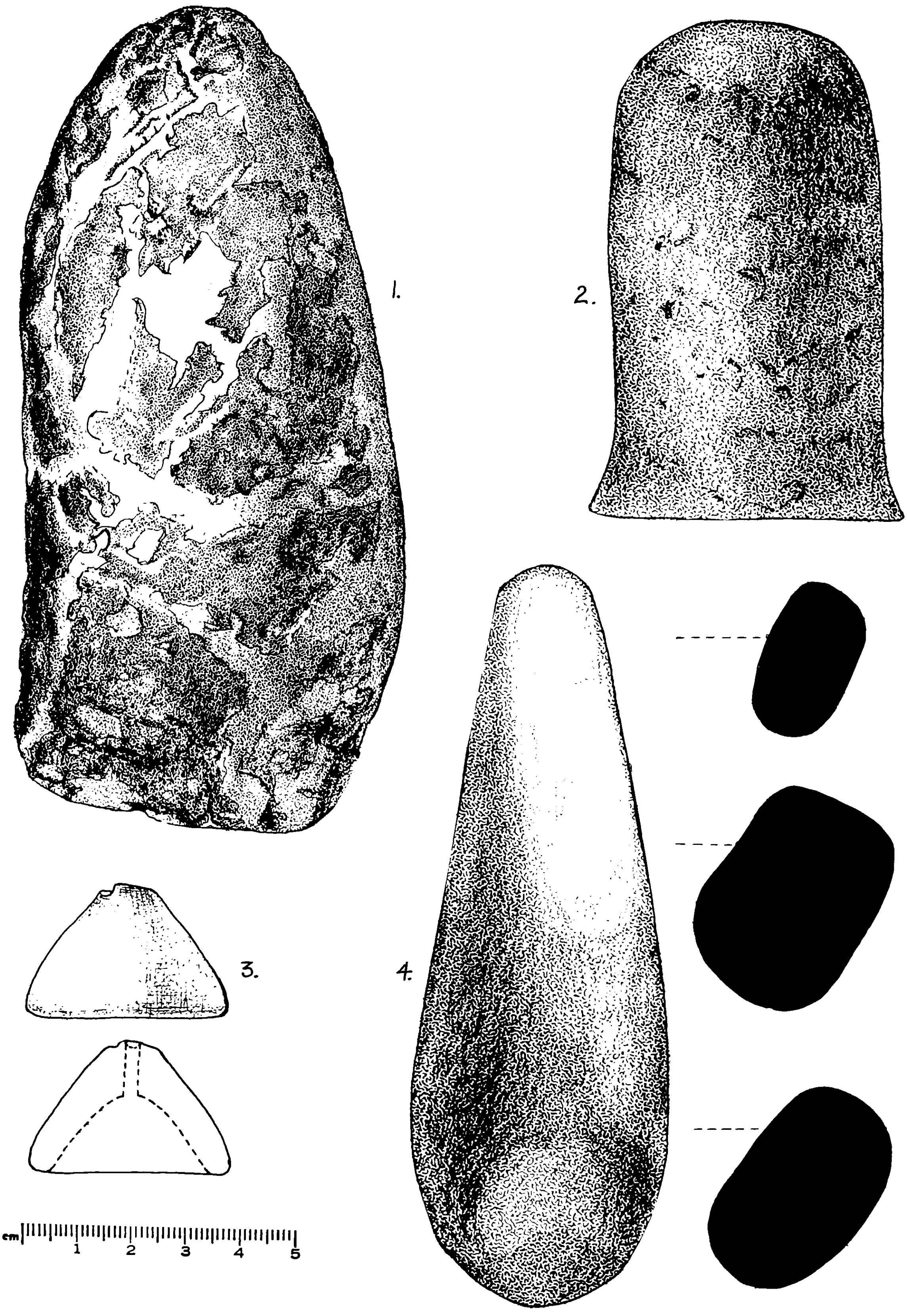
Lower: Stone objects from Room 5, rearranged for photograph.

FIGURE 9 - OBJECTS ON FLOOR OF ROOM 5



1 (145) Cup made of rhyolite. 2 (146) Stone cup of syenite gneiss (?) 3 (140) Fired clay object 4 (144) Stone cup of black basalt (?) 5 (139) Ground slate object showing scratches 6 (141) Bone awl blackened by fire. Not shown is 142, a marine shell bead. See Plate 3 for various large stone objects found on the floor of this room.

FIGURE 10 - OBJECTS ON FLOOR OF ROOM 5 AND FILL OF ROOM 6.



1: (147) Ground Stone Axe of Felsophyre 2: (299) Stone Pestle (basalt?)
3: (no number) Stone Pestle 22 x 8 x 6 cm 4: (87) Pottery spindle whorl from fill of Room 6.

is then probably the true floor of the room and on it lay an assortment of complete artifacts such as would have been left when the room was hastily evacuated. The pottery vessels shown as belonging to the upper level probably also rested on the lower one. At the lower level, in the west corner of the room, was a fireplace. (Items on these floors are shown in Figs.9, 10; Pl.3).

Room 8

This room was on the southwest corner of the building and had interior measurements of approximately 2.80 by 1.50 m. Doorways led to rooms 5 and 7, the one leading to room 5 having been bricked up, as previously noted. Another doorway led outside to area 9, which we suppose to have been a courtyard. There was one window, facing on the alley (area 11). The entire side of a very large vessel of Lalehzar Coarse pottery had been placed in the window to block it.

The most striking feature of the room was a mealing bin occupying all of the south corner (Fig.5; Pl.4). Two large saddle querns had been set in a slanting clay platform and below each was a built-in clay box to catch the flour as it fell from the querns. The open side of the bin was blocked by a thin clay wall which curved around to end in the doorway leading to room 5. The result was to render the doorway practically useless and so it was blocked up with crude bricks, and a mano was placed on top of these.

Scattered about on the floor were mortars, querns, manos, a pestle, sundry cobbles and two pottery vessels (Figs.11, 12). Another mano lay in the doorway between this and room 7.

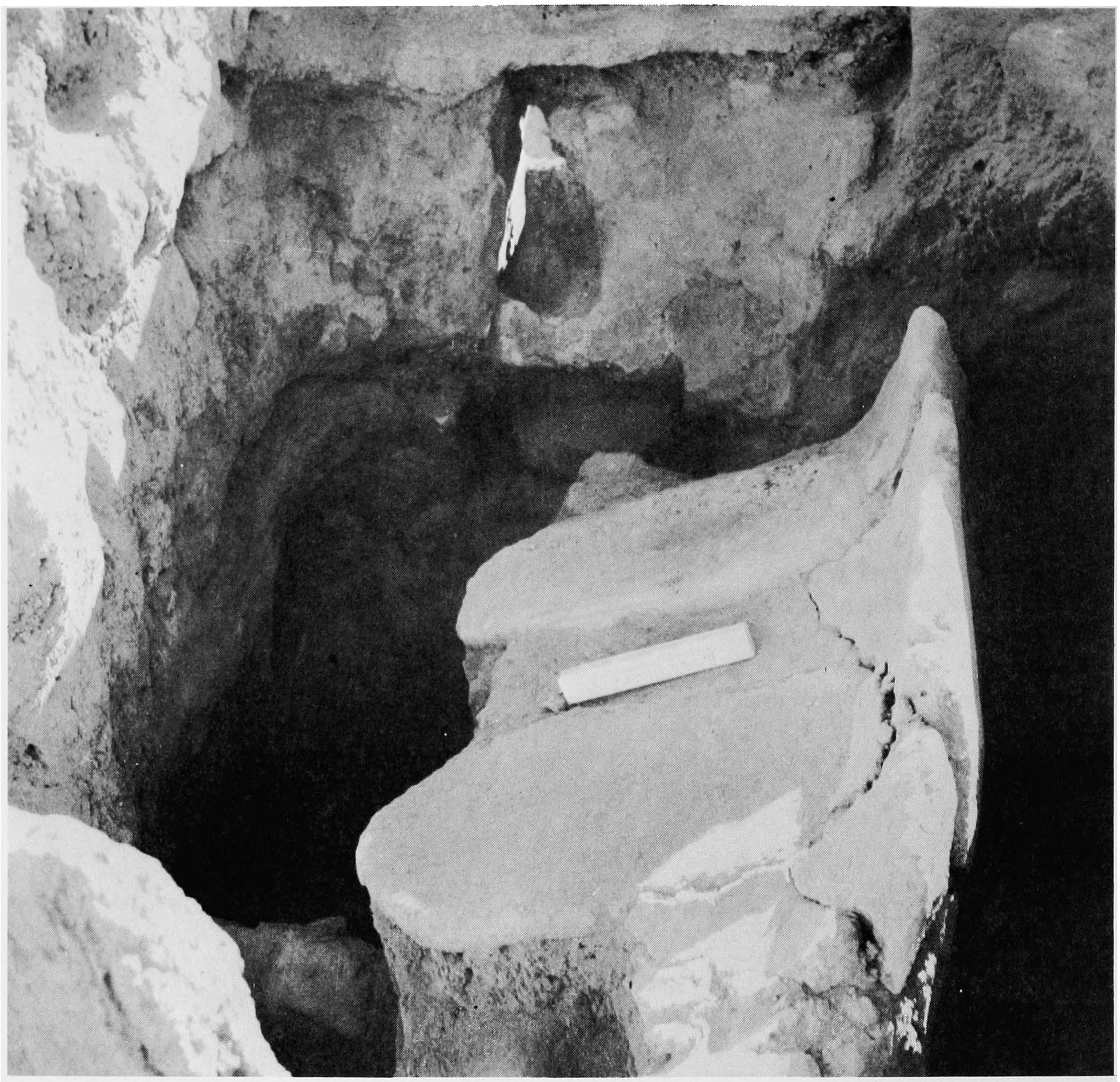
Area 9

On the northwest side of structure B 3-8 was an area of much refuse but with no walls. We think this may have been a courtyard, possibly corresponding to another possible courtyard south of wall B 2. Doorways from rooms 6 and 8 opened out to it and a window of room 7 overlooked it. Efforts to distinguish floors in the area were usually in vain, but just outside the doorway of room 8 the ground had been paved with mudbricks. Within the limits of our excavation the paved area sloped downward toward the northeast. Northwest of the room 8 door we exposed part of a ring-like discoloration with a total diameter of perhaps 3.50 m. At first we thought this was a circular wall but it showed none of the usual characteristics of bricks.

Area 11

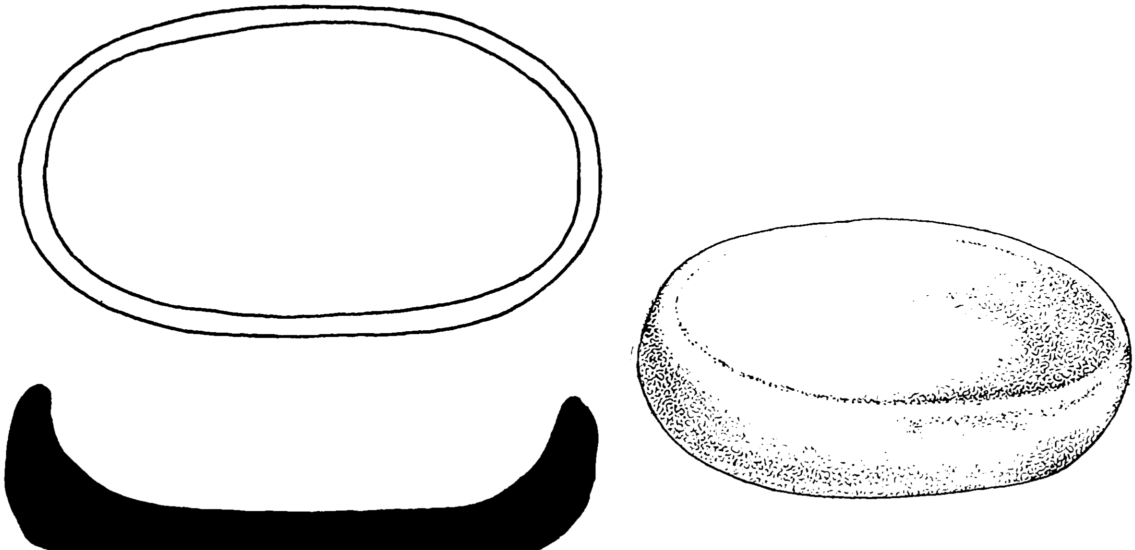
On the southwest side of structure B 3-8 was an alley approximately 1.5 m wide, separating B 3-8 from structure B 13, 14, 22. The alley was partly filled with a speckled brown soil which we took to be earth mixed with ashes. In the alley were quantities of broken pottery of the type Lalehzar Coarse and two or three fragments of buff ware, probably of the Bard Sir complex. The distinctive speckled earth continued around the west corner of structure B 3-8 and around the east corner of structure B 13, 14, 22 indicating an open passage linking these areas.

PLATE 4 - ROOM 8

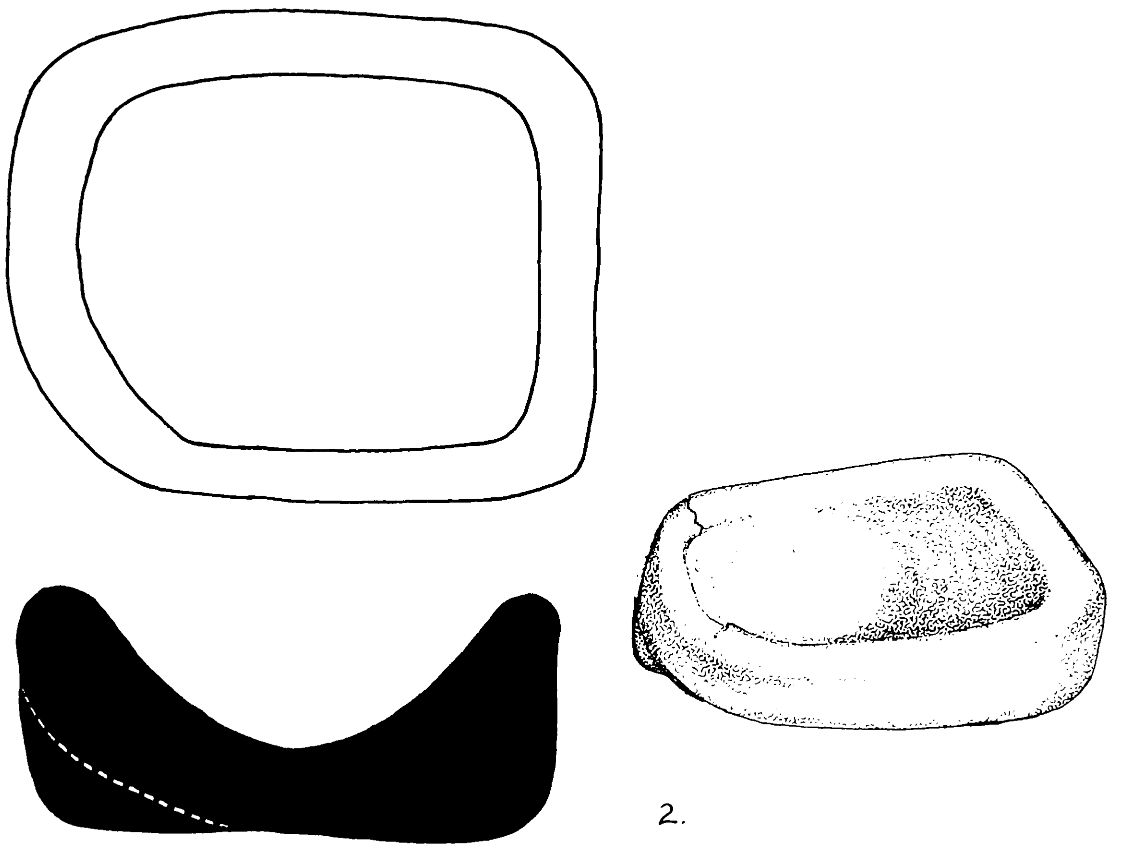


Upper: Saddle querns set at an angle in clay bench. Ground meal falls into clay boxes below. In upper center is a window blocked by a large sherd of Lalehzar Coarse ware. Lower left: Vessel (item 11) 26 cm high. Lower right: Various other objects on floor rearranged for photograph.

FIGURE 11 - OBJECTS ON FLOOR OF ROOM 8



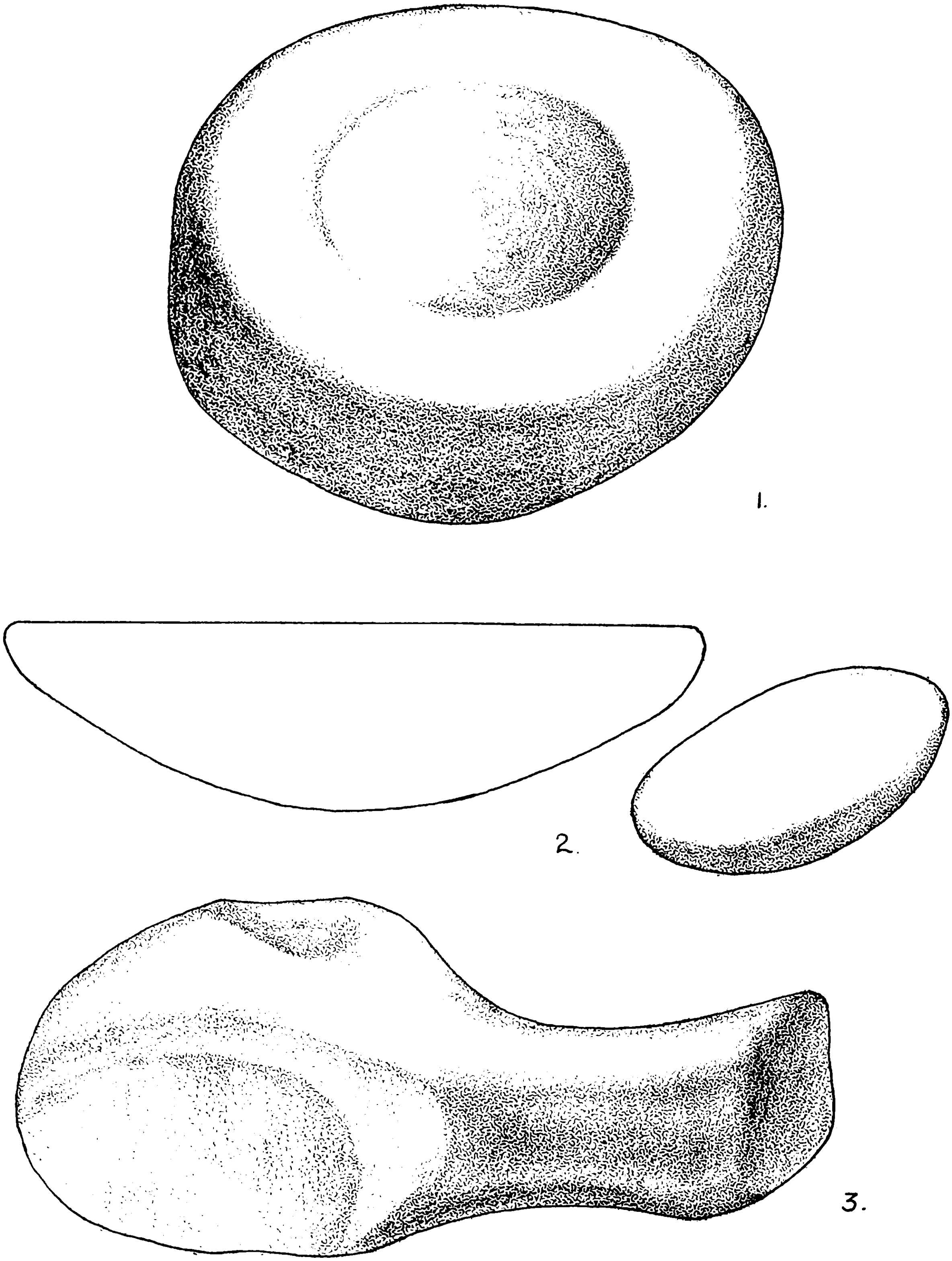
1.



2.

1: (item 17) stone mortar 34 x 22 x 10 cm 2: (item 2) stone mortar 33 x 28 x 15 cm

FIGURE 12 - OBJECTS ON FLOOR OF ROOM 8



1: (item 18) Stone mortar, 12 x 8 cm 2: (item 15) Saddle quern, 26 x 16 x 7 cm
3: (item 12) Pestle, 15 cm long

Structure B 13, 14, 22

Some parts of this building had been destroyed, while other parts were beyond the limits of our excavation. We were able to examine a large room, B 13, within which a later wall had been built to make room B 14. The northwest wall of the original room continued on to form one side of room B 22 (Fig.13). The building had been destroyed by fire.

The interior walls of room 13 had piers at regular intervals. Some of these corresponded to other piers on the outside of the walls and some did not. As usual, all walls were plastered inside and out. The interior of room 13 had red painted walls, but we neglected to determine whether the walls of room 14 had been painted as well. Everywhere on the floor were impressions and white silica residue of hassir matting. We do not know, however, whether the room was covered by a number of mats or a single large mat.

Room 13 had been completely burned out and the originally red-painted walls and piers were covered with black soot. Room 14 showed less burning and room 22 showed none at all. The floor of B 13 was covered with charcoal, some fragments being up to 7 cm in diameter. Lying below this was the aforementioned hassir matting. As we noted in room 3, the hassir matting itself had not been burned. We found it by flicking up a very thin layer of clay, and it then appeared as impressions in the clay below filled with white silica residue.

At one place on the floor were burned fragments of what may originally have been a basket. Nearby was a large stone mortar. There were also broken fragments of large flat rocks. Large cobbles lay here and there; three cobbles close to the skeleton of a child. The child lay directly on the floor. It may have perished during the fire which burned out the room, but we could detect no trace of calcination of the bones -- which were in unusually poor condition -- and it seems equally possible that the child was interred in the ruins after the fire. The age and sex of the skeleton have not yet been determined.

The south doorway of room 13 was essentially intact. One large brick of the course above the doorway had slipped down and lodged in the top of it. From this it was possible to calculate the original height of the door and to determine its shape (Pl,5).

Areas 16 and 17

The south doorways of rooms 13 and 14 looked out into an open area. The piers on the south side of room 13 suggested that it had been an exterior wall. The open area was covered with an ashy deposit, including numerous Lalehzar Coarse ware sherds, which resembled the ash in the alley between structures B 3-8 and B 13, 14, and 22. South of this were the walls of another building, B 18-19, of which very little remained.

Structure B 18, 19

Only the lowest courses of brick still remained, but within the rooms so outlined we were unable to find any floors. The rooms were quite small and reminiscent of the small rooms which made up the central core of Evett's structures in Areas D and F. Evett's small rooms were also notable for the lack of definite floors, and he suggests they may have been for storage. It is possible then that rooms 18 and 19 were the central core of a destroyed structure. A glance at the profile (Fig.17) suggests that this area was not deliberately leveled but was destroyed, possibly by natural causes begun by the wind. We recall that the much later pottery kiln already discussed was found at the same absolute

FIGURE 13 - ROOMS 13, 14, AND 22. AREA B.

Hassir Matting

Red Painted Walls

ITEM		ILLUSTRATION
1	Child's skeleton	Pl. 5
2	Cobble	Pl. 5
3	Cobble	Pl. 5
4	Cobble	Pl. 5
5	Mortar	Pl. 5
6	Basket fragments ?	Pl. 5, Fig. 14:6
7	Mano	Pl. 5
8	Stone slab fragment	Pl. 5
9	Stone slab fragment	Pl. 5
10	Stone slab fragments	Pl. 5
11	Stone slab fragments	Pl. 5
12	Stone slab fragment	Pl. 5
13	Mortar	Pl. 5
14	Mano in doorway	Pl. 5
15	South door	Pl. 5

Small objects are not shown in Figure 13.

FIGURE 13 - ROOMS 13, 14, and 22. AREA B.

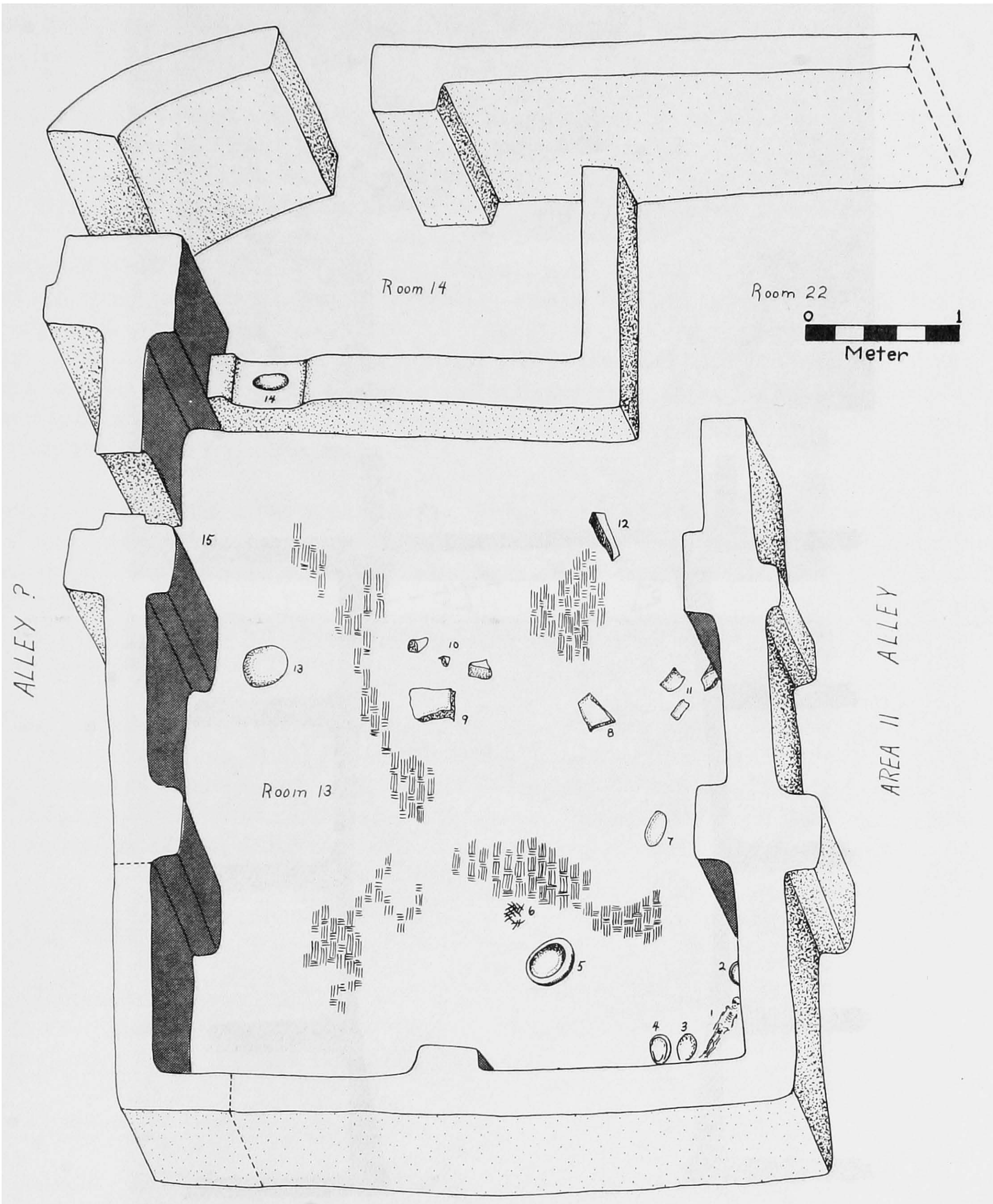
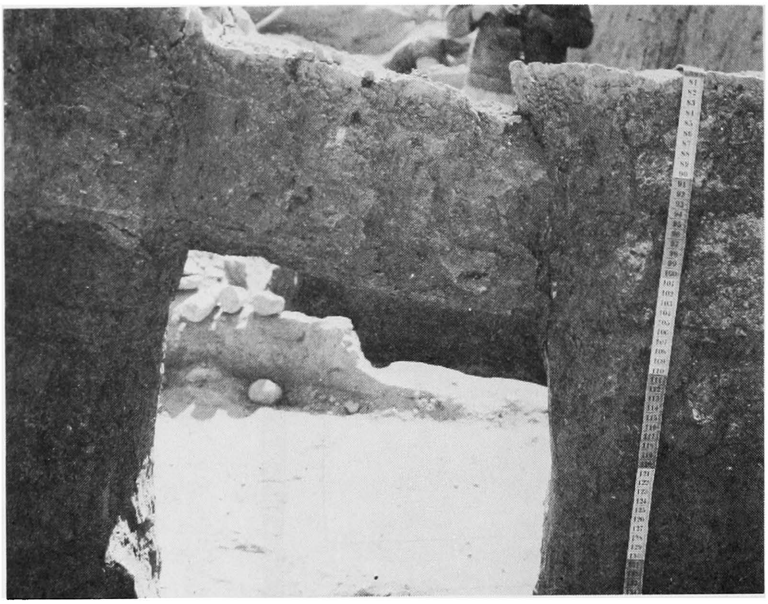
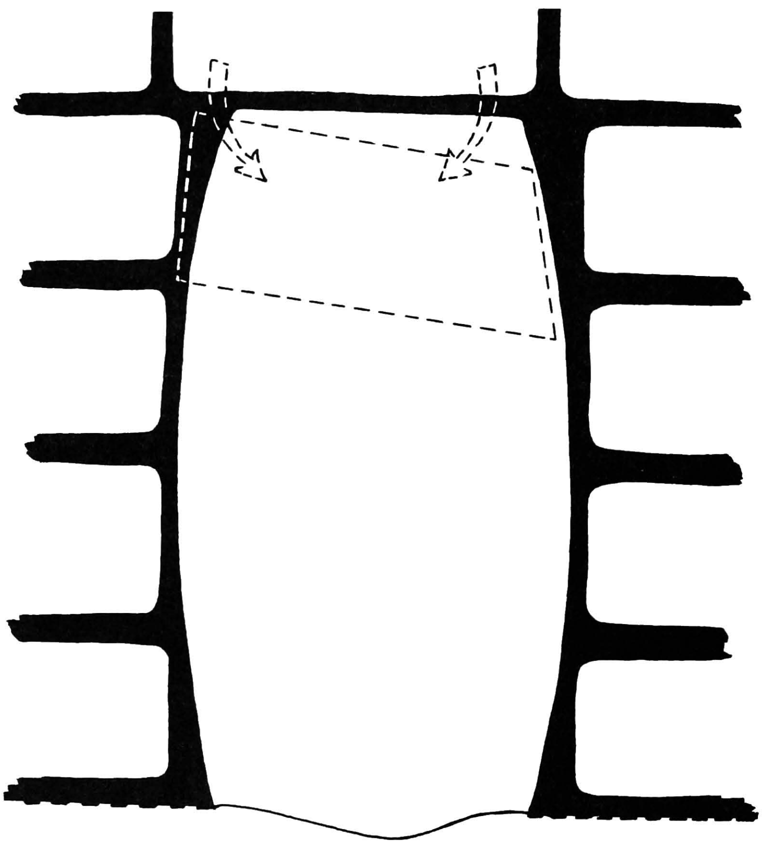


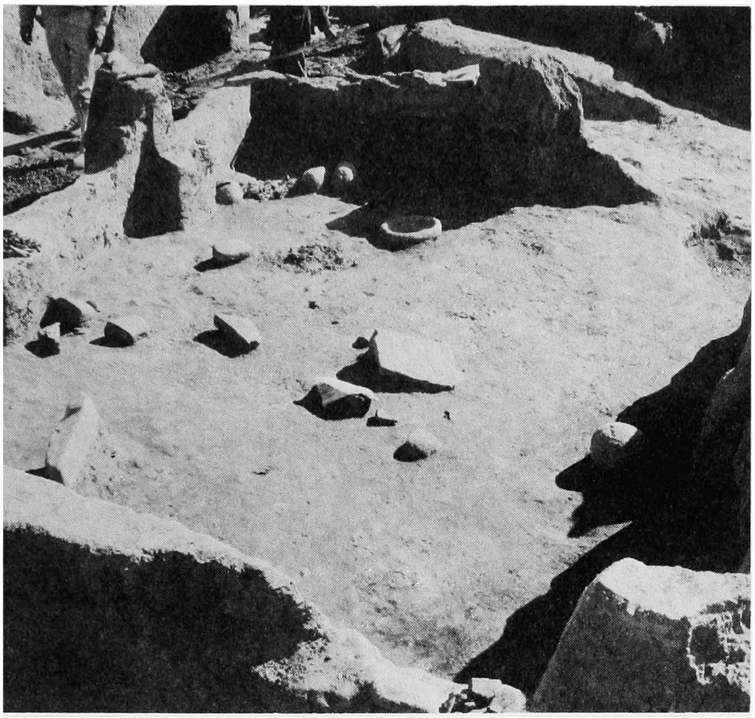
PLATE 5 SOUTH DOOR OF ROOM 13

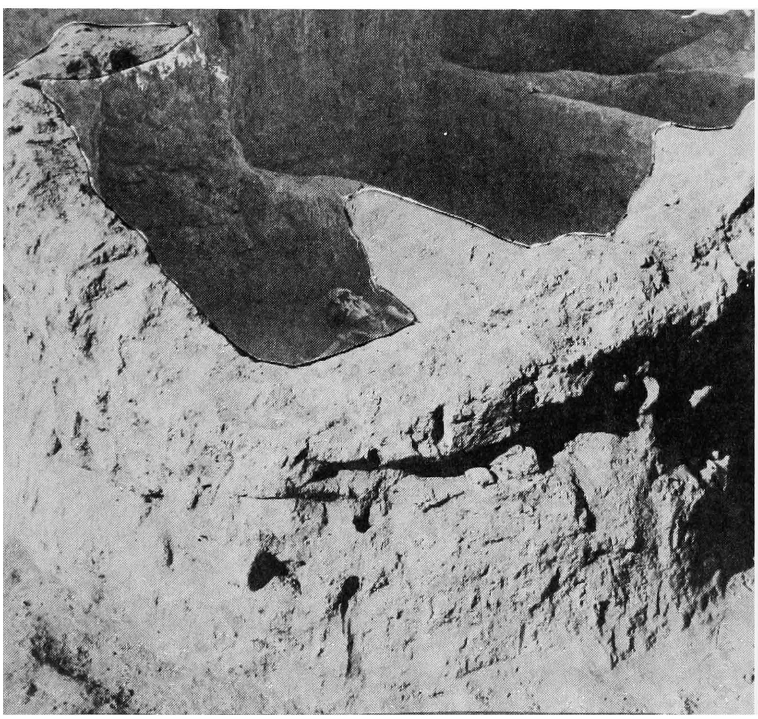




Doorways in structure B 3-8 were heavily plastered to a rounded appearance. In this doorway a large brick, presumably the lintel, slid down. For this reason we suppose the tops of the doorways to have been horizontal as in the drawing. The plaster was not removed from the surrounding bricks and the reconstruction may be slightly in error. The assumed brick sizes shown are typical.

PLATE 6 - ROOM 13 AND TOMB (Room 20)

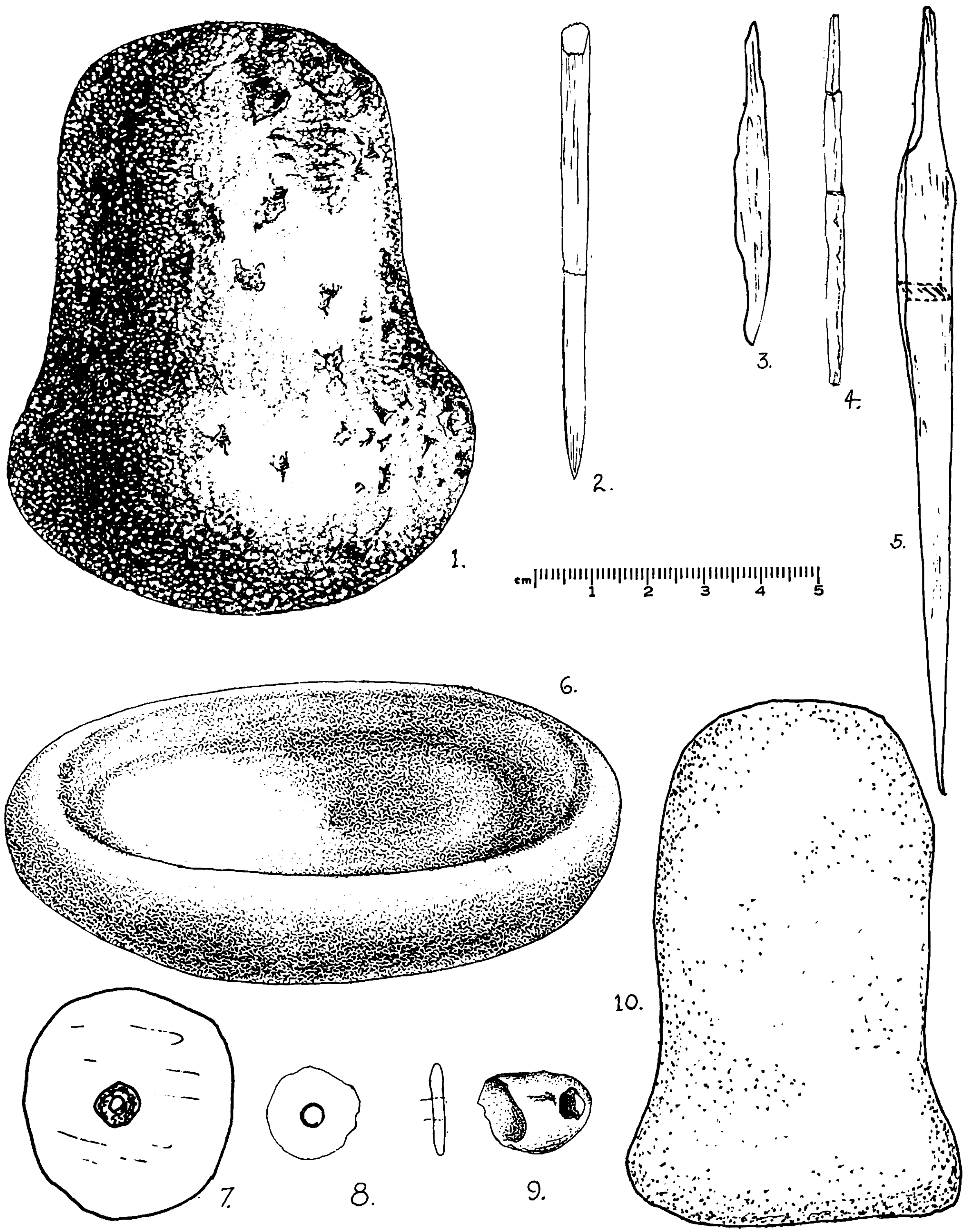




Upper: Room 13 To left of mortar is a mealing stone; in foreground are unworked stone slabs. The skeleton of a child is in far corner by rocks.

Lower: Tomb (Room 20) Showing rounded corners, but plaster has not yet been removed from bricks. Bricked up entrance in background. Picture is misleading in that the tomb was <u>not</u> connected with any other walls.

FIGURE 14 OBJECTS FROM FLOOR OF ROOMS 13 AND 14.



Room 13: 1: (167) Pestle 2: (171) Polished bone awl or pin 3: (170) Copper pin 4: (173) Copper pin 5: (172) Copper object with tang and square cross section 6: (no number) Stone mortar 40 x 28 x 14 cm 7: (168) Perforated sherd disc 8: (169) Shell (?) bead 9: (218) Shell bead. Room 14: 10: (106) Stone pestle

level as these prehistoric buildings. Apparently there had been earlier disturbances in this part of the mound thousands of years before the depredations of the fertilizer diggers.

Structure B 20

Beyond the last was a small isolated room, unique in being attached to no other room and also unique in having somewhat rounded corners doming inward. On the west side was a bricked up entrance. On the floor inside was an adult male skeleton and a complete vase probably of calcite (Fig.16; Pl.6 lower). The unique features of this room indicate that it was not part of a dwelling but was deliberately constructed as a tomb. Removing the plaster from the bricks turned out to be more difficult than expected, and it is hoped that a more complete examination can be made next season. Around the outside of the tomb at the base was evidence of bricks which may have been put around it or might even be part of a small platform on which the tomb was situated. Unfortunately our season came to an end before this could be investigated.

Later Walls and Rooms

Resting upon the ruins of structures B 3-8 were several later walls and parts of three later rooms. These lay at different elevations above the earlier buildings and are shown as dashed lines in Figure 4. Of these, walls A, B, and C originated 60 cm above the floor of room B 13, and wall D 70 cm above. In room 15 lying between walls A and B were two pestles lying side by side on the floor, both of types common in ruins of the buildings below.

The floors of upper rooms F and G were 50 cm above the floors of the rooms below them. In the southwest corner of upper room F was a hearth (Pl.7 upper) of the kind found by Evett in several instances. Within a ridge of clay were successive layers of very smooth, hard baked clay, as if the floor of the hearth had been constantly renewed. When these layers were removed,many sherds of Lalehzar Coarse ware were discovered at the bottom of the hearth. It may be suggested that these strange hearths were used for baking bread. The procedure may have been analogous, although the shape of the hearths is not, to a type of oven described by Wulff[1] as recently used by nomads of north and northeast Iran:

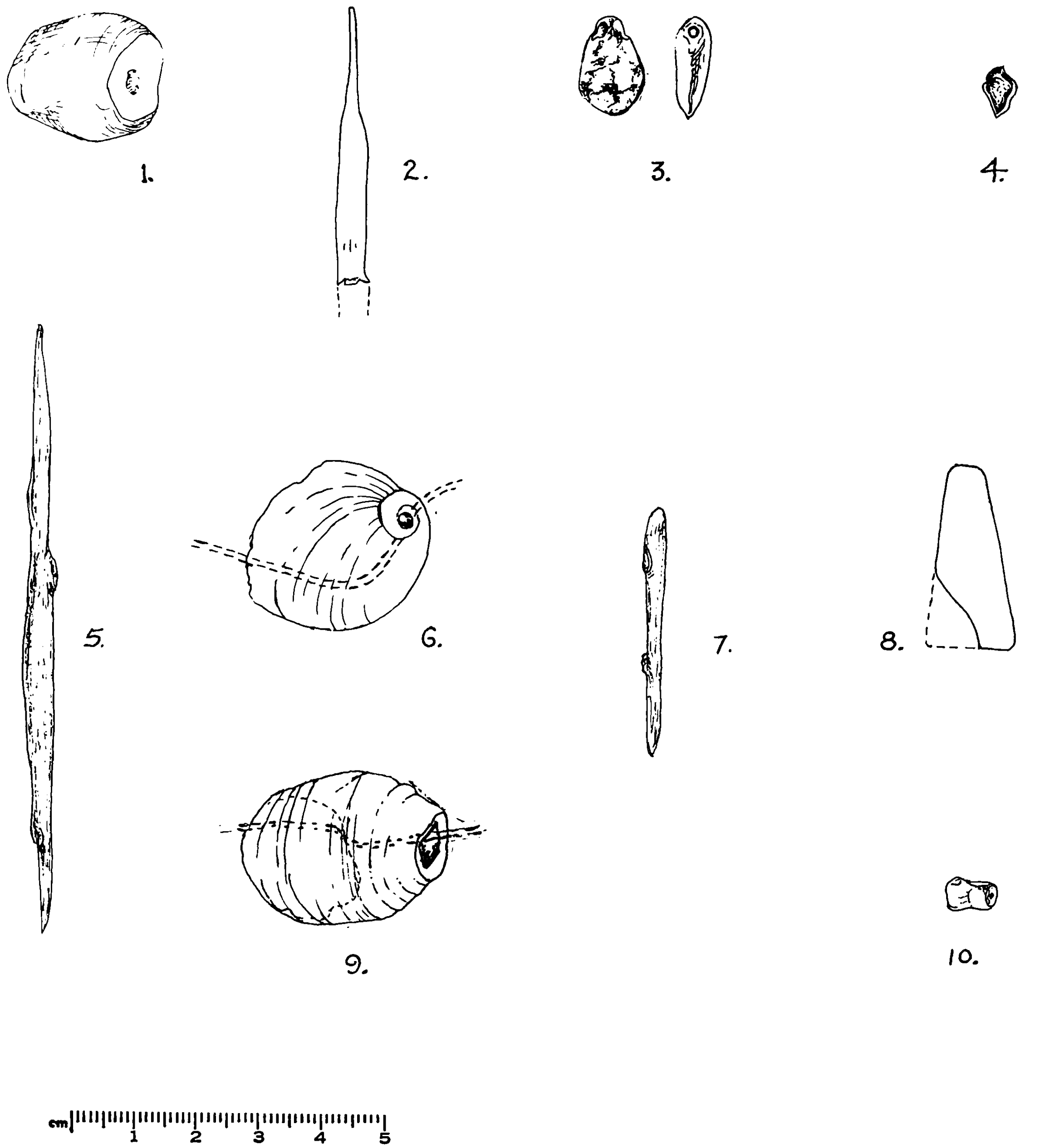
> "A fire is kept for awhile in a clay line hole in the ground. When its walls are sufficiently hot the embers are taken out with an iron shovel, a flattened cake of dough is placed in the bottom of the hole, a steel plate or an earthenware dish is placed over it, and the whole is covered with the hot embers. After three to five minutes the bread is baked."

We may have here before 4000 B.C. the earliest known form of bread baking device. It is also possible that the sherds found at the bottom of the hearth provided insulation to hold in the heat. This, with other examples given by Wulff, could be arranged in a typological sequence ending with the modern types of Persian bread making ovens. It is curious why these very smooth fired clay surfaces had to be constantly renewed. Whether new clay has some of the qualities of Teflon can probably be determined by experiment.

In both upper rooms F and G were quantities of Lalehzar Coarse ware, but in room F was also a large sherd of Bard Sir Plain. It is doubtful if much time elapsed between the

1 Hans E. Wulff, The Traditional Crafts of Persia, Cambridge, M.I.T. Press, p. 292, 1966.

FIGURE 15 OBJECTS FROM FLOORS OF AREAS 9, 10, 17, ROOM 18, AREA 19, ROOM 21 AND 2nd UPPER ROOM.



1: (115) partly drilled marble (calcite) bead, Area 9. 2: (114) bone awl fragment, Area 9. 3: (137) turquoise pendant (scale 1 1/2x), Area 10. 4: (219) turquoise bead (scale 1 1/2x), Area 17. 5: (262) double pointed copper pin, Room 18. 6: (197) marine shell bead, Area 19. 7: (198) copper pin, Area 19. 8: (200) clay object, Area 19. Not shown is a fragment of galena from Area 19. 9: (261) marine shell bead, Room 21. 10: (136) two copper beads oxidized together from 2nd upper room.

FIGURE 16 - CUTAWAY DIAGRAM OF ADULT MALE SKELETON AND CALCITE (?) VESSEL IN TOMB (Room 20). THE ENTRANCE WAS BRICKED UP, BUT THE BRICKS OF THE TOMB ITSELF ARE NOT SHOWN.

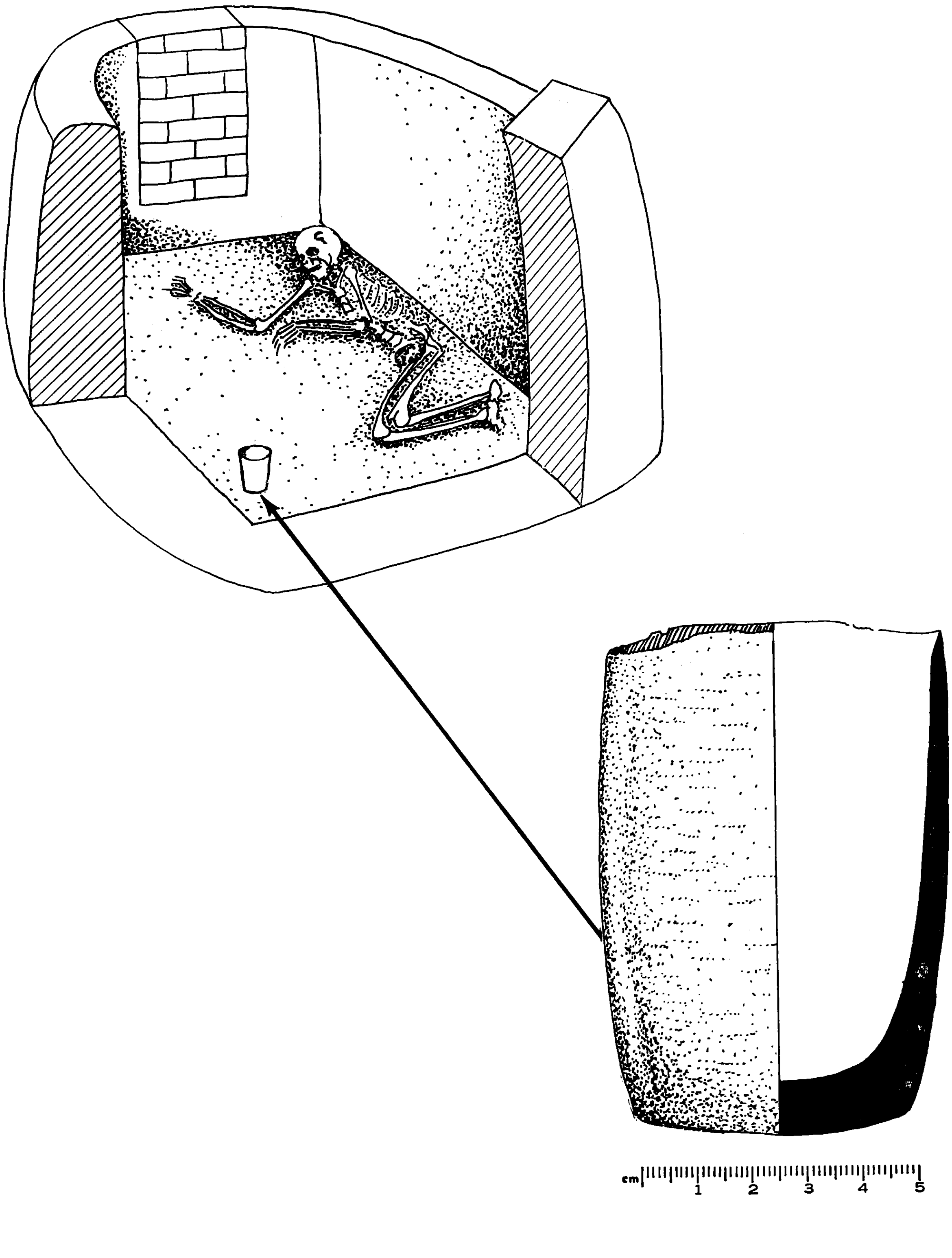
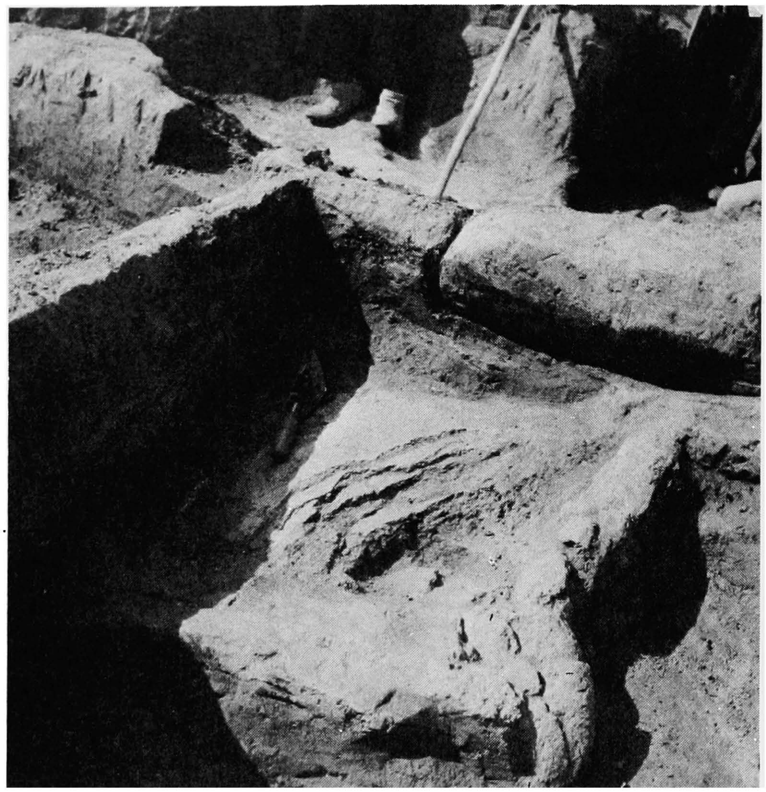
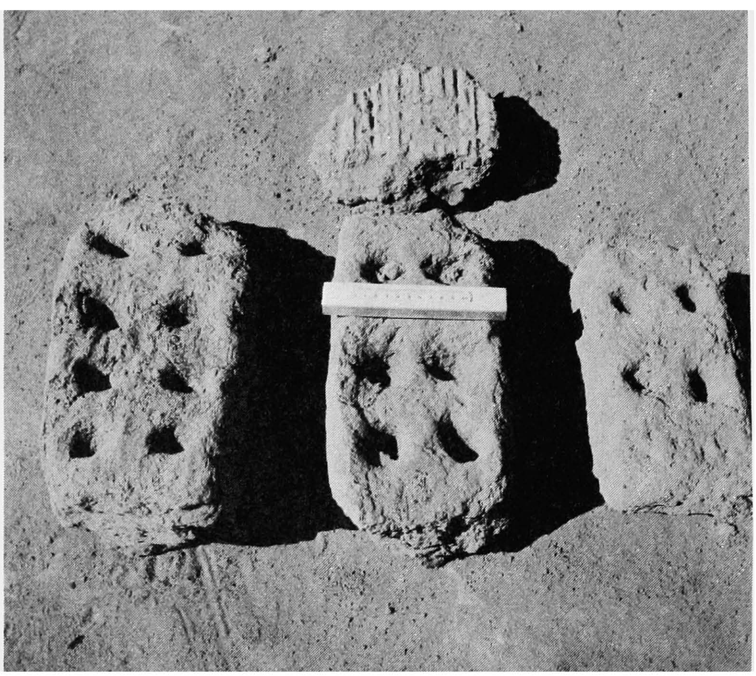


PLATE 7 HEARTH IN FIRST UPPER ROOM, ROOF PLASTER AND BRICKS FROM VARIOUS LOCALITIES IN AREA B.

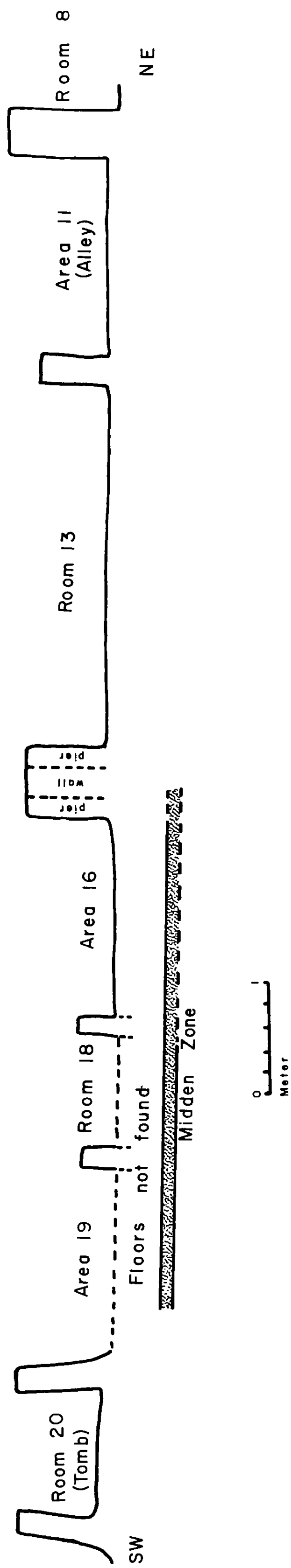




Upper: Successive layers of very smooth fired clay surfaces suggest hearth was used for baking bread.

Lower: All roof plaster showed parallel impressions of slender poles. Largest bricks showed eight depressions, smallest only four.

FIGURE 17 - PROFILE OF PART OF AREA B



destruction of the earlier buildings by fire and the rebuilding of later buildings on the site. While we have only a limited number of artifacts from the later rooms, they are in no way different from those found in the earlier buildings.

A Note on the Bricks used in Area B

As previously stated, all bricks were handmade, straw tempered, and none appeared to have been intentionally fired. Quite common was the occurrence of two rows of deep depressions on the underside of bricks, 4-8 depending on the size of the bricks (Pl.7, lower). Similar depressions occurred in bricks of Sialk II,[1] but those illustrated have only four depressions. The Sialk bricks are stubbier, rounder, and of more uniform size than the Iblis bricks. Moreover at Iblis the depressions are invariably on the underside of the brick, while at Sialk they can be up, down, or face outward.

In Fig. 18 are offered some histograms of bricks measured in room B 7 which show that brick width and thickness are more uniform than brick length. Also shown are some details of brickwork in room 7 including both lightly plastered and heavily plastered doorways. The latter thereby are given rounded bottoms. The same illustration also shows the curious habit of placing manos in doorways, and windowsills, also shown in Figs. 5 and 13.

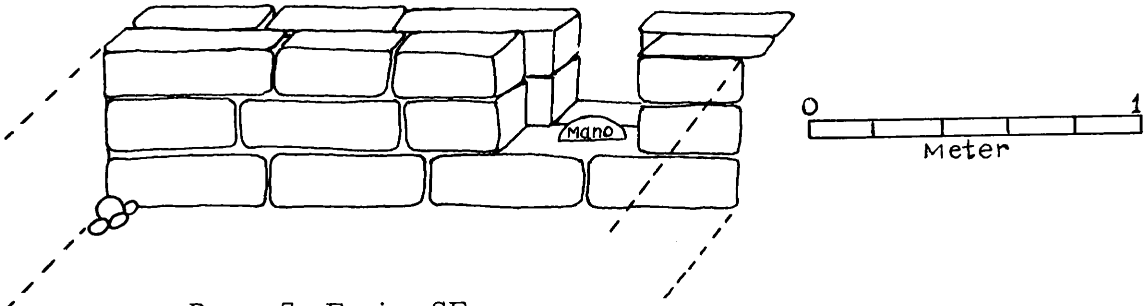
The main observation to be drawn from the sizes of the bricks in room 7 is their great variability, greater even than the handmade bricks of Sialk II. To add to our data, one measured brick in room B 13 was 13 cm high, 24 cm wide, 37 cm long; another was 13 cm high, 24 cm wide and 32 cm long. These dimensions are quite close to the means of the histograms of the bricks in room 7. The bricks of the later walls and upper rooms are not far from these means, except that walls B and D are narrower and the bricks of wall D are usually but not always shorter. Wall D bricks are 13 cm high, 17 cm wide, and range from 20-40 cm long. Wall B bricks are 13 cm high, 13 cm wide, and average 35 cm long. Wall C bricks are 13 cm high, 30 cm wide and 35 cm long.

Conclusion

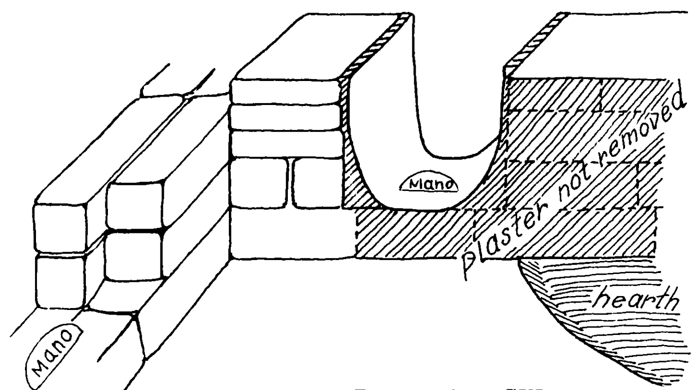
At the beginning of the excavations in Area B we had cleared hundreds of Lalehzar Coarse ware sherds out of several rooms without finding any of the Bard Sir types, and we believed that all the structures in the area (except the pottery kiln) belonged to the Iblis O period as proposed by Chase. Then we found a Bard Sir Painted sherd in the alley between B 3-8 and B 13, 14, 22. In the meantime a large Bard Sir Plain sherd occurred on the floor of upper room F. It will be recalled that during the excavation of B 18, 19 we were unable to find any floors of those rooms. Digging deeper at this point we encountered a midden zone about 10 cm thick extending under these rooms and under room B 13 and which may connect with a midden of the same depth and thickness noticed near the juncture of long wall B 2 and room B 4. In our limited investigation of this midden we found three more Bard Sir sherds along with a multitude of Lalehzar Coarse Ware. We must conclude, therefore, that some Bard Sir sherds were already present during the initial occupation of Area B. Both the earlier and later buildings of Area B must by definition belong to Iblis I. We suspect that Area B is relatively early within Iblis I whereas Area E excavated by Chase is relatively later within the same period. For Area B we have two C^{14} determinations: 4410 $\pm$ 165 years (GX 867) from room B 13 and 3674 $\pm$ 110 (GX 868) from room B 5.

1 Ghirshman, Roman, "Fouilles de Sialk, Près de Kashan," Musée du Louvre, Serie Archeologique: Tome IV. Paul Geuthner, Paris, Pl. LVIII, 1938.

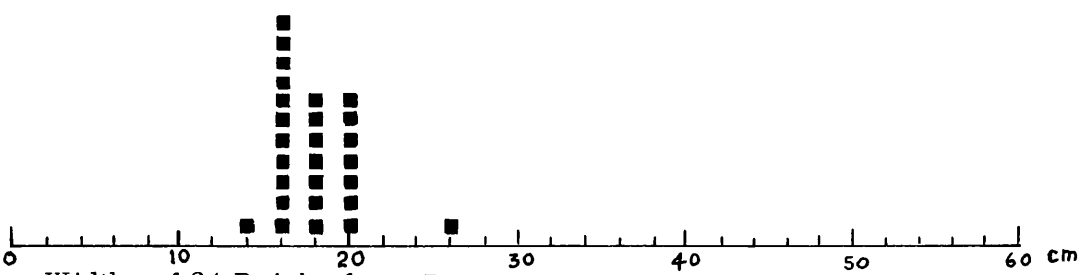
FIGURE 18 - BRICKS OF AREA B, ROOM 7



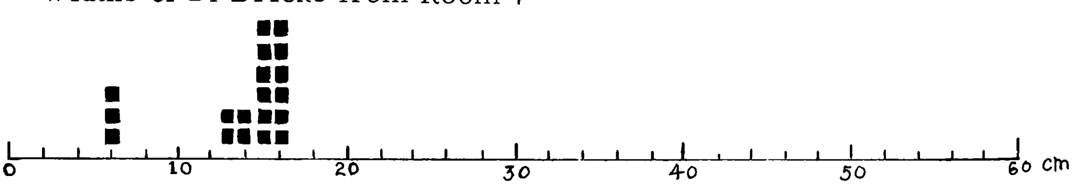
Room 7, Facing SE



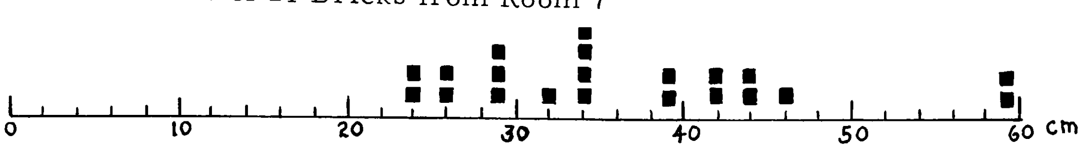
Room 7, Facing SW



Widths of 24 Bricks from Room 7



Thicknesses of 21 Bricks from Room 7



Lengths of 24 Bricks from Room 7

Of these we accept the former but reject the latter; indeed it is later than our two C^{14} determinations for Iblis II and therefore could not possibly apply to room 5 in Area B[1].

In summary, Area B shows first an Iblis I midden over which were put several buildings of sundried brick. Within this area we have two possible alleys and several possible courtyards. Subsequently the two main buildings in Area B were destroyed by fire, perhaps simultaneously. Within a short time the area was rebuilt. Fallen debris, especially fired roof plaster, already filled part of the ruined buildings. On these was created a fairly level surface 50-60 cm higher upon which the later buildings were placed.

Much more work can be done here -- several of our walls continue into the northwest margin of the excavation. Some meters beyond is a small area dug out for fertilizer, which we cleaned up finding additional Iblis I walls and debris.

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1 See discussion of C^{14} determinations in Paper V, by Caldwell.

XIV

THE PREHISTORIC VERTEBRATE FAUNA OF TAL-I-IBLIS

Sándor Bökönyi

During the 1966 excavations of the prehistoric settlement of Tal-i-Iblis in the Bard Sir Valley, Kerman, under the direction of Dr. J.R. Caldwell, many animal remains were uncovered. Unfortunately, the bone material was extremely fragmentary and contained no whole skeletons, skulls or mandibles, and only rarely long bones. Most of the 1008 bones which could be identified came from Iblis I, the oldest period presently known at the site, and characterized by the Bard Sir ceramic complex, ca. 4400-4100 B.C. This is probably contemporaneous with Ubaid 3 in southern Mesopotamia (and with Sialk II in eastern Iran. Ed.). Two other periods which yielded some bone material in the 1966 season were Iblis II (Iblis ceramic complex) ca. 4000 B.C. and Iblis IV (Aliabad ceramic complex) with a beginning date of ca. 3600 B.C. and probably contemporary with early Uruk or Warkan in southern Mesopotamia.

The distribution of the identified material according to period and species is given in Table 1.

TABLE 1 Distribution of Identified Material According to Period and Species

	Iblis I (Bard Sir)	Iblis II (Iblis)	Iblis IV (Aliabad)	Total
Turtle	-	1	-	1
Vulture	1			1
Lion	1			1
Domestic Dog	19	4	-	23
Horse	16		1	17
Onager	22	8	18	48
Deer (?)	1			1
Gazelle	48	3	-	51
Sheep	36	1	3	40
Goat	34	4	7	45
Sheep or Goat	567	58	37	662
Aurochs	37	7		44
Domestic Cattle	49	15	3	67
Man	7	-	-	7
Total	838	101	69	1008

Despite the fact that only half of the bone material uncovered in 1966 was available for study, the remainder being in Tehran, the sample clearly shows the environment to have been desert or semi-desert just as today. The deer is the only possible species in the sample which would favor a forest biome, but its existence is questioned on the faunal list because it is identified only from a fragment of a lower molar tooth. The aurochs (Bos primigenius), wild ancestor of domestic cattle, is an animal of the forest steppe and all other species favor or at least can live in a dry environment. Other evidence of the aridity of the Bard Sir Valley during these early settlements is the absence of wild or domestic pigs, who also favor a more moist environment. The one fragment of turtle carapace was too small to identify. The only bird bone, a fragment of an interior phalanx I, is from a vulture, probably the griffon vulture (Gyps fulvus), quite common in southwest Asia.

The only bone of a lion (Panthera leo) is a burned phalanx II, of the same size as that of the female lion in the collections of the Hungarian National Museum (Pl. 1). This occurrence is not surprising: the Persian lion has been well known since prehistoric times.

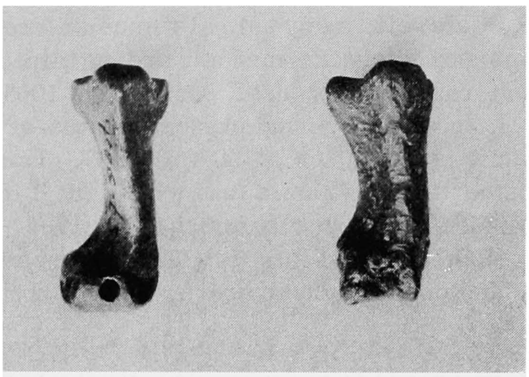

Plate 1. Lion phalanx

Most of the dogs (Canis familiaris) at Tal-i-Iblis are small, but among them are some medium sized individuals as is generally the situation in the Neolithic sites of Europe and southwest Asia. The length of the lower premolar rows is 35, 36 and 39 mm. That of the lower molar row is 35 mm. The lower M_1 is 20 and 22.5 mm long. On one mandible from the Iblis I period and on two from the Iblis II period,marks of advanced domestication can be seen: the molar and premolar rows have a convexity to the lateral side and their aboral parts curve upward. The P_2's stand distorted in their alveoles and slip to

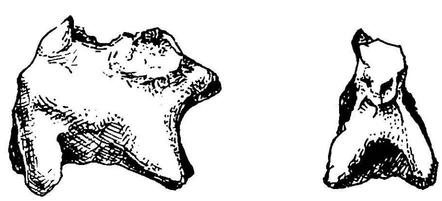

Figure 1. Pottery figurine probably representing a curly-tailed dog. Iblis I period.

the lateral side of their P_1's (Pl.2). All these details reflect the phenomenon that the skull, particularly the facial part, shortens with domestication. This is followed only later by reduction of the teeth. Therefore, in the short mandibles the big teeth do not have enough space.

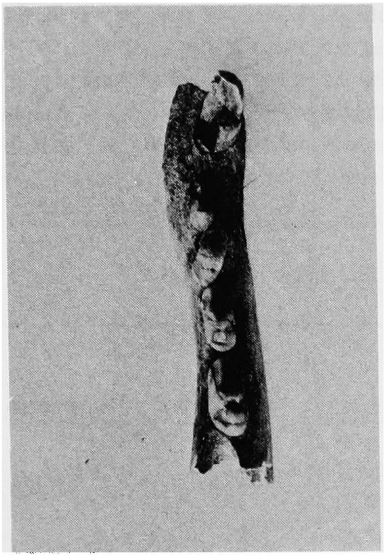

Plate 2. Fragment of dog mandible.

Of the two equids at the site, the onager (Equus hemionus) is most common. It is represented by a skull fragment, two upper molars, some mandible fragments and many extremity bones. Except for an incisor of a subadult animal and the upper molar of a senile one, all the bones are from adult individuals. On the basis of the enamel of the upper molar and the measures of the extremity bones, they can be separated from the true horses. Unfortunately, there were no complete long bones returned in the sample; therefore, the size of the animals cannot be exactly determined. They are probably in the upper half of the size variation of the Persian onager.

TABLE 2 - Measurements for Onagers (in millimeters)

	Proximal Breadth	Distal Breadth	Proximal Diameter	Distal Diameter	Period
Radius	75 +		45 +		Iblis II
Metacarpus	44.5	-	32		Iblis I
Metacarpus	-	41		28.5	Iblis IV
Metatarsus	40.5	37.5	37.5	29 +	Iblis IV
Metatarsus		40		32	Iblis I

The 17 remains of true horses (Equus caballus) belong to two individuals. The 3 upper premolars and 13 upper molar fragments of the Iblis I period come from one animal, and the femur fragment of the Iblis IV period from a second. The teeth have a short protoconus; their enamel has the simple pattern typical of horses of the oriental type.

Fundamentally they resemble Duerst's Anau horse and Amschler's Shah Tepe horses.[1] It cannot be determined whether they were domestic or wild animals, although their antiquity suggests a wild condition.

It is interesting that the great majority of gazelle bones (Gazella sp.) came from the Iblis I period, while from the Iblis II period there were only 3 bones of one individual. No gazelle remains were found in Iblis IV. If we had a better sample we could come to the conclusion that hunting declined during the life of the settlement. Unfortunately, the gazelle bones are very fragmentary and there is only a fragment of a horn core. Most of the bones come from adult animals; only 4 bones are from subadult and mature individuals. There are no remains of juvenile or senile gazelles.

TABLE 3 Measurements on Gazelles (in millimeters). All Iblis I Period.

	Distal Breadth	Distal Diameter		Length	Breadth	Diameter
Humerus	27	24	Astragalus	26	17	15
Tibia	22	18	Astragalus	27.5	17	-
			Astragalus	26	16.5	15
			Astragalus	27 +	15	13
			Calcaneus	50	16	18

As in the settlements of southwest Asia in general, the bones of sheep (Ovis) and goat (Capra) are the most common at Tal-i-Iblis. The morphological similarity of the bones

Figure 2. Pottery figurines believed to represent sheep (left) and goat (right).

1 Duerst, J. U., "Animal Remains from the Excavations at Anau and the Horse of Anau in its Relation to the Races of Domestic Horses." In: Raphael Pumpelly, Recent Explorations in Turkestan. Smithsonian Contributions to Knowledge, Vol. 2, Washington, pp. 339-442, 1908. Also, Amschler, J. W., "Tierreste der Ausgrabungen von dem Grossen Konigshugel Shah Tepe," in Nordiran. Scientific Expedition to the Northwest Province of China under the Leadership of Dr. Sander Hedin, Vol. 9, pp. 35-129, 1943.

of these small ruminants is well known, and because modern works[1] dealing with the osteological differences of sheep and goat -- with some exceptions -- indicate only the whole bones as surely separable, the Tal-i-Iblis material proved to be a problem. Therefore from 747 bones of small ruminants only 85 could be specifically identified: 40 sheep and 45 goat. This sheep/goat proportion would be unusual in Europe, where sheep are always more common than goats, but in the hilly-mountainous regions of southwest Asis the proportion of goats is generally greater than that of sheep. In age distribution there are some differences between the two species. The actual ratio of young to adults is misleading since the identifiable bones included many young animals and a few senile individuals.

TABLE 4 Age Distribution of Sheep and Goat

	Juvenile	Subadult	Adult	Mature	Undeterminable
Sheep	-	3	27	-	10
Goat	2	4	23	4	12

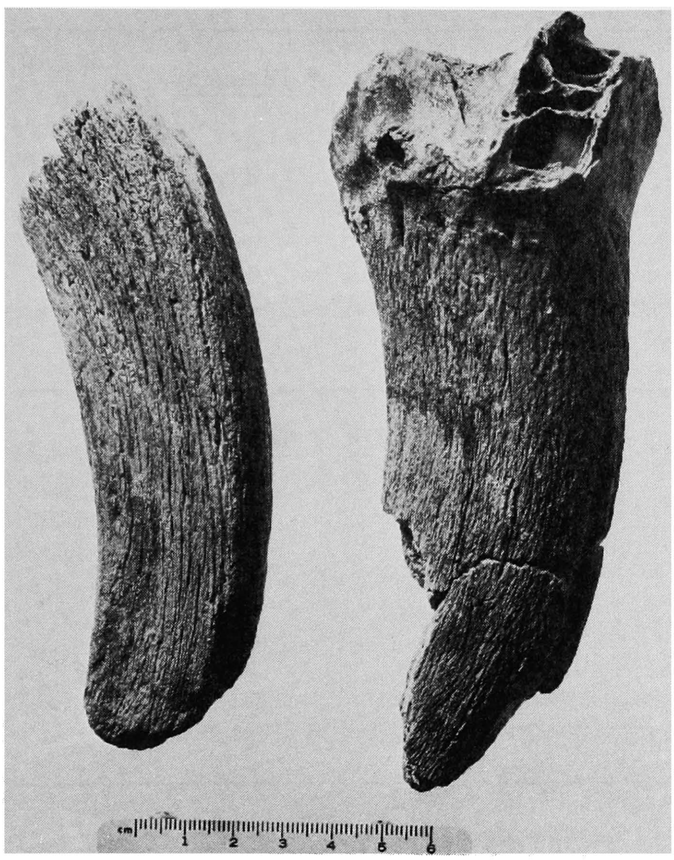

Plate 3. Sheep horn cores.

Among the sheep bones there are two horn cores and several horn core fragments, all from the Iblis I period. Both horn cores are long, thick, twisted, have a triangular cross section at their base, and run in the shape of a semicircle. These characteristics indicate that they belong to the so-called "Copper Sheep" type, which was thought by earlier authors to be a separate group, but which lately has proved to be the male of a large, variable group. These horn cores resemble those of the wild sheep but are a little smaller. One of the horn core fragments is also of the same type but the others are too small for identification. All the identifiable horn cores at Tal-i-Iblis are those of rams. The females were evidently hornless, as has been usual since the beginning of the Neolithic.[2] The Iblis sheep were quite small, within the size variation of prehistoric primitive sheep.

1 Gromova, V., "Osteologiceskie otlicia rodov Capra (kozly) i Ovis (barany)." Trudy komm. po cetwert. period. X, 1. Moscow 1953. Also, Boessneck, J. Muller, H.-H. -Teichert, M., "Osteologische Unterscheidungsmerkmale zwischen Schaf (Ovis aries Linne) und Ziege (Capra hircus Linne)." Kuhn-Archiv. Vol. 78, Nyphen, pp. 3-129, 1964.

2 Bokonyi, S., "The Vertebrate Fauna of the Neolithic Settlement at Maroslele-Pana." Arch. Ert. 91, pp. 87-93, 1964.

All the measured bones are from the Iblis I period with the exception of a second calcaneus from the Iblis IV period.

TABLE 5 Measurements on Sheep (in millimeters)

Horn core - greater diameter 59, smaller diameter 44

	Proximal Breadth	Distal Breadth	Proximal Diameter	Distal Diameter
Humerus	-	34	-	30
Humerus	-	30.5		28
Radius	30	-	17	-
Radius	-	29	-	21
Metacarpus	-	24.7	-	16.3
Metacarpus	-	24	-	16

	Length	Breadth	Diameter
Astragalus	29	19	16
Astragalus	30.3	21	17.5
Astragalus	27.5	18.5	-
Astragalus	31	20	-
Astragalus	30	20	17
Astragalus	28	19	16
Astragalus	28	19	16

	Length	Breadth	Diameter
Calcaneus	61.5	-	25.5
Calcaneus	54	18.5	22
Calcaneus	62.3	21.5	24.5
Calcaneus	52	19	20
Calcaneus	56.5	20.5	24.5
Calcaneus	53	19	21
Calcaneus	57	-	22
Calcaneus	59	20	21.5

Among the bones of the goat there are 6 horn core fragments and two pieces of skulls. All the horn core fragments are from very twisted horns -- doubtless of domesticated animals. The degree of twisting is much higher than that of the European prehistoric goats (a general phenomenon in southwest Asia). The extremity bones usually indicate small animals, but include some larger specimens, evidently from males.

TABLE 6 Measurements on Goats (in millimeters)

Horn core - greater diameter 27.5, smaller diameter 17.5 - Iblis I

	Breadth of the Column	Breadth of the Distal End	Diameter of the Distal End	Period
Scapula	19	29	18.5	Iblis I
Scapula	19.5	35 +	24 +	Iblis I
Scapula	21.5	35 +		Iblis I
Scapula	23.5	35 +	23.5	Iblis I

	Length	Proximal Breadth	Minimum Breadth	Distal Breadth	Period
Humerus			-	29.5	Iblis I
Radius		28	17.5		Iblis IV
Radius	-			33	Iblis I
Metacarpus		-		28 +	Iblis I
Metacarpus			-	30 +	Iblis I
Metatarsus	115 +	-	-	27.5	Iblis IV
Metatarsus		22	14		Iblis IV
Metatarsus			-	24 +	Iblis I

	Proximal Diameter	Minimum Diameter	Distal Diameter	Period
Humerus	-		26	Iblis I
Radius	15 +	-		Iblis IV
Radius			25	Iblis I
Metacarpus	-		16.5	Iblis I
Metacarpus	-	-	17.5	Iblis I
Metatarsus	-	10.8	18 +	Iblis IV
Metatarsus	20.5	-	-	Iblis IV
Metatarsus		-	15 +	Iblis I

	Length	Breadth	Diameter	Period
Astragalus	30 +	20 +	16 +	Iblis I
Astragalus	27.5	21	17	Iblis I

All the aurochs bones (Bos primigenius) came from adult animals. There were 22 fragments of the horn core of one large bull. Unfortunately they are fragmentary; therefore the exact form of the horn core cannot be determined. However, it would be interesting to see whether it had the closed shape of the European variety or the open one of Egyptian wild cattle. Only the measurements of two tibiae could be taken. (Table 7)

TABLE 7 Measurements on Wild Cattle (in millimeters)

	Distal Breadth	Distal Diameter	Period
Tibia	68	54	Iblis II
Tibia	80	61	Iblis II

Most of the cattle bones of Tal-i-Iblis came from adult animals. There are no remains in the sample of young or old animals; nor were horn cores or larger skull fragments present. Therefore nothing can be said about the type of the Tal-i-Iblis cattle. While most

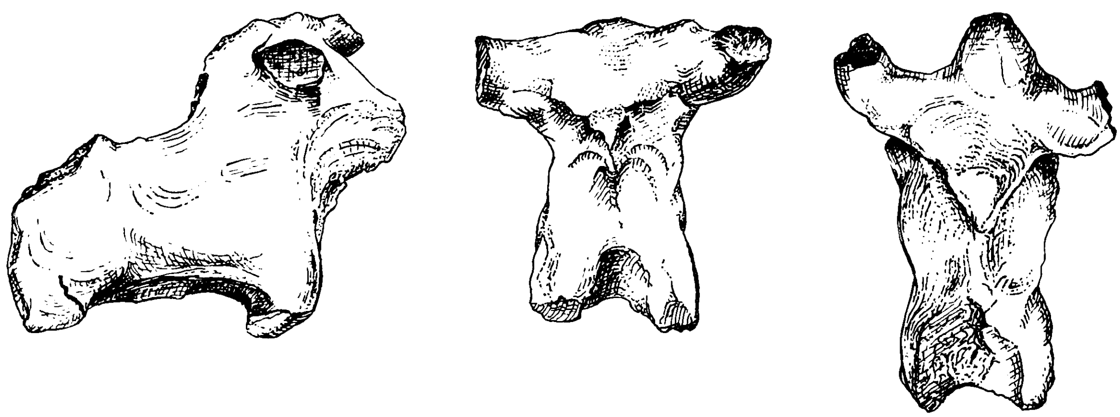

Figure 3. Pottery figurine representing an auroch. Iblis I period.

of the bones came from animals of small to medium size, some remains of larger cattle appeared in the early (Iblis I) period. The size of these is close to the wild form, at the dividing line between the variation of domestic cattle and that of the aurochs (Table 8).

TABLE 8 - Measurements on Possibly Domesticated Cattle (in millimeters)

	Distal Breadth	Distal Diameter	Period
Tibia	61 +	44	Iblis I

Cattle bones of this type occur abundantly in Middle to Late Neolithic sites of the Danube Basin when large-scale cattle domestication was occurring.[1] There, the cattle were

1 Bokonyi, S., "Die fruhalluviale Wirbeltierfauna Ungarns." Acta Arch. Hung. 11, pp. 39-102, 1959. Also, Bokonyi, S., "Zur Naturgeschichte des Ures in Ungarn und das Problem der Domestikation des Hausrindes." Acta Arch. Hung. 14, pp. 175-214, 1962.

either in a primitive stage of domestication or were crosses of domestic and wild cattle. Of this type at Iblis, there is only one measurable bone in the sample, an astragalus of 76 mm length and 55 mm breadth, which leads one to wonder if there was a local cattle domestication at Iblis. More material will be needed to demonstrate this.

The 7 human bones in the sample were all from the Iblis I period.[1]

The present study of the bone material of Iblis is a preliminary investigation. I hope the excavation of the site will be continued, and a larger sample of bone material can be obtained.

1 While it is possible that these are from burials somehow disturbed in Iblis I times, the discovery of three children's skulls in refuse deposits at widely separated points in the mound, suggests that some humans were not accorded a ceremonious burial. Cannibalism or head hunting is a possibility. (Ed.)

XV

PRELIMINARY REPORTS OF THE METALLURGICAL PROJECT

Cyril Stanley Smith, Theodore A. Wertime and Radomir Pleiner

Forty years ago, a number of European countries were vying to be known as the original home of the blast furnace. Today the competition has moved in space to the Middle East and in time to the much earlier beginnings of smelting of ores to metals. Some scholars would put the first intentional application of a reducing fire to a metallic mineral at the large village of Çatal Hüyük in Anatolia about 6000 B.C.; others would find the primordial smelting hearth at desert Timna, in Palestine, about 4000-5000 B.C.[1]

A limited claim has been made for Tal-i-Iblis in southern Iran, where copper-stained fragments of crucibles, copper artifacts, and other metals dating back to the fifth millennium B.C. were found by Joseph R. Caldwell in 1964. Iblis offers the oldest extant evidences of smelting of copper in crucibles, a peculiar art identified at very few chalcolithic sites in the Middle East. Crucibles were used for smelting purposes at Amouq in Syria (3rd millennium), and at Timna in Palestine (1st millennium), as well as Iblis in Iran.[2] Crucible smelting thus appears in space from the Mediterranean to the Indian Ocean, and in time from 5000 B.C. to 1000 B.C., but it is a distinctly isolated phenomenon in the broader story of the development of copper and lead smelting.

The uniqueness of Iblis was reason enough to make it the scene of a multi-dimensional undertaking, involving both an archaeological and a metallurgical investigation. The points isolated for investigation by the metallurgical team being:

1. Old Carmania, Kerman Province, may have been a copper smelting locale for much of the 6000 year period since Iblis first yielded

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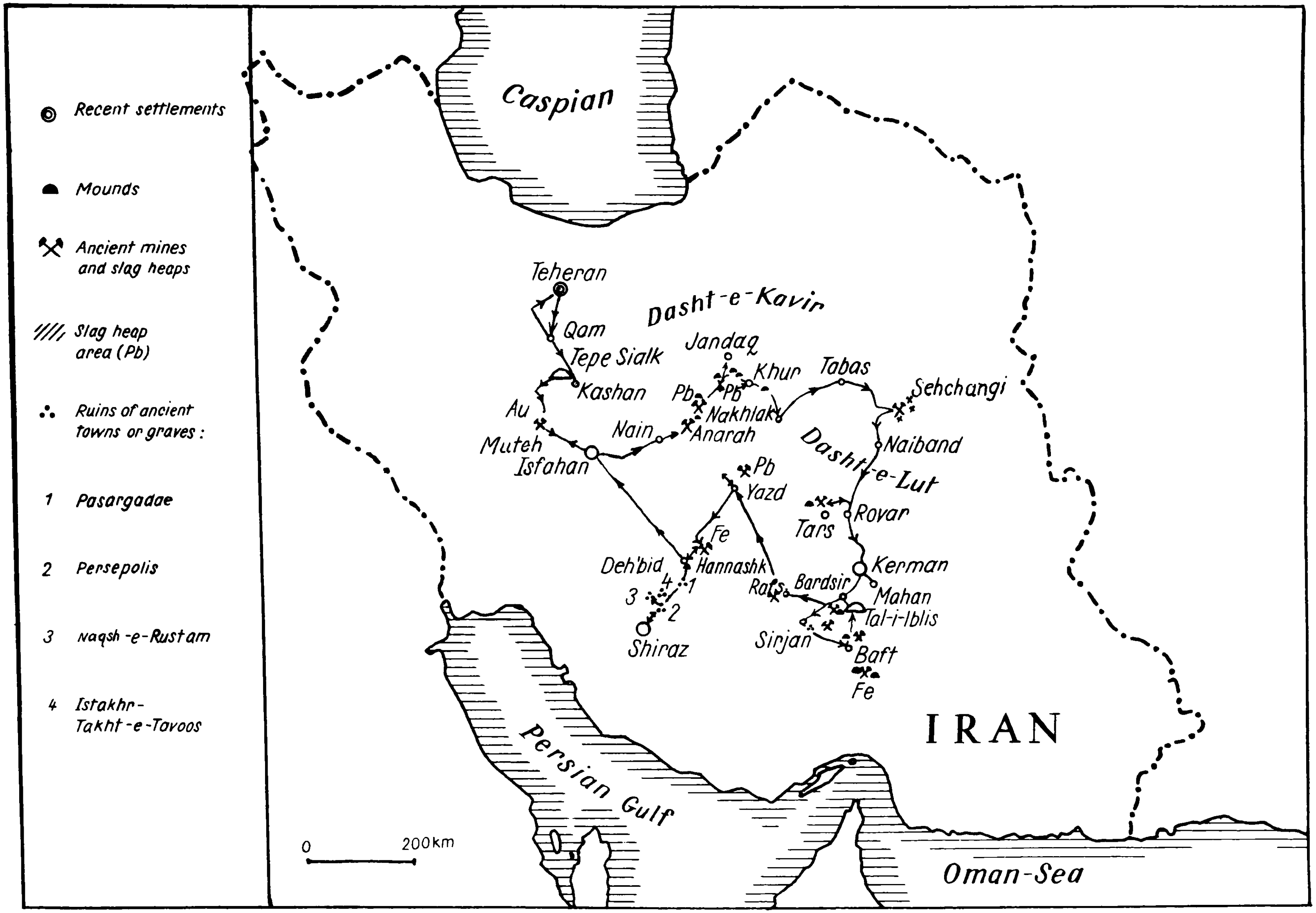
1 Heinz Neuninger, Richard Pittioni, and Walter Siegel, "Fruhkeramikzeitliche Kupferwinnung in Anatolien," Archeologia Austriaca, 98-110, 1964. Beno Rothenburg, "The Chalcolithic Copper Industry at Timna," Bulletin No. 8, Museum Haaretz, Tel Aviv, pp. 86-95.

2 R. J. Braidwood, J. B. Burke, N. Nachtrieb, "Ancient Syrian Coppers and Bronzes," Journal of Chemical Education, Vol. 28, p. 89, 1951. Nelson Glueck, "Ezion-Geber," The Biblical Archeologist, Vol. 28, p. 78, September, 1965. Ralph C. Dougherty and Joseph R. Caldwell, "Evidence of Early Pyrometallurgy in the Kerman Range in Iran," Science, Vol. 153, pp. 984-985, August 26, 1966.


Recent settlements
Mounds
Ancient mines and slag heaps
Slag heap area (Pb)
Ruins of ancient towns or graves :
1 Pasargadae
2 Persepolis
3 Naqsh-e-Rustam
4 Istakhr-Takht-e-Tavoos
Caspian
Teheran
Qam
Tepe Sialk
Kashan
Dasht-e-Kavir
Jandaq
Khur
Tabas
Sehchangi
Pb
Pb
Nakhlak
Anarah
Nain
Au
Muteh
Isfahan
Dasht-e-Lut
Naiband
Pb
Yazd
Tars
Rovar
Fe
Kerman
Deh'bid
Hannashk
Rafs
Bardsir
Mahan
Tal-i-Iblis
Sirjan
Baft
Fe
Shiraz
IRAN
Persian Gulf
Oman-Sea
0
200km

MAP 1

metals; it must be looked at seriously as a jumping off point for metallurgy and pottery into India.

2. Kerman Province also yielded lead, iron, and zinc oxide, in phases suggesting the importance of studying the interconnection of these metals in the history of smelting.

3. The old mines, slag heaps, and oasis settlements of the central Iranian desert linking such sites as Sialk and Iblis are invaluable repositories of ancient and traditional lore.

4. A reconnaissance seemed to us in advance to have the additional merit of providing data on ecology over a wide area, of importance to understanding the fuels consumed in smelting, and in reconstructing the settlement patterns of the men who worked and traded metals.

The group consisted of Cyril Stanley Smith, metallurgist from the Massachusetts Institute of Technology; Theodore A. Wertime, consultant to the Smithsonian Institution; Radomir Pleiner, archaeologist from the Ceskoslovenska Akademie vēd Archeologický Ústav in Prague; and Gholam-Hossein Vossouqzadeh, a geologist loaned by the mining department of the Iranian Ministry of Economy. The aim was to make a rapid but wide survey of some old mining and smelting sites in Iran, seeking evidence of early metallurgical operations that might merit future excavation, to assist at Tal-i-Iblis, and to make some attempts to smelt copper and lead under field conditions. In addition observations were made of surviving crafts to provide suggestive background for the understanding of ancient operations.

The Geological Survey Office of the Iranian government was most helpful in advising us of important sites -- all modern mining operations are in locations marked by ancient workings known to the local inhabitants -- and both in Tehran and in the field they gave unstinted assistance. The route followed was from Tehran through Kashan, Muteh, Isfahan, Anarak, Nakhlak, Khur, Tabas, Naiband, Tars, Kerman, Bardsir, Baft, Yazd, Haneshk, Shiraz, and return to Tehran.

Gold is and was mined at Muteh. The ores there are fairly rich and some pottery finds suggest possible operation in Sasanian times. Remains of rotary querns, small mortar blocks for crushing ore, and fired clay ore-dressing pans have been uncovered by miners in recent operations. The Nakhlak-Anarak area abounds in both lead and copper, iron was mined in Baft and Haneshk, and lead at very many sites in the mountains fringing the Dasht-i-Kavir and Dasht-i-Lut. The ancient workings were all simple holes -- in one case over 100 meters deep -- dug from the surface following the visible ore, with no tunnels for exploration, for drainage, or for easy access. Oxidized ores alone were mined and operations had been stopped whenever either ground water or sulphide minerals were encountered. Both mining and metallurgy were primitive (sulphide ores had been worked in the West by 1000 B.C. or earlier).

Innumerable slag dumps identify old furnace sites. They were usually about 1-2 km into the plain, now desert, immediately below the mine workings in the lower slopes of the mountains. The furnace remains that were found were all compatable with the small rectangular blast furnaces that remained in use until a few years ago for smelting both copper and lead, worked by double hand bellows feeding a single tuyère. The large amount of lead ore that had been mined and smelted may have been processed mainly for its silver content, for the demand for metallic lead as a building material and lead compounds (perhaps simply cerussite) in pigments and ceramic glazes seems inadequate. A statistical study may, however, show otherwise.

The fuel for smelting is charcoal from pistachio, almond, taq and hom depending on the region; all these are small trees tolerant of low rainfall and were relatively abundant until a recent depletion, mainly for domestic fuel.

It has not yet been possible to date any of the old workings. C^{14} analyses of charcoal and mine props are being made. Pottery sherds suggest that Muteh may be Sasanian, and Haneshk 11th Century A.D. The superficial mines and slag piles elsewhere are probably from later workings, though earlier evidence may be concealed beneath. Only in the Anarak-Nakhlak area were there operations recent enough to have any continuing tradition. This area has provided all the skilled manpower utilized in the recent re-opening of operations elsewhere in Iran. The iron workings at Baft and at Haneshk were visited by only part of the group. The old mine workings were cut into soft parts of the ore and ceased on coming to hard hematite or country rock. At Haneshk the resulting caves have served as shepherds' shelters and have deep layers of ash -- easy excavation with a vacuum cleaner would be one way to reveal numerous artifacts. About six furnace sites were visible. Two trial trenches by Radomir Pleiner disclosed an 11th Century sherd, a number of refractory furnace stones, branched tuyere pipes, and both bloomery slag and hammer-slag. Nearly flat circular stones had been quarried, unknown elsewhere in iron working.

At Tal-i-Iblis attempts were made to reduce malachite and cerussite in a small hearth and in a miniature blast furnace driven by goat-skin bellows. The experiments were useful in showing the poor metallurgical suitability of the local clay, (which melted at about the melting point of copper, as did the original crucible fragments from Joseph R. Caldwell's earlier campaign at Iblis studied by Dr. Ralph Dougherty,[1]) but yielded only minute quantities of metal.

Evidence of an unrecorded pyrotechnical process was discovered at an old smelting site at Saavand, near Tars. There were hundreds of fired clay rods, now broken but originally about 35 cm long and 2.5 to 4 cm diameter with rounded tapered ends. They were not highly weathered and seem to have been all of about the same age, shape and size. Many guesses as to their use were forthcoming, but no definite clues. Lumps of fused litharge were found in the same locality but no cupelling hearth remains. This prompted attention to rumors circulating in Iran of a lost method of desilverising lead by a cold process, which we hypothecated might be based on white lead manufacture. Analysis showed that the deposit on the surface of the bars is zinc oxide and it now seems possible that the bars were placed over the open tops of blast furnaces to collect zinc oxide fumes. The Tars lead ores are rich in zinc, indeed zinc blend is today one of the main products of the Tars mine and tutty is known to have been a product of the region from at least the time of Marco Polo's visit. Against this is the fact that the rods have been reported in Anarak, where zinc is not plentiful (?).

Everywhere in Iran the group was greeted with the greatest courtesy and assistance was freely provided by mining officials and personnel. Under our questioning many of the mine operators became really interested in the history of their mines and promised to seek and preserve lamps, tools, sherds and other evidence of the old workings. If this interest persists it might easily be the most valuable result of our all-too-rapid survey,

1 Dougherty and Caldwell, ibid.

which is presented in the form of a diary type itinerary.

A final report to be published later will contain detailed notes on many of the sites we visited, analyses of slag, metal and charcoal samples, and a discussion by Theodore A. Wertime of the role of Iran in early metallurgy both in general and in relation to its transmission to India, based on archaeological evidence and the remarks of both Arabic and early European travelers.

Itinerary

The itinerary below, by Pleiner, is presented in a sort of diary form, not always in complete sentences, in order that the reader of this report may have some idea of the variety and the sequence of our experiences. (See Map 1)

Friday, Sept. 9th -- Arrival Tehran. Evening conference with other participants at the Sina Hotel.

Saturday, Sept. 10th -- Purchased utensils etc. Afternoon visit to the Archeological Museum of Iran (Muze Iran Bastan).

Sunday, Sept. 11th -- Preparations completed with the arrival of the Landrover. Left for Kashan in the afternoon, arriving late in the evening, having driven 260 km.

Monday, Sept. 12th -- Excursion from Kashan to Tepe Sialk, where stratified samples of slag were taken. On the road observed the work of a native brick maker. Visited the famous Fin Gardens. Returned to Kashan where we visited the bazaar (coppersmiths, weavers, and blacksmiths), after lunch left Kashan, over the mountains (Mashadi Ardahal) to the gold mine near Muteh, 160 km away. Conferred with Mr. Sabour, an assistant at the mine.

Tuesday, Sept. 13th -- Mr. Vossouqsadeh joined the team. Visited the old mines Dar-i-Ashki (Damp valley), Sandjede, and Chah Bagh (garden well). Samples were taken, photographs and sketches were made. In late afternoon left for Isfahan, 160 km from the camp at Muteh. Arrived at Isfahan late at night having driven 215 km.

Wednesday, Sept. 14th -- Visited the coppersmiths, blacksmiths, file makers, and also jewelers in the Isfahan bazaar. Visited the famous Masjid-i-Shah, the Chehel Sotun garden, the Sio-seh-pol bridge, and after lunch departed for Anarak. This center of copper and lead mining is 230 km from Isfahan. Spent the night at Anarak.

Thursday, Sept. 15th -- Left Anarak early in the morning for Chah Kharbuzeh (well of the melons), where we found lead slag heaps, passing on to Nakhlak. Nakhlak, where there is a flotation plant, is an important lead mining center today, producing galenite and cerussite. Smelting activity has been greatly reduced recently. In the rock faces, the adits, and galleries there are numerous traces of older mining activities, probably of several periods. Close by the mountains, and out in the surrounding desert as well, there were many lead slag heaps. After conferring with Mr. Mirbaha, an engineer and director of the State-owned mine, we stayed overnight at Nakhlak. Some changes were made in the original itinerary.

Friday, Sept. 16th -- Jomeh, a free day in Iran. Visited adits in both old and new mines. Spent a second night at Nakhlak.

Saturday, Sept. 17th -- Departed Nakhlak, traveling down the edge of the Kavir to Chubanan and Jandaq. On the route we noted many lead slag heaps and took samples. In the vicinity of the desert village of Jandaq lead and iron mines were in operation some thirty years ago, but no data was available on the technology in use there. Many families have left the village due to the dessication of the area, but a primitive smithy was located and documented. From Jandaq we continued through Akbarabad, Farrokhi, and several other villages to Khur. The area is rich in lead smelting sites. Slag heaps were found every several kilometers, some only one kilometer apart. Traveling along the road at least 20 such sites were noted. Many others are probably covered with sand. None of the natives questioned remember the period of this intensive activity. Miners some 100 years ago reported extensive traces of older mining and smelting. It appears that the area between Chubanan and Khur was extensively worked long before the present activity at Nakhlak. Having traveled 328 km through the edge of the Kavir we arrived in the evening at Khur where we spent the night.

Sunday, Sept. 18th -- Made an early departure for Mehrijan, Dehno (new village) and Baiazeh. From Baiazeh on the edge of the Kavir we turned toward Rabat-i Pusht-i-Badam (fort of the almond shell). 19 km out of the village of Baiazeh, the last water stop, we encountered a group of lead slag heaps, where we took samples. From Rabat we crossed the Dasht-i-Lut itself to Tabas, 316 km from Khur. We spent the night in the Governor's garden.

Monday, Sept. 19th -- Rested in Tabas where we visited an old mudbrick fortification and several mosques. Marco Polo probably passed through this place in his 13th Century travels from Chubanan to Mashad.

Tuesday, Sept. 20th -- Departing from Tabas early in the morning, we traveled in the direction of Dehhuk. Turning into the Dasht-i-Lut we passed Minareh, with its heaps of skulls dating from the time of Nadir shah, and went on to the Seh Changi (three prongs) mine, a distance of 200 km. Seh Changi is a privately owned lead mine belonging to the Gorbani family. It is relatively primitive, but not much more so than the State-owned mine at Nakhlak, where there are only ladders in the shafts. In the immediate vicinity of the mine there are important traces of older mining activity encountered during prospecting in the area. At distances of one to fifty km there are both copper and lead mines. Conferring with Mr. Gorbani, we took notes on the mines.

Wednesday, Sept. 21st -- Excursion to Gar Kheshti (mud brick maker?), one of the older mining sites, where there are twin pits and house ruins. Visited the Seh Changi lead smelting works and the modern galleries, where there are traces of older mining activity, (the remains of wooden supports). We had great difficulty in securing samples for radio-carbon dating. After lunch we departed across the Dasht-i-Lut for Naiband where we stayed in the gendarmerie station, some 60 km from Seh Changi.

Thursday, Sept. 22nd -- Visits in the little town of Naiband, an oasis in a mountainous area of the Dasht-i-Lut where some references report lead smelting. We were unable to collect any information. Departing across the desert, we passed a caravansarai, Chehel Payeh (forty footings), and arrived at Ravar, some 174 km. This was the most difficult part of the journey. Leaving Ravar we detoured in the direction of Chubanan, which Marco Polo reported as a center for steel making (ondanique or andanico) and the manufacture of tutia (zinc oxide). There is no steel production in the area now, but several mines in this area, whose lead ores show considerable zinc content, are still in operation. A mine near Tars, 82 km from Ravar, was reported to be the best for our purposes. Arriving at the Tars mining camp we conferred with Mr. Nazafijan, the foreman of the mine, and spent the night in the camp.

Friday, Sept. 23rd -- Visited two old pits on top of the hill near a recent mine owned by Mr. Tabatabai of Yazd. A miner's mummy had been found in one of the pits, but nothing is now known of the location of this important find. Study made of some clay lamps found at the Gujer mine, and an old lead smelting furnace and bellows, apparently never used. Excursion to Saavand about 5 km from the mine at Tars, where we found heaps of fragments of clay rods, together with traces of slag and litharge. In Tars we visited a cemetery of stone tumuli, date uncertain, but which are reported to yield both bronze and iron ornaments. After lunch we departed from Tars, passing again through Ravar and on to Kerman, a distance of 248 km. We arrived at Kerman late in the evening, having traveled some 280 km in all.

Saturday, Sept. 24th -- In Kerman we visited the offices of the Governor-General (Ostandar) Mr. Firuzabadi, and the Governor (Farmandar) Mr. Ziai. We purchased a goatskin bellows in the bazaar and visited with Mr. Azarin, an engineer in the Kerman office of the Geological Service. In the afternoon visited the mosque at Mahan, 40 km south of Kerman.

Sunday, Sept. 25th -- Further conferences with Mr. Azarin, Mr. Sharushiyan, a local mining expert, and various other experts and mine owners. After lunch we left for Mashiz (Bardsir), located 72 km southwest of Kerman, and the headquarters of the archaeological team under Dr. Caldwell. We took up quarters in one of the houses belonging to the sugar factory at Bardsir. In the evening conferred with the entire archaeological team, and Dr. Hans Wulff of Australia.

Monday, Sept. 26th -- Shopped for the supplies necessary to construct the proposed experiments in smelting (tools, charcoal, clay, sand etc.) and left for the site of Tal-i-Iblis, 17 km distant. On the site we viewed the ruins of houses and the strata from which copper pins, crucibles and ores have been recovered. We set about the construction of a low shaft furnace and an open hearth, for use in the smelting experiments. Mr. Saidi having arrived, we finished the construction late in the evening. Since it was necessary to give the furnaces time to dry, it was decided that Wertime, Vossouqsadeh and Pleiner should make a two day reconnaissance in the Baft area.

Tuesday, Sept. 27th -- Since information on the road through the mountains to Baft was uncertain, we headed for Sirjan, 121 km to the west, and from there turned to the southeast,passing through the medieval ruins of Khosravi and Kelim-Khan (12th Century), through the village of Balvar and on to Baft. Here we conferred with Mr. Abalfat Shahabi, District Supervisor (Bakhshdar). In the early evening we visited slag heaps of uncertain date at a place called Zarangeran (clever ones) located northwest of Baft in the mountains. Chemical analysis will indicate whether the slags found there are those of copper or of iron. There are various reports that iron has been smelted near Baft, possibly in the mountain range 100 km to the south. Since it was not possible to visit this area,we returned to Bardsir, passing through the hills past the village of Piruje, where we noted a number of smelting sites. This area is called Chah-i-Mess (copper well). We made sketches, and collected samples of the slags, which, upon analysis, turned out to be of copper.

Arriving at Bardsir we lunched, and set out for Tal-i-Iblis. Dr. Smith prepared some smelting experiments, using the small crucibles, and some very poor malachite ore fragments picked up in the vicinity of the tal.

Thursday, Sept. 29th -- Lead was smelted in both the furnaces. Furnaces left to cool.

Friday, Sept. 30th -- Since the furnaces were not yet cool, the day was spent in reconnaissance in the area southwest of Bardsir where copper mining and smelting had been reported. About 10 km from Bardsir a site was located just at the foot of the mountain.

On the slope above were two copper mining pits, at a place called Tal-i-Homi, and here we found some sherds. On the plain below the smelting site we visited a curious hill, circular, the top flat and surrounded by three concentric sets of walls. The diameter of the hill was about 40 meters, of the enclosed platform 20 meters, and the height about 15 meters. It is possible that this was a fire tower of the Zoroastrians, but no sherds were found.

In the afternoon, working at Tal-i-Iblis, we sectioned the shaft furnace, taking samples and making sketches. In the evening a last conference of the entire metallurgical team was held. Dr. Smith was to stay at Bardsir, while Wertime and Nezam departed for Haneshk. Vossouqsadeh and Pleiner were to proceed also to Haneshk, and from there to Pasargadae, Persepolis and Shiraz.

Saturday, Oct. 1st -- Leaving Bardsir, we passed through Rafsanjan, through Anar and on to Yazd, a distance of 242 km. In the evening we visited a Zoroastrian fire tower about 17 km from Yazd, where we spent the night at a guest house.

Sunday, Oct. 2nd -- Short sightseeing trip through Yazd, visiting an 11th Century mosque, and the bazaar. After a visit to the Geological Office there,we left for Abarqu. Traveling through dust storms in the Gavkhaneh Desert, we arrived at Abarqu, and from there went on to Haneshk, 199 km from Yazd. Haneshk is a fortified village in the Goli mountains. 5 km from Haneshk to the northwest, in the Cheshme Gol (flower spring) Valley we located evidence of iron mining. The first day's work was cut short by a shower. Unfortunately, we were unable to stay at Haneshk. The rooms were not yet dry from a recent refurbishing. Traveling on to Dehbid, about 36 km away, we spent a most uncomfortable night in a tea house.

Monday, Oct. 3rd -- Wertime and Nezam departed from Haneshk in the Landrover. Vossouqsadeh and Pleiner, in the former's car. Arriving from Dehbid they hired two men from the village, and started a test pit at the Spicy Smell Mine site, and another at a slag heap numbered 1. In addition to the excavation and sketching of a profile, they also mapped hematite veins in the area. Returning to Dehbid in the evening,they found another tea house, the Sahrabad, and here spent the night.

Tuesday, Oct. 4th -- Work continued at Haneshk. A third test pit begun at slag heap number 2. Interesting material was found, <u>tuyère</u> nozzles, pottery, etc. A map was made of the smelting site, a search made for furnace sites, and a geological reconnaissance of the vicinity. A second night was spent at the Sahrabad tea house.

Wednesday, Oct. 5th -- Left for Pasargadae, to study the use of iron and lead in joining stone blocks. On to Persepolis for a brief preliminary visit before arriving at Shiraz, where they spent the night.

Thursday, Oct. 6th -- Visited in the Provincial Museum of Fars, especially the archaeological collections. Visited the tombs of Hafez and Saadi, and the Vakil and Jomeh mosques, also the bazaar and the Iran Garden.

Friday, Oct. 7th -- Visited the museum located in the Queen's Palace at Persepolis, conferring with Dr. Rahnoi, the curator. This museum is a branch of the Muze Iran Bastan, and is in charge of archaeological research in the entire province. Visited the graves of Artaxerxes the II and III, and afterwards the tombs of Darius and Xerxes at nearby Naqsh-i-Rustam. 7 km from these visited the site of Istakhr and the ruins of an early Persian town. At Istakhr found some slags, possibly from a smithy. Departing for Isfahan, by way of Abadeh and Shahreza, we arrived at night, having traveled 476 km.

Saturday, Oct. 8th -- Leaving Isfahan, returned to Muteh to identify some of the sherds we had collected, and the collection from Sanjede as well. Late in the afternoon left Muteh for Tehran, arriving there after a total journey of 361 kilometers. Our travels in Iran were finished.

Sunday, Oct. 9th through Wednesday, Oct. 19th -- Sorting and packing of samples. Visits to the Muze Iran Bastan, Dr. Ezat O. Negahban and others, some sightseeing, and preparations for departure.

XVI

A METALLURGICAL EXPEDITION THROUGH THE PERSIAN DESERT

Theodore A. Wertime

The Zagros and Alborz mountains form the lip of a basin, the bowl of which is the Central Persian Desert of 170,000 sq. km. Called "Biabanak," this zone of mountain, sand, and salt has diversified deposits of minerals, prominent among which are gold, lead-silver, copper, iron, antimony, zinc, nickel, and chromite. Lead and copper appear in small deposits around the whole rim. Gold is largely limited to the Muteh-Golpayegan region northwest of Isfahan. Though magnetic ores of iron are found at isolated points around the rim -- Semnan, Bafq, Kashan, Asna -- the chief locale of historical exploitation of iron was a zone across the south from northern Fars into southern Kerman province. At Anarak-Nakhlak nearly all the minerals of the desert come together in remarkable juxtaposition, suggesting, with other evidences, that it is one of the earliest homes of metallurgy anywhere in the world.

Human hands first dug these minerals about 6500 B.C., judging from recent excavations at Ali Kosh near the Mesopotamian border, where a native copper bead has been found.[1] Five Fifth Millennium mounds mark the advent of metallurgical activity and settlement on the desert rim. They are Tepe Sialk, Chesmeh Ali, Tepe Hissar, Tepe Anau, and Tepe Yarin. Tal-i-Iblis is the southernmost of this group of ancient testimonials to the art of smelting. It closes the circle of metal about the great desert.

Historically, of all the desert provinces, Carmania (Kerman) affords us the most complete written record of metal working. In 305 B.C., Onesicritus, Alexander's vice-admiral in the Persian Gulf,told of the production in Kerman of silver, copper, and iron ochre (presumably referring to the island of Hormoz). He also mentioned gold dust washed down by a river; and spoke of mountains, one of arsenic, the other of salt.[2]

By the 10th Century A.D., the province was famous for its export of zinc oxide, or tutiya, for the eyes. The Arab geographers Moqaddasi and Mostofi visited the area of Chubanan and Ravar in northern Kerman in the 10th and 11th Centuries A.D. and described in some detail the smelting of both cannular tutty and iron.[3] Marco Polo also

1 From a personal communication by Kent Flannery.

2 Truesdell S. Brown, Onesicritus: A Study In Hellenistic Historiography, Berkeley, University of California Press, p. 104, 1949.

3 Guy Le Strange, The Lands of the Eastern Caliphate, London, Cass, p. 309, 1966.

found this zone of metallurgy famous for its "Iron, Steel, and Ondanique." He admired the "steel mirrors of great size and beauty," saying "they also prepare both Tutia (a thing good for the eyes) and Spodium."[1] We know from other evidences that the zinc oxide was a by-product of lead mining, which goes back into great antiquity.

Gold dust in the Jiruft region was talked about by Afzal Kermani in 1188.[2]

Though many of the ancient smelting sites were obliterated by the twentieth century, modern travelers and geologists till recently found Kerman province a rich source of both copper and lead-silver; and a number mentioned the substantial evidences of iron smelting in the Baft-Jiroft range. Of great importance for our expedition were the excursions of Major Percy M. Sykes through Kerman about 1900. Sykes traversed the Mashiz area and himself passed the copper-rich diggings of Chehelitan, which in ancient times supplied Iblis.[3]

Our own foray into the Persian desert to gather traditional lore was guided by writings of Arab geographers of the 10th and 11th centuries, travels of European mining engineers of the 1930's and 1940's, and geological surveys of the Iranian Ministry of Economy.

Reports of silver output in the Nain-Anarak-Nakhlak area go back to Ibn Haukal in the 11th Century; but an inked stone has been found in debris at Nakhlak that may have Pahlavi writing of the Sasanian period on it.[4] The central desert oases of Jandaq, Khur, Tabas, and Naiband are variously described by the Arab geographers. The Naiband lead mines are recorded in the excursions of Swiss and German geologists of the early 1940's.[5] We had to miss the extensive and evidently ancient copper and lead workings of Ozbekuh north of Tabas; and Chubanan, our last stop on the metallurgical rim of the desert I have already mentioned.

The gold mines of Muteh were our biggest surprise. Mentioned in no known historical or geological source, these forlorn but wealthy pits of a bygone era have been rediscovered only in the past decade and put to modern uses only in the past three years.

Our reconnaissance added up to nearly 5000 km of travel clockwise from Isfahan to Tabas and Kerman-Mashiz, back again to Yazd, Dehbid, and Isfahan. We passed through a sequence of the ages of gold, silver-lead, copper, and iron, one surprisingly in keeping with the myths of Mediterranean peoples, though somewhat askew to the actual history of metallurgy.

We traversed three ecological zones, the zone of the salt oriented plants like "taq,"

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1 Henry Yule, The Book of Ser Marco Polo, (2 volumes, London, Murray, 1929), II, pp. 125-126.

2 Percy M. Sykes, Ten Thousand Miles In Persia Or Eight Years in Iran, London, Murray, p. 48, 1902.

3 Sykes, ibid., p. 61.

4 Le Strange, ibid., 294; Richard N. Frye, "Biyabanak: The Oases of Central Iran," Central Asiatic Journal, Vol. 5, p. 187, 1960.

5 Le Strange, ibid., 325; see also Georges Ladame, "Les resources metallifers de l'Iran," Schweiz, Mineral. Petrog. Mittheilungen, Vol. 25, pp. 198ff.

"qich," and "shur," the pistachio of the lower mountain slopes found about Muteh, Chubanan, and Mashiz, and the high mountain vegetation of "arjen" (almond) and "hom" between Mashiz and Baft in southern Kerman province. We visited classic oases of the palm, crossed deserts of sand and salt.

Muteh And The Age of Gold

We came to Muteh by way of Kashan and Sialk, the city and the dead mounds of settlement that together represent nearly 8000 years of habitation at this site and nearly the same stretch of metallurgical activity. Our purpose in visiting Kashan was to refresh our memories concerning the traditional crafts of the Kashan bazaar and to reconnoiter quickly the two tepes which mark the advent of settlement at Sialk along the Kavir-Lut and the beginnings of local working of Anarak copper.

Muteh is a zone of gold ore located west of the Tehran-Isfahan road about 165 km north of Isfahan and one km west of Kavhan. It is not the only place at which gold has been dug in Iran, mines having been mentioned in former times in Azerbaijan. We were assured by geologists, however, that Muteh is the only substantial deposit of gold ore known in Iran.

The mineral zone extends from the Qum river to Golpayegan. It was discovered by the presence of nearly 100 old vertical surface diggings, generally no more than 15 m in depth. Drawing on surveys by Russian engineers, Engineer Sabour, deputy director of the mine, has estimated the reserve at possibly one million tons. It is thus very rich, one of the richest veins in the world, yielding 35 kilograms to the ton from its best ores, 8 kilograms from inferior ores and mixed proportions from the powder (cf. Pleiner, this volume. Ed.). Three mines are currently worked; five could be. Plans are being made to pipe the water necessary for a flotation plant.

We visited two early diggings some 8 km apart, Darreh Ashki (moist valley) and Chah Baq (garden well). The old pit at Darreh Ashki is 4-6 m in diameter, intersecting underground at about 15 m with the modern shaft (which has the usual trappings of a modern mine). Found in the loose dirt were grinding stones,which were common at these sites. Such stones were 39 cm across. Three pots and a hammer from similar digs were also photographed, and their identification becomes important to the dating of the main period of working at Muteh.

One pot roughly 90 cm high and 75 cm in diameter may be of the Shah Abbas period. Another 38 by 30 cm in diameter, is thought to be Islamic, about a thousand years old. A third pot, 50 cm high and 18 cm in diameter, appears much like the ware of Sassanian times.

The nature of traditional working was explained to us by Ali Yazdanpanah, an old Anaraki miner. At Chah Baq, gold powder has been found in the stream bed, suggesting washing. After grinding by stone, the workers

1) Either washed the gold in wooden bowls,which permitted the gold to settle while removing the gangue.

2) Or sluiced it into a sheepskin *a la Jason and the Golden Fleece.*

Given the exhaustion of Iran's rivers of placer gold in very ancient times, and Iran's dependence on Siberian gold in the days of the late Achaemenians and early Seleucids, it could be that Muteh came to play a role in the domestic supply of gold from the days of the late Sasanians well into the Islamic era, possibly the 17th Century.[1] The near absence of gold objects in the Sasanian period -- of gold coinage, bowls, art objects -- points to a severe shortage of gold, at least relative to the abundance of silver, of which nearly every precious thing seems to have been made. Muteh thus reflects a widespread trend toward underground mining of scarce gold throughout the Mediterranean and Caspian basins. Its subsequent neglect is hard to explain, however, if neglect it was.

Lead mining was also known about Muteh, and was the main reason for the deforestation of wild pistachio in the area.

Nakhlak And The Age of Lead-Silver

The Arab geographer Ibn Haukal tells us that silver was mined near Nain. The combined testimony of tradition, archaeology, old mines, and slag heaps suggest that lead (and consequently silver) was being mined about the Kavir-Lut much earlier than the 10th Century A.D.

Silver appears in the third metal producing stratum of Sialk, lead in the earliest levels of Anau and in the later artifacts of Tepe Hissar. Throughout the Biyabanak we were told that the intensive search for silver began in the days of a legendary king Shaddad (Shaeddad or Shudad). From discussions with Persian colleagues, it seems possible to me that Shaddad was one of the Sargonid Assyrian kings who ventured deep into the Iranian desert, very possibly Esarhaddon (681-669 B.C.) or Ashurbanipal (669-626 B.C.).[2]

Between Nakhlak and Bayazeh, a distance of more than 200 km, one sees along the road numerous heaps of lead slag, some in a very advanced state of disintegration (possibly by the hand of man as well as the weather). Though we did not visit the main slag heaps along the Nakhlak kavir (many buried in sand) it was not hard to accept German estimates of the 1940's that several hundred thousand tons of slags of various vintages dot those areas of the Biabanak where desert plants flourished.

The mountains of Nakhlak are a feature of a north-south range of andesite which faces toward open desert and looks some 60 km northeastward toward a salt kavir. The mines of Nakhlak represent the easternmost extension of the versatile Anarak zone of ores; they are an assemblage of venerable pits and slag heaps on which have been superimposed modern shafts and a modern flotation plant.

1 The Achaemenians probably got their gold from northern Iran (sources suggest the northeast, though Strabo points to Armenia as a rich source of gold.) Herodotus first speaks of the "ant-gold" of India, which Tarn interprets as an oblique reference to gold from the Altai mountains.

2 Some Persians equate Shaddad with Nimrod. Chapter 7 of the Koran describes the attempt of the Prophet Houd to convert the tribe Aad. He was not successful and the Lord destroyed them. According to Forrens (<u>The Arabian Nights Entertainments</u>, Vol. 1, Supplement, New York, Heritage Press, p. 13, Note 24, 1955.) the Aad were destroyed by a poisonous wind. The city of their last king, Shudad, is still supposed by the Arabs to exist in the deserts and occasionally to be seen. In the 56th Arabian Nights Entertainment, "The City of Brass," Musa bin Nusayr, Governor of Morocco, found in a deserted city of brass, an inscription on a tablet of China steel written by one Kush, the son of Shaddad, son of Ad the Great, telling how Shaddad had once ruled the earth. See also Pleiner (this volume). (Ed.)

The community of Nakhlak is approached by a graded desert road, which passes several slag heaps - one at a site called "Watermelon Well" - before turning into the mountain niche occupied by the village and mine. The village is a dun assemblage of mud huts and tiny palm and "gaz" trees, split by a spring and dominated by the rectangular brick buildings of the mine, by ore and slag heaps, and by an old smelter now gradually going out of operation.

Nakhlak is managed by Mojtabah Mirbahah, a French-trained engineer. Nasser Daizadeh, a German-trained engineer, supervises the eight-year-old flotation mill. Today the 35-year-old smelter produces 210 tons of lead a year and is being phased out because of its fumes; the flotation plant yields between 2400 and 2800 tons of concentrate a year, all sold to the Soviet Union. The modern diggings are reached by a vertical shaft of more than 100 m depth, which one descends by crude ladders of pistachio and other woods. There is a modern rail and timbering system in the actual mines, which admittedly have poor ventilation.

The older workers, of which Ali Ashkeri was representative, distinguish two eras at Nakhlak, the "cerussite" and the "galena" eras. These same eras applied in varying degrees to all of the lead mines that we visited. The era of mining the sulfide galena began at Nakhlak only about 100 years ago with a new influx of Anarak miners. Prior to that time, the miners had concentrated on the east-west surface fault lines which, owing to hydrothermal deposition and geologic weathering, contain cerussite ore ($PbCO_3$), a type of lead ore substantially lower than galena in silver. The reasons for mining cerussite were threefold:

1) Cerussite lies at the surface.

2) It is much more readily smelted than galena and gives off less noxious fumes.

3) Galena lies below the water table and requires pumping or bailing operations.

The long era of "prehistory" of lead mining at Nakhlak is written solely in the pits and shafts of the veins of cerussite, generally not going below 60 m because of the water. The miners at Nakhlak had preserved very little of the past: of lamps, picks, camel-skins, or cowhides. The stone tablet mentioned above is the only substantial written record of Nakhlak, though legend records a cowhide with Hebrew writing. Nor did we find any old timbers that might permit a carbon dating. Throughout the two-day visit to Nakhlak we were trying to look back 7,500 years through a hundred-year-old keyhole.

We personally observed the distinction of the two phases at Palani Gavi, an old digging in the fault line of the mountain (named after the saddle oxen used to carry away the ore) The original shaft was 60 m deep, about 50 years ago being deepened to 140 m. Still in existence near today's slag heaps was the remnant of the hearth of a primitive furnace in operation 30 years ago, when German engineers designed the modern smelter. About two thirds of a meter in diameter, the former furnace today is used for baking bread. There was a battery of such furnaces. The story of their operations was told by travellers of that period, such as Alfons Gabriel; it was a grim one in human terms.

The ores were carried by camel or donkey back to the desert fuels for smelting. A typical smelting site is an isolated mound of perhaps 20 m in diameter, with remnants of the furnace at the center and slags in varying stages of decomposition spread out to the edges. We took samples from two such sites, one approximately 2 km east of Nakhlak, the second being 1 km to the north. We were also able to produce samples of litharge from a site at which silver was cupelled from the lead, again an operation of substantial chemical interest because of our gradually unfolding knowledge of the employment of both arsenic and vinegar as essential adjuncts of the so-called "Anarak" methods of oxidizing the lead and deriving the silver.

Our own smelting experiments at Tal-i-Iblis tended to reconstruct the ancient methods of smelting (as had experiments of 1962 at Anjileh near Yazd). But it is useful to recapitulate operations as they were told to us by Hassan Nejat of Nakhlak and Ali Yazdanpanah of Muteh. The standard furnace was 2 m high and 100 cm in diameter, made solely of dried clay, with special ceramic clays employed on the inside of the hearth. Such furnaces were run twelve hours a day and were repaired every two to three months. The bellows (an example of which we later saw at Tars) were paired vertical types about 2 m in breadth, feeding into a common tuyere. A day's charge was 35 kg of charcoal, 30 kg of lead ore, and 30 kg of iron ore.

The bellows-blown furnace mentioned above served, with only slight variation, for the smelting of lead, copper, or iron ores alike, though at Anarak smelting was largely confined to copper, at Nakhlak,lead. A similarity in copper and lead smelting lay in the use of iron ore ($Fe_2 O_3$) as an additive to both, a practice also noted in Palestine, and of utmost importance in the identification and ultimate exploitation of iron as well as the advancing use of sulfide ores of lead and copper. For the chalcocite ores of Anarak, lime was also a useful additive. For 1 ton of cerussite, 400 kg of $Fe_2 O_3$ were added; for one ton of chalcocite, 300 kg of $Fe_2 O_3$ and 100 kg of lime.

Desert practice also embraced a wind furnace called <u>falaqeh</u>, a large roasting or smelting device 5 m high and 2 m in diameter (resembling the modern blast furnace). Smelting in this furnace was confined largely to carbonate ores such as malachite; it proceeded very fast.

We had learned that one wild pistachio tree might yield 360 kg of metallurgical fire wood. Unfortunately, no figures were available for the <u>taq</u> (haloxylon amodendron) or the tamarisk, desert bushes that fueled the smelting operations so heavily concentrated along the salt Kavirs toward Khur. The <u>taq</u> grows to 3-4 m in height, trunk 60 cm in diameter, and has pendules rather than leaves. In former times, areas of the desert sustained what the Persians called <u>jangal</u> (forests): really stands of desert mesquite-like bush. Though limited in quantity, the quality of such wood was superb for smelting. One can see stumpy remains of former <u>jangal</u>. Elsewhere the trees have begun to reestablish themselves despite modern depredations by the goats. But even the dried vine of the wild watermelon or the wispy <u>shur</u> were sufficiently caloric to prime the smelting furnaces of this desert zone.

Naiband

The journey across the Biabanak was useful metallurgically for the picture it gave us of more than 20 slag heaps extending beyond Baiazeh; a visit to the blacksmith shop in Jandaq; the clarification of the legend of Shaddad; evidences that copper and iron were mined near Jandaq and lead-silver near Khur. We did not, as hoped, visit the old mines of Ozbekuh, north of Tabas. We took instead the opportunity to visit the lead mines of Naiband, which appear to have been last active in the 1930's and have been reopened in the past two years to supply the Soviet Union.

The Naiband plateau is reached by travelling southwards nearly 200 km from Dehuk over a desert road that has long linked the villages of the upper Dasht-i-Lut. It is a Paleozoic zone of igneous or andesitic rock, marked by occasional upthrusts of dark granitic rock. The mines lie in the uplands some 160 km east of Naiband mountain and village on the Khur road. A very stony and bare country, the vicinity of the Naiband mines is mainly washes and rock, the washes greened by occasional taq and qich (a round leafed plant), the rock broken by mineral-filled fault lines that may run straight like a pencil for many miles. Snakes abound. Whereas mining at Nakhlak was carried on along the mountain slopes, here the old pits followed the plain, and the deposits are largely galenic in character. This area is called Seh Changi (three prongs).

Two brothers recently reopened the old diggings in response to the demand from the USSR, their names Mohammad-Ali Qorbuni, and Ali Qorbuni. The production today is 2 tons of concentrates an 18-hour day from the Wiffley table, 3 tons from the flotation plant.

Under the guidance of a graybeard, Mohammad Qassem Tudeshki, an Anaraki foreman, we examined an old trench 1 m wide and 3 m deep lying between hard igneous rocks, and yielding mixed Pb CO_3 and Pb S. Gypsum had been dug away from over the vein, and the rocks carried the distinctive tool marks. We also climbed down a modern shaft to view the old diggings underground, there coming upon an abandoned mining timber that may permit carbon 14 dating. The slags heaped about the smelting site indicate two distinctive periods of working, one fairly ancient, the other fairly modern, perhaps those seen by German geologists in the 1930's and early 1940's. We extracted samples of furnaces, clay tuyeres, and charcoal.

At this smelting site of Seh Changi were the remnants of perhaps a hundred old smelting furnaces in their enfolding slags, ruined tuyères prominently in evidence. The furnaces had been about 1.5 m tall and were stone walled with clay linings. Smaller furnaces only 60 cm deep were also to be found. One could not be sure the smelting had not also included copper; there were droplets of copper in the slag. Chalcopyrite copper had been mined 4 km north of Naiband and 50 km south. Magnetic iron ore was also to be found in these rocks; iron ore had been drawn upon for smelting the lead.

At Gar Kheshti (mud brick maker?) we visited a second set of horizontal diggings, parallel trenches in the ground, averaging 3 m in depth, but reaching 8-10 m in one instance. There were three trenches about 100 m in length, their ages were indeterminate but possibly fairly recent. In the ruins of an old stone building were sherds of Islamic pottery. Here the wind had scoured the desert of sand, leaving pieces of malachite lying around.

The Tars Mines

At Tars, one makes his entry into a mining zone made famous by the Arab geographers and Marco Polo and evidently quite ancient. Though we did not visit Chubanan proper, it was probably at Tars that Marco Polo first made the acquaintance of the cluster of small mining villages that he wrongly regarded as the great metallurgical community of Chubanan. We were satisfied, both by the zinc content of Tars lead ores, and our own production of the white fumes of zinc oxide in smelting lead, that we had definitely crossed paths with Marco on the matter of tutiya, though we remained completely in the dark about now-extinct processes of fabricating fine steel. We are hopeful that the new discovery by the Smithsonian's Hans Wulff, near Isfahan, of wootz bars, will do something to lift the mystery of ondanique in the Kerman area.

The Tars anteroom offers an impressive, if not spectacular, welcome to the Kuhbanan plain. A lovely green village, Tars is surrounded by perhaps 1000 large stone cairns or tumuli 6 m in length and 60 cm high that were burial places for the ancient tribes of Kerman or perhaps of the larger Baluchi ambiente. They are reported to yield rings, bracelets, pottery, and swords. Such tumuli appear elsewhere in Kerman province, [1] and are still being built by tribesmen in the Baft area above the Gulf. They, along with the green village and the mountain peaks that set off Tars and Saavand villages, provide a not-to-be forgotten way to Chubanan. Minus the smelting fires, one's entrance is probably much as it was in Marco Polo's day, impressive alike to desert traveler from north or south

Under the watchful eye of Ali Najafian, sturdy Anaraki manager of the Tars mines, we visited the hilly mining zone of Tars, capturing pictures of an intact primitive lead furnace and attendant bellows. Najafian's incidental and lengthy comments on Iranian smelting techniques are discussed elsewhere. Most important, however, were artifactual evidences of old practice in the evidently ancient shafts of Tars, named "Old Mine" (Ma'adene Kohne) nos. 1 and 2 at Tars proper, and Kuhe Gujer, 6 km to the north.

A mummy has recently been rescued from one of the shafts and is said to be in Tehran. We were presented several miners' lamps, an old steel pick (from a distant site), and a seemingly partly petrified piece of wild pistachio timbering (Chubanan means "pistachio mountain"). Unfortunately no stone, horn, or wooden tools or palm baskets found there have been preserved; but the timbering acquired from the Ministry of Mines in Kerman, is being subjected to carbon 14 dating.

The lead galenas of Tars yield 400 gr of silver to the ton. The mine is interesting mainly, however, because of its interlaced veins of zinc, which today are being exploited for exports to Belgium at the rate of 200 tons a month (small quantities of lead being sent to the USSR). Today's exploitation exactly reverses that of ancient times, when miners wanted lead-silver minus refractory zinc (and how refractory zinc is as an impurity was found out in our furnaces at Tal-i-Iblis).

Ma'adene Kohne no. 2 is a hole in the steep mountainside 10 m in diameter and 30 m deep. We explored Ma'adene Kohne no. 1, which ran 40 m in depth to the water line. Inside the modern mine we were able to see how the former miners had avoided the brown sphalerite (Zn S) ores, digging both above and below them to get the speckled galena. Zinc was not positively identified as a metal till possibly 1500 A.D., though both the oxides and the pure metal were isolated well before, and brass was a common product.

From our later experiments, we judged it likely that the furnaces for tutiya (a Persian word) and spodium seen by the Arab geographers and Marco Polo were lead furnaces yielding fumes of Zn O as a major by-product. Since lead smelting at Tars could well have been very ancient, there is a strong presumption that old metal workers relatively quickly learned to distinguish the medicinal effects of zinc oxides from the toxic effects of the oxides and carbonates of lead. Even today, villagers about Tars use the fire bars of old smelters to heal sores on the skin.

Our visit to the village of Saavand, an old smelting site 3 km on the Tars road to Chubanan and 25 km from Chubanan, raised a number of technical questions, not least being that of the burned clay bars that we found on the old smelting hillside. Possibly 31-38 cm in original length and tapered on the ends, such bars littered the old furnace site, along with pieces of litharge testifying to the cupelling of silver from lead. In a later discussion with Mohammad-Bagher Saidi, foreman of the Anjileh lead mines near Yazd, and the team's chief consultant on the techniques of purifying ores to metals,

1 See Fehérvári and Caldwell, this Volume.(Ed.)

Cyril Smith learned that the bars were possibly employed in the oxidizing of lead through the use of vinegar, releasing the silver through a unique chemical process.

For the time being it should suffice to point out that the metallurgic possibilities of vinegar were explored before 300 B.C. by Theophrastus, the naturalist and pupil of Aristotle.[1] He described the making of ceruse or white lead, $Pb\,CO_3\,Pb\,(OH)_2$, by immersing lead plates in vinegar. In the many centuries that this process has been a common one, no one has ever before suggested vinegar as a successful cupelling agency nor cupelling as a partially wet chemical process.

At this point, a note is desirable on our conversations with Engineer Jamshid Soroushian, a leading Zoroastrian of Kerman, whom we interviewed in the presence of Engineer Azarin, head of the Bureau of Mines in Kerman, and Houshang Rashti, owner of a zinc mine near Sirjan. Soroushian, commented that a large number of metals appears in the Avesta, the Zoroastrian religious text written sometime around 700 B.C.: lead, iron, gold, silver, zinc, copper, brass (zinc appearing in ceremonial vessels). Though we were surprised at zinc's being identified so early, Soroushian stuck to his story. Zinc mining is well known in the Yazd-Kerman area and at Jaliye Sirjan may be at least 500-600 years old.

Kerman Bardsir

In Kerman, Azarin and his colleagues supplied us samples of baneh found in Ma'adene Kohne no. 2 at Tars, a miner's lamp from the Chahgaz copper mines between Sirjan and Shiraz, and a piece of an iron hammer or pick from the Abbid area between Tars and Ravar. Azarin told us at length about a second Tal-i-Iblis 40 km from Bam, rich in the phosphate of bones and still evidencing signs of a copper working furnace. He discussed at length old iron workings near Dalfaend and Jiroft. His assistant, Engineer Fouroughi added to prevailing testimony about tin, saying that acid intrusions had been found near Quchan and Torbati Hayderi, suggesting tin; and that wolframite had been found near Torbati Hayderi and Naiband.

The mise en scene now shifts to Mashiz, or Bardsir, some 17 km from which lies Tal-i-Iblis, the site of Caldwell's excavations. At Iblis we designed the experiments that were intended to throw light on the smelting of copper in crucibles as found at Iblis, and to bring some resolution to the related parameters of lead and iron smelting.

It had been our hope to test out the thesis that iron was discovered in the course of the reduction of lead and possibly copper ores. This supposition, developed in 1962 on a trip by Smith and myself to Yazd and other points, had been strengthened in this journey of 1966. All sources attested that iron oxide was a common traditional flux in the smelting of lead ores, whether cerussite or galena. One had said that it was also exploited in copper smelting, with lime (see Muteh discussion above). We planned to build a furnace adequate for testing this hypothesis.

The preliminary report by Pleiner takes up in some detail the one furnace and two hearths in which we sought to reenact some of the early inter-connected history of smelting. The construction of the mud-clay furnace for the lead-iron experiment was

1 Sir John Hill, Theophrastus's History of Stones, London, p. 133, 1746.

entrusted to Mohammad-Bagher Saidi, foreman of the Anjileh lead mines near Yazd. We were well acquainted with Saidi from previous metallurgical journeys in southern Iran. The furnace that resulted wedded Saidi's particular expertise in traditional Persian processes with that of Pleiner in ancient European methods. The result was interesting and not entirely satisfactory.

We unwittingly created one unforeseen obstacle to the simple smelting of lead or to the lead-iron process. Most of the lead ores for our experiments had been brought from Tars, and proved moderately high in zinc and intractable for precise experimentation. Though our goatskin bellows produced the remarkable temperature of 1380 C in the little lead-iron furnace (according to the thermocouple), we had no success in producing a visible bear of iron, a result to be expected where much charcoal and heat are brought to bear. Adventitiously, however, we managed to raise the white fumes of tutiya, along with those of lead, ample proof of the comments of Marco Polo and the Arab geographers about furnace practices at Chubanan. Because of the zinc, however, the slag of the furnace failed to run and the yield of liquid lead was poor; and the lead smelting hearth gave no metal at all.

We were constantly impressed with the number of hazardous variables that plagued the early diggers of ores and smelters of metals. My own theory had been that the metals and their many-faceted mother ores were identified not in glorious isolation, but by reference to each other and to fire. Such is the case of lead and its two offspring, silver and iron. In the broader context of all pyrotechny, the slagging of metals must be understood as an exercise in glass making, just as the coloring of glass must be seen largely as an exercise in metallurgy. The disturbing effects of a slight admixture of zinc, an unidentified substance for most of the history of metallurgy, was our case in point.

Other material hazards affected the smelting of copper in crucibles, which was undertaken by Cyril Smith. With the help of a hand compressor, Smith substantially exceeded 1200 C in a small charcoal-fuelled fire in the ground. He produced a bead of copper -- and melted the crucible. Though we had an experienced ceramacist, Hildegard Wulff, preparing our crucibles, the choice of refractories posed problems for us, as they must have at first for Iblis' metal workers. Of equal complexity was the matter of matching the ores used by those same workers about 4000 B.C. The pieces of azurite and malachite found in smelting stratum of Iblis could well have been reject material.

These difficulties explain why clear and unqualified theories of smelting at Iblis and related mounds around the Persian desert cannot be presented till other, extensive experiments have been carried out.

Of special interest was our brief reconnaissance of the diggings of Chehelitan, in the Baft range southwest of Iblis, which we undertook on September 30. This area of former copper working was evidently visited by Percy Sykes nearly 70 years ago. A number of sites were pointed out to us, which might be how the number "chehel" (forty) was introduced into the name.

One ascends the mountain from the old baronial village of Torshab ("bitter" or alkaline water). Not far from Torshab, on the first slopes of the mountain, is an old heaped-up, rampart-type mound, perhaps once a fire temple or fortification. Along the road, one finds evidence of a reddish copper slag weathered small. The same road leads upward to the high village of Torsuye, a good 20 km above Iblis on the flat plain. Within a radius of 5 km are 3 separate old digs belonging to the Chehelitan.

We visited one such site, about 2 to 3 km counter-clockwise along the mountainside from Torsuye. Inhabiting the lip of the mountain, along a fault line, are two primitive holes cut into an andesite formation, collectively called Tal-i-Homi. One hole was about 8-10 m across and 4 deep, the other being substantially smaller; both were small craters with the malachite-azurite of earlier digs rubbling their slopes. Here, as at the iron-smelting site of Piruje near Baft, we found sherds of a plain red pot of an earlier day, but how much earlier is impossible to say. It was not the pottery of today. Near the digs we found both "hom" and "arjen," sturdy caloric bushes or trees that served for smelting. From "hom," Tal-i-Homi takes its name. No slags were in evidence at this altitude.

Baft, Heneshk, And The Age of Iron

Stretching across Fars and Kerman provinces of southern Iran, from Abarqu to Jiruft, are the remnants of Iran's first Age of Iron. The Age had a physical locale, possibly because the early Parsua tribes helped to bring the technologies of iron making south from Azerbaijan, possibly also because the small outcrops of oxide and carbonate ores in these districts were more amenable to smelting than the large magnetic deposits to the north. The hardwood fuels of the high plateau also played a role in the location of early iron manufacture.

As a last feature of our reconnaissance, Pleiner, Vossouqzadeh, and Wertime made a quick tour of Baft and Heneshk as the two most important poles of the zone of iron. The deposit of Heneshk is now being surveyed by Iranian and Russian geologists as a source for the new iron mill at Isfahan. Because of the need for haste, Pleiner excavated its slag heaps. Unfortunately there was not time to reconnoiter the intermediate sites of Bavanat and Niriz, though Pleiner did visit Istakhr, an iron working settlement of pre-Islamic and Islamic times.

We had prepared for the Baft visit by consulting the several surveys of Sir Aurel Stein and the writings of such travelers in the Baft area as the Stacks.[1] These fragmentary accounts, as well as consultation in 1961 and 1966 with Engineer Azarin of the Ministry of Mines in Kerman, had partly prepared us for the quite extensive digging and smelting operations that had prevailed about Baft in the indefinite past.

The zone of iron extends from slightly north of Baft toward Jiruft in the south and embraces sites by the names of Kuh-i-Kabre, Desarbe, Mesarbe, Seh Chah and Gushk Shadran. This we learned from Abulfaeti Shahabi, mayor of Baft and leader of the tribes in the Baft region. Iron slags mixed with occasional slags of lead are particularly heavy over a mountainous area extending 120-300 km to the southwest of Baft. Each heap averages about 50 tons of slag. Copper mining, too, was not unknown in this region.

All sources averred that mining in and about Baft was old -- 1000 years, 2000 years, as old as Shaddad. At Gushk, the old mining shafts run 20 meters deep.

In the course of our day and a half journey about Baft, we visited two nearby smelting sites and slag heaps. One was 12 km from Baft, near Zarageruni, Shurak, and Bideshk. The other lay north of Baft on the old Kerman road, at a site called Piruje, near the village of Bezanjan. Both smelting locations lay well up on mountain slopes that once boasted wild pistachio and the bush-trees called "hom" and "arjen." The slag heaps at

1 Sir Mark Aurel Stein, Archeological Reconnaissances in Northwestern India and Southeastern Iran, London, pp. 104ff, 1937.

Zaragaruni were sparse and could have been those of copper. At Piruje, however, they were extensive, recent, and unmistakably those of iron.

The final focus of our reconnaissance was upper Fars province and specifically the mountain of Heneshk, visited by Wertime in 1961, Smith and Wertime in 1962, and Pleiner, Vossouqzadeh, and Wertime in 1966. Today the site of major geological investigations, this scene of diggings and old smeltings is clearly a landmark in the history of the iron age in Fars Province. Only 50 years ago Heneshk was still reasonably well forested with wild pistachio trees. Today only one or two small trees still cling to its slopes. The future will reveal the modern metallurgical potentialities of this zone.

Concluding Remarks

In closing, I should offer a few thoughts on the success of our three-dimensional undertaking in archaeological metallurgy.

There were two dimensions to our reconnaissance. One was the dimension of traditional practice. We explored a host of traditional processes and sites and are now trying to extrapolate what we can about ancient methodology. Obviously the degree of extrapolability from evidence or crafts still extant today must vary enormously from item to item. For example, it was clear that miners in the Biabanak till a century or so ago exploited cerussite but not galena. One is permitted to say with some finality that cerussite was the first ore exploited for lead and silver. Here traditional practice coincides with ancient practice.

Was iron ore added as a flux from the very beginning? The answer is necessarily tentative. It was evidently possible to smelt very pure ores in a small hearth with charcoal only. However our experience with very small admixtures of impurities, as well as that of German engineers 25-30 years ago, suggests that iron ore may have been added at a very early date, possibly even before men tried to smelt the sulfide galena. That iron ore and lime were also used to help free copper of its rocky impurities -- in both Palestine and Īran -- suggests that ancient smelting practice was more complex than we had suspected.

On several other fronts, the traditional data sets one to thinking. We were told by Ali Najafian at Tars that copper workers in the bazaars of Kashan and Yazd have always melted the native copper of Anarak for use. This was a logical presupposition, judging from the difficulties of hammering Anarak native copper even when annealed. The presupposition now has some basis in fact. One is permitted to speculate that casting of native copper could have been an early phase in the evolution of copper smelting.

Tutiya, the old name for zinc oxide, comes from the Persian word Dūd, meaning smoke. The philological history of tutty now seems to coincide with the technological. To the several suggestions from the Arab geographers and Marco Polo that Chubanan was an early center of the trade in tutiya may be added our scrutiny of the Tars mines and our smelting experiments. Zinc was an unwanted and chemically complex partner of lead smelting operations. Nevertheless, the oxide was present, even impregnating the fire bars found at the old smelting site near Tars.

This brings up the thorny question of cupellation, which must have been the earliest method of extracting silver from lead, dating back to early strata of Sialk, Hissar, and possibly Iblis. We have not yet fathomed the startling revelation of Saidi and others that vinegar (and arsenic) were chemical agencies of the cupellation process. Yet one cannot foreclose all speculation about vinegar as a metallurgical agent. Theophrastus in 303 B.C. gives a clear account of the making of white lead from vinegar. The two processes are so analogous that one can only wonder if desilvering lead with vinegar was not discovered in the course of making white lead. Why the chemical cupellation process seems to have been confined to Iran and was not diffused throughout the Mediterranean basin is a mystery -- if indeed there was a workable process. One needs to have a new look at the alchemical formularies of the Assyrians.

The second added dimension of our metallurgical researches was the experimental one. Such experiments are a respectable part of the armamentarium of contemporary historians of metallurgy, having been performed by Coghlan, Tylecote, Rothenburg, and others. Indeed Smith and Wertime had in a sense anticipated the experiments of 1966 by those at Yazd in 1962. Pleiner was fully familiar with the whole experimental domain.

Nor were we disappointed. We did reduce a bead of copper in the crucibles, learning more about ceramics than about copper in the process. From the experiments in lead smelting,we did learn something about temperatures and about zinc. The experiments in iron, though not entirely disappointing, will have to await more propitious circumstances.

The moral is clear, however. The origins of metallurgy cannot be treated as one-dimensional exercises in man's elucidation of single metallic elements -- copper, lead, silver, iron. The truth of metallurgy will be known only by simultaneous attack on the interconnected phases of pyrochemistry.

XVII

PRELIMINARY EVALUATION OF THE 1966 METALLURGICAL INVESTIGATIONS IN IRAN

Radomír Pleiner

Foreword

Following preliminary discussions in Warsaw in 1965,I was invited by Dr. Joseph R. Caldwell of the Illinois State Museum to join the metallurgical team of the Illinois State Museum-National Science Foundation archaeological project in Kerman. The Director of the Archaeological Institute, Prague, and the President of the Czechoslovak Academy of Science kindly gave me permission to participate in this kind of international cooperation. The Iron Metallurgy Institute of Prague loaned some apparatus, including an optical pyrometer and a millivoltmeter with thermocouples.

Leaving Prague on September 8, 1966, I arrived in Tehran on the 9th to join Professor Cyril Stanley Smith, Mr. Theodore A. Wertime, Dr. Caldwell and other expedition members. The complete metallurgical group comprised Smith, Wertime, Dr. Gholam-Hossein Vossouqzadeh, geologist attached to the Ministry of Economy of Iran, Mr. Nezam, photographer from the United States Information Service, two drivers, and myself.

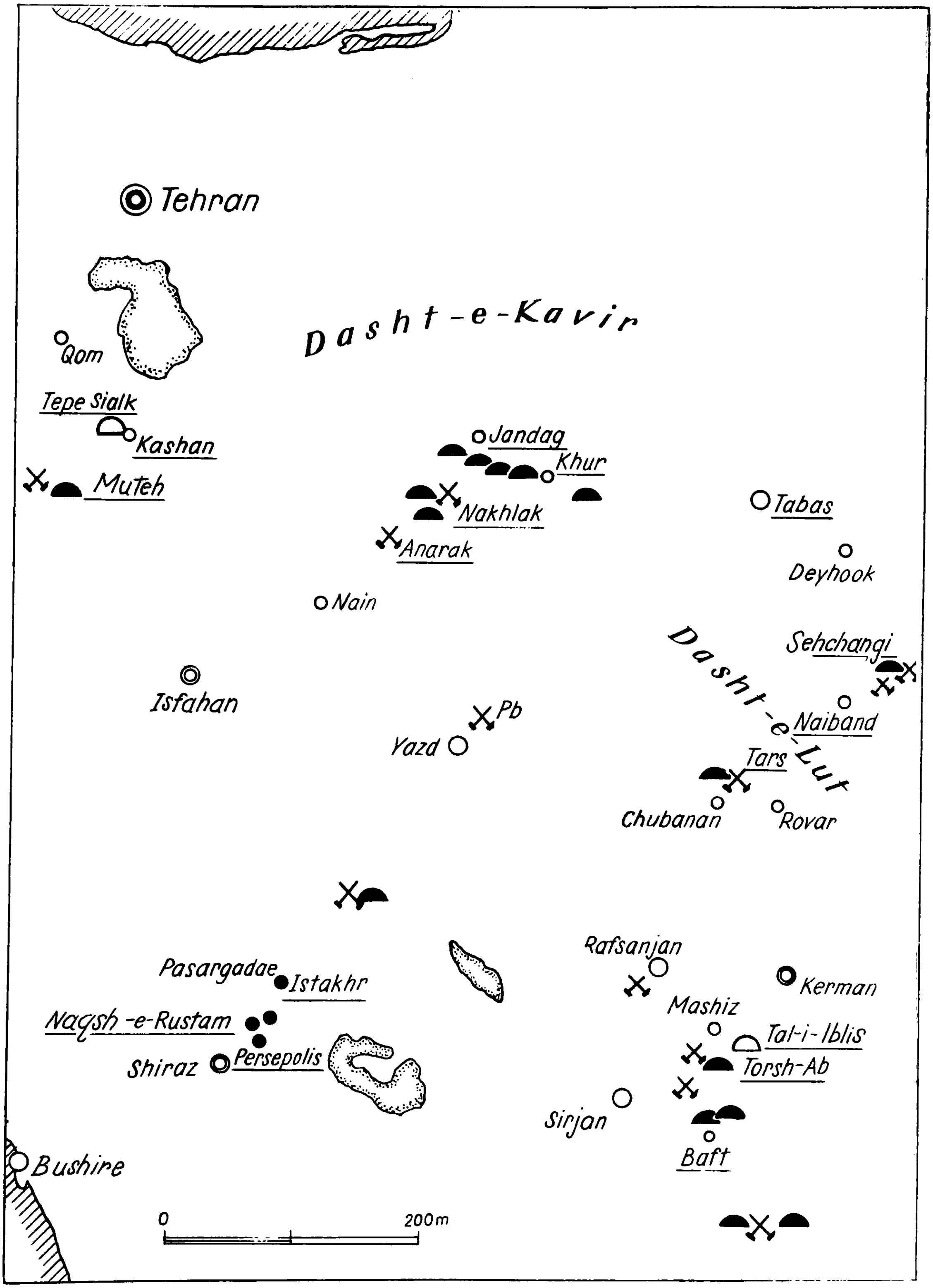
I wish to express my thanks to Prof. Smith and Mr. Wertime, and not least to Dr. Caldwell for the opportunity to take part in the expedition. I am also obliged for the help of all the members of the team, to my American friends and especially to my Iranian friends. I am also greatly indebted to Dr. Vossouqzadeh for his assistance in completing our itinerary. Finally, I express my gratitude to Dr. J. Filip, my Institute Director, and to F. Šorm, President of the Czechoslovak Academy of Sciences, and to the members of the Czechoslovak Embassy in Tehran for facilitating many formalities.

Introduction

At present writing many chemical analyses have not been made and some of our specimens lack even simple identification. Hence this is a preliminary report. Throughout our travels we studied the metals now in use; their mining today and the evidences of their mining in earlier times; the techniques of extraction and working of the various metals; and finally, their use in antiquity. The following preliminary report is arranged as follows: discussions of gold; then lead; notes on silver and the problems posed by the presence of zinc in many of the lead ores being mined; a discussion of copper; and some notes on iron metallurgy.

It is not known whether copper or gold was discovered first. Gold is the more striking, but much rarer than copper. Both occur in Iran in their native metallic forms. Of the

MAP 1


Tehran
Dasht-e-Kavir
Qom
Tepe Sialk
Kashan
Muteh
Jandaq
Khur
Nakhlak
Anarak
Tabas
Deyhook
Nain
Sehchangi
Dasht-e-Lut
Isfahan
Pb
Yazd
Naiband
Tars
Chubanan
Rovar
Rafsanjan
Pasargadae
Istakhr
Kerman
Mashiz
Naqsh-e-Rustam
Tal-i-Iblis
Shiraz
Persepolis
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two metals, gold early acquired the greater value it presently enjoys. It can be taken by washing river sands and gravels, or can be mined from quartz veins as it frequently was in ancient Egypt in the Nubian desert. Throughout the Middle East the graves of early kings and nobles were often furnished with enormous amounts of gold. The sources of this have not been adequately studied. In later periods gold continued to increase in value. The early importance of gold and the reported discovery of an old mine and miner's tools at Muteh led us to commence our investigation in that area.

Gold

The State-owned gold mine at Muteh is located in a mountain range southeast of Mahalat and includes several test adits. The goldbearing quartz vein was rediscovered some ten years ago, but had clearly been worked in earlier times. The productivity of the modern mine is not high, about 8 gr of gold each day. The vein is attacked by horizontal adits each some 50 m in length. The gold is separated by mechanical ore dressing. Recent adits at Darreh Ashki (moist valley) show traces of older adits. There are also two pit mouths on the slope to the valley, and evidence of other adits, probably sloped. The old pits are from 3 to 9 m wide and perhaps reached 16 m in depth. These old workings followed the vein, exploiting the best parts. This area of the site is also being worked now. Two sherds with reinforced rims and molded bands are of a kind (Fig. 1:4) which might have been made any time from Elamite to late Islamic times.[1] Querns (Pl. 1:2) were found near the pits at Darreh Ashki.

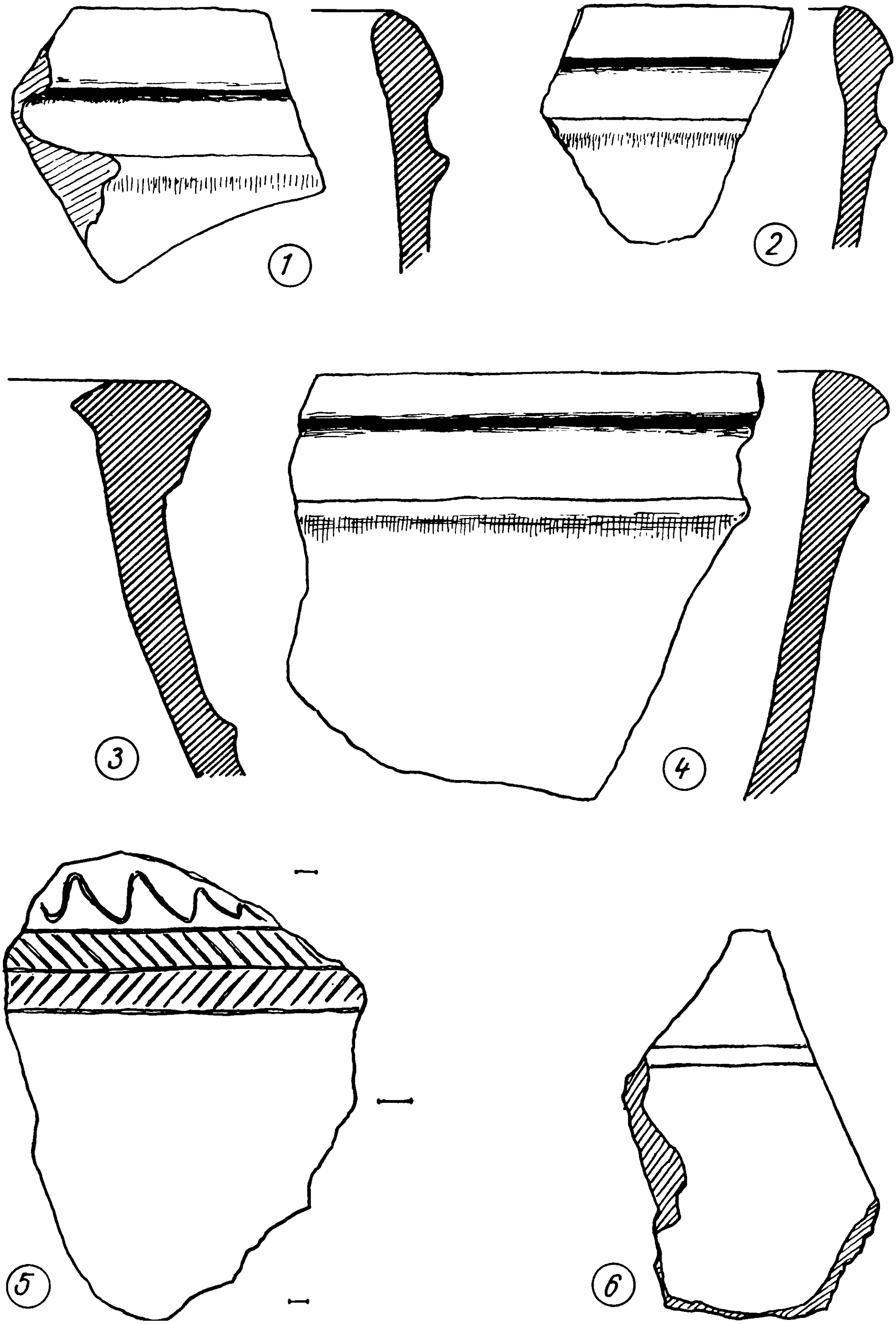
A second old mine is at a place called Sanjede, close to the laboratory of the present mine. Here we found a number of sherds similar to those from Darreh Ashki and others with a waved comb decoration (Fig. 1:1, 2, 5, 6). An important find made here was the lower portion of a vessel, 23 cm in diameter at the base and a preserved height of 14.2 cm (Fig. 2:3). There is a hole of 12 mm diameter in the wall of the vessel 20 mm above the base. This vessel may have been used for washing crushed ores. The grog of the vessel is a curious needle shaped material similar to that used in a flask of unknown provenience which is kept in the mine office (Pl. 1:3, right). Here too we found a clay lamp of developed type (Fig. 2:5). The pottery is not dateable but it may belong to early Islamic times. There were also parts of rotary querns, perhaps the two parts of a single quern (Pl. 1:4 and Fig. 2:2). At least one of them had a second hole in the upper or outside surface, 2 cm across and 2 cm deep, presumably to take the handle by which the upper stone was turned upon the lower. We also found a flat stone with depressions in the upper surface (Fig. 2:1) with diameters of 4, 4.8, 6.8, 7, and 7.5 cm which ranged in depth from 1 to 3.8 cm.

A third mine is situated about 30 km to the west at a place called Chah Bagh (garden well). There is a trace of an inclined shaft or gallery of unknown depth. Nearby were many thick walled sherds (Fig. 1:3) and some querns. The pottery is also difficult to date.

All three mines employed the same technique, an excavation inclined into the slope at an angle of about 30°, the pit following the vein. Iron picks were in use, one of which is preserved in the mine office (Fig. 3:4). It is 13 cm long and the diameter of the shaft hole is 2 cm. The mined ore was brought to the surface where it was probably crushed in querns. Although these valleys are now dry, the curious vessel found at Darreh Ashki suggests that the crushed ore may also have been washed just at the pit opening. The working face of the mine was lighted by oil lamps of the flask type. These have a

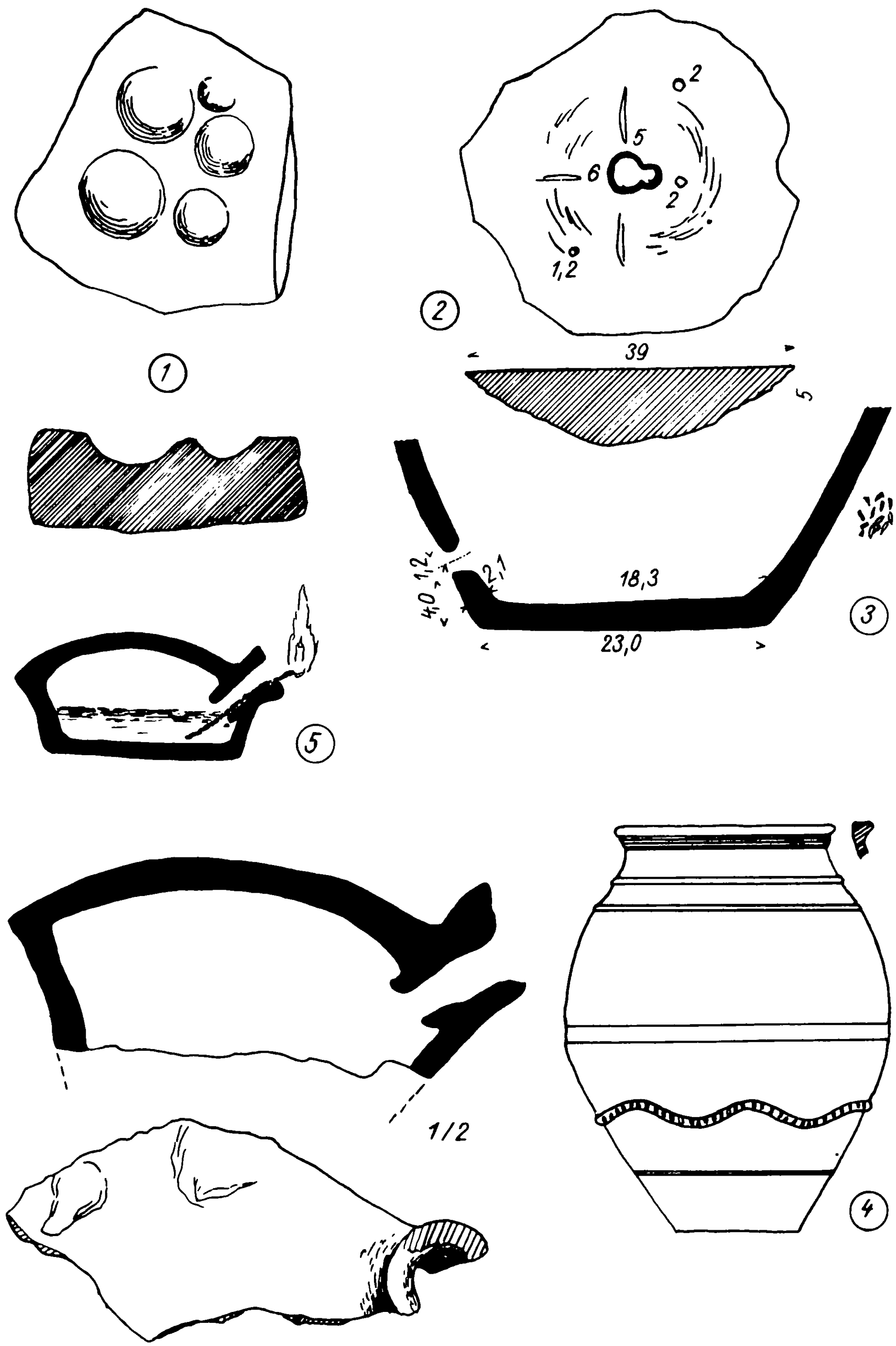
1 Communication from Dr. Ezat O. Negahban of the Muze Iran Bastan.

FIGURE 1. - MUTEH, GOLD MINES



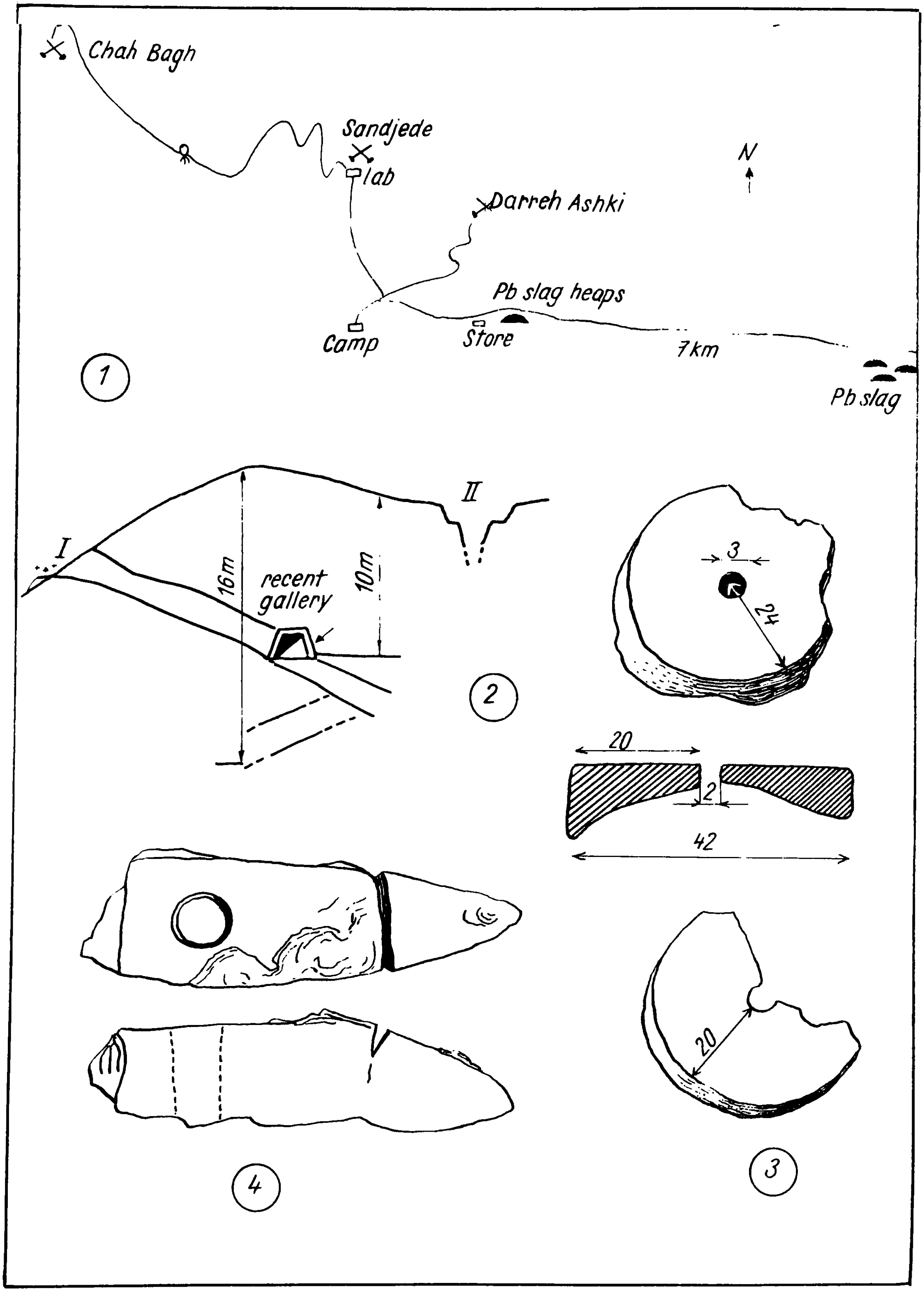
1, 2, 5, and 6 are potsherds from the Sanjede mine; 3 is from the Chah Bagh mine and 4 is from the Darreh Ashki mine. Scale slightly less than two-thirds.

FIGURE 2. - MUTEH, GOLD MINES



1. Pitted stone slab, Sanjede mine. 2. Part of rotary quern from Sanjede mine. 3. Lower part of pottery vessel with hole near base. 4. Large vessel from Muteh area (h. 67 cm, rim d. 25 cm, max. d. 56 cm. 5. Pottery lamp and reconstruction from Sanjede mine.

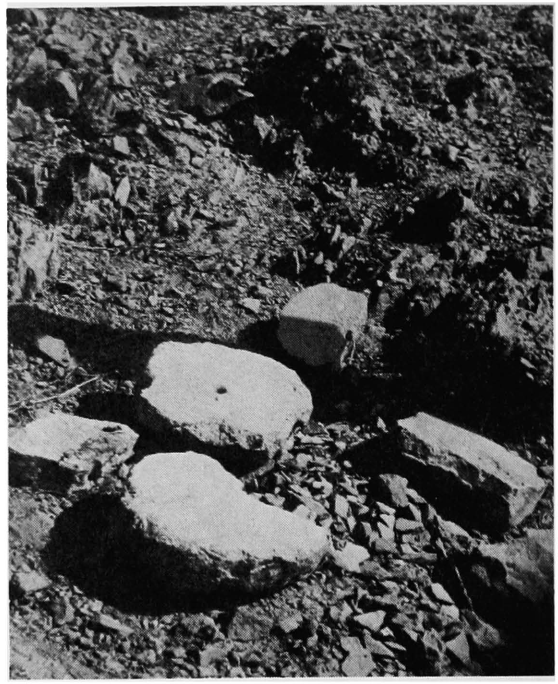
FIGURE 3. - MUTEH, GOLD MINES



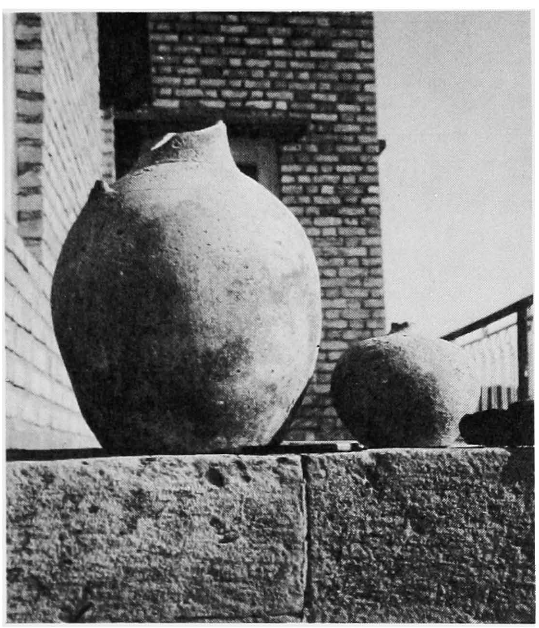
1. Sketch of the mining area. 2. Scheme of the old mine Darreh Ashki.
3. Rotary querns found in Darreh Ashki. 4. Iron pick from the Muteh area.

PLATE 1. MUTEH, GOLD MINES

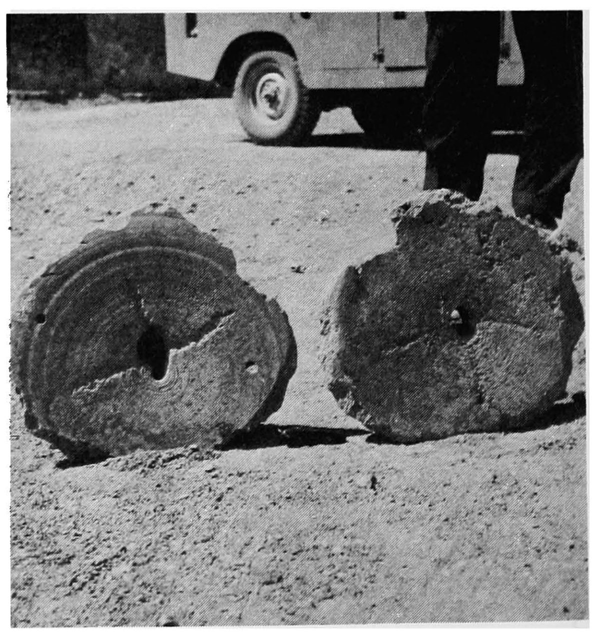
1. Darreh Ashki mine.



2. Rotary querns in old pit (No. 1) at Darreh Ashki.



3. Pottery vessels probably found in old pits of the Sanjede mine and now in the mine office.



4. Rotary querns from Sanjede mine.

Plate 2.- Querns and sherds from the old Chah Bagh mine.

long,narrow throat to support the wick (Fig.2:5). The ancient mining at Muteh was a small-scale operation, and since the sherds from the three sites investigated do not show significant differences, it is possible that all three were in operation at the same time.

In addition to the evidence of early gold mining at Muteh there must have been some lead mining conducted in the area in times past. In the plain, at points 2 and 9 km from the camp, there are groups of lead slag heaps. These slag heaps are quite dark and stand out clearly against the grayish-tan color of the terrain. The easternmost is the larger of the two groups. Among the slag are burned stones and bits of reddish fired clay (Table 1, A). There was no pottery to help us date these, but since lead smelting requires much fuel, it is likely that these slag heaps belong to a time when there were still forests in the area. There is still a remnant of almond and pistachio forest.

There is little agreement concerning the importance of lead in the early civilizations of southwest Asia. Some authors are of the opinion that lead was of minor importance up to Roman times,[1] but actually, after a period of sporadic use in the 3rd to 4th millenium B.C., this metal came into wide use in the middle of the 1st millenium B.C. This is a thousand years older than Aitchison suggests. Since the 5th Century A.D., lead was extensively used in an Achaemenian building technique joining blocks of stone with mortised iron clamps and the balance of the cut being filled with lead. Lead was also used for making anchors, weights, and other objects. There are cuneiform texts that contain remarks on <u>anakum</u>, but it is uncertain whether the metal referred to is lead or tin.

In our search for the early metallurgy of lead we visited Nakhlak (Pls.3,4 and 5). This is the center of Iranian lead production and is situated on the southern edge of the <u>kavir</u> (salt desert) bordering the Dasht-i-Lut. In the past hundred years Anarak has shifted from the mining and smelting of copper to lead, but Nakhlak has been throughout its history a major area of lead production. It is interesting that the mining traditions of

1 L. Aitchison, <u>A History of Metals</u>, Vol.I, p.75. New York, 1960.

both Anarak and Nakhlak should be very much alive in many parts of Iran.

The state-owned mine at Naklak exploits polymetallic ores of galenite and cerussite, which occur in veins, and are reached by simple pits and adits. The lead content of the undressed ore is given as 10%. We were told that cerussite is about ten times as abundant as galenite. The ores should have a silver content of 400 to 1600 gr per ton. About 65% of the production of the flotation plant at Nakhlak is exported. The balance is smelted in simple blast furnaces which leave about 7% of lead in the slag. The equipment at Nakhlak is far from modern and produces a very little return on the investment.

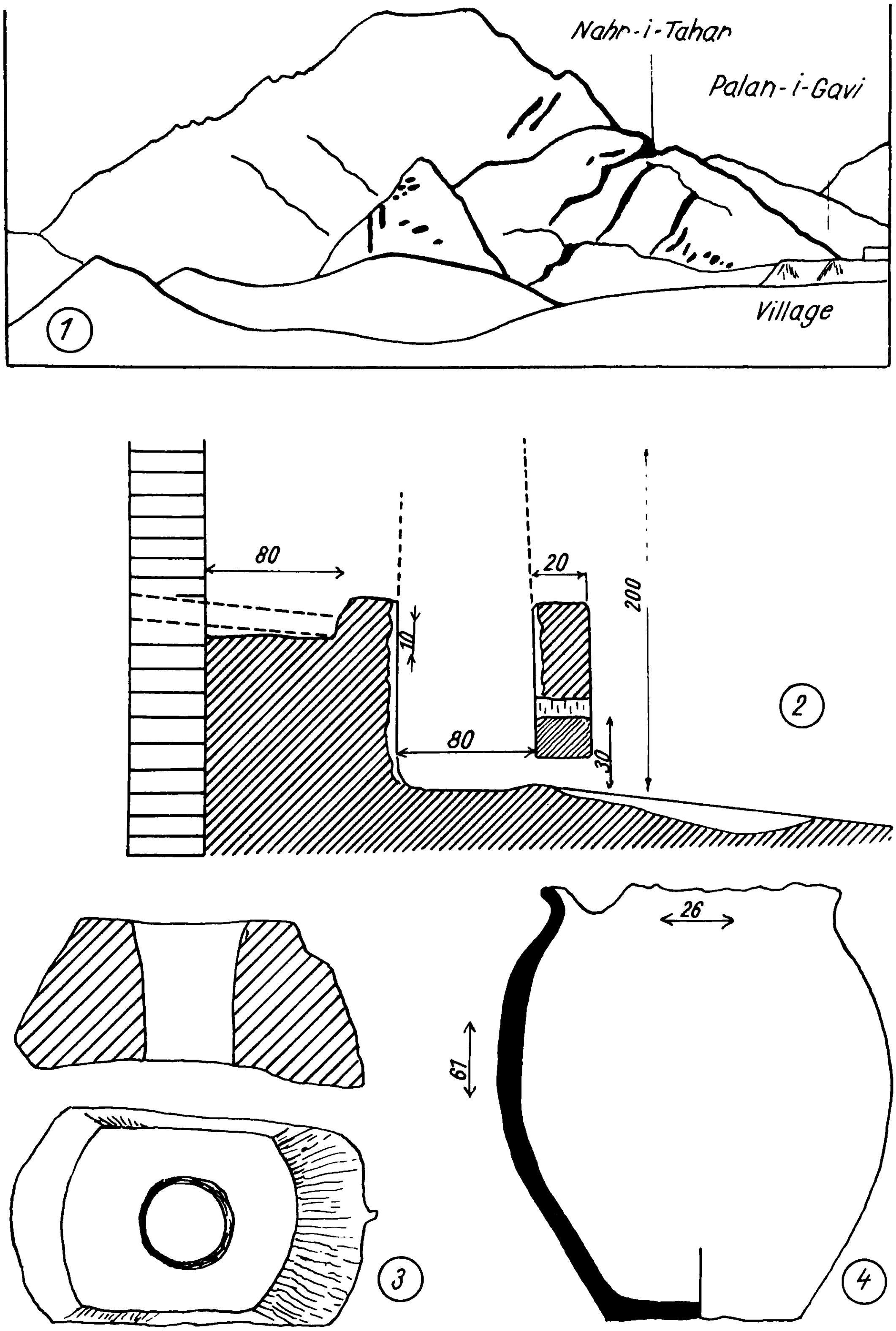
We were informed that fifty or sixty years ago lead was smelted here in low shaft furnaces. The last of these was in operation in 1940 (Fig.4:2). It is now used as a hearth for baking bread. The height of this smelter is about 2 m, with a diameter of 80 cm. The walls, about 20 cm thick, are of clay mixed with straw. There is a tapping hole at the base for lead and another situated just above for tapping the slag. The mouth of the tuyère is at the top of the lower third, about 60 cm above the base, and was connected by an iron tube to a bellows located inside an adjacent building. According to the available information a typical charge for such a furnace consists of 100 kg of lead ore, 30 kg of iron ore, and 35 kg of charcoal. A single smelt usually took 12 hours. This is an old process in which the lead is precipitated by the iron, which is simultaneously reduced. Iron sponge and grains of iron can be observed in the slag produced by the furnace (Table 1, B). The smelting of a typical charge should produce about 15 kg of lead. One of the foremen at Muteh, who had formerly worked at Anarak, described a taller furnace, about 5 m high, which had several tuyères and no tap for the slag. Nakhlak lacks any such furnace, which may have been built for the smelting of copper.

Although the recent mining history of Nakhlak is scarcely a hundred years old, there is abundant evidence that the area had been intensively exploited in earlier times. A rocky spine lying in the modern village of Nakhlak is covered with the old trenches of a strip mine known as Pirman (old man) (Pl.4). These are similar to the ancient Egyptian gold mines in Nubia and the Sudan. Having exploited the oxidation zone, it was necessary to begin a series of pits and inclined shafts, often reaching a depth of 70 m or more. The vein at Nakhlak has been almost completely exploited by the early miners. Below the surface there are huge rooms, which in some places are touched by the modern galleries and adits. Unfortunately it is not yet possible to date these old workings. We were told about the discovery some thirty to forty years ago of an inscription similar to those at Persepolis of the Achaemenian period. Nothing is known of the present location of this important find. Other objects from the old workings, sherds, an iron sledge, and other tools are kept at the mine office (Fig.4:3). There is even a wooden saddle. Doubtless these artifacts belong to different periods. A large pottery vessel found in the village area about 30 cm below the surface (Fig.4:4) now serves as a water container in the courtyard of one of the villagers. It does not appear to be a typical piece and is at the moment undateable. Previously no great interest was taken in such finds, but the staff of the mine has promised to carefully keep any artifacts found in the future.

Among the numerous old pits some deserve special attention. Palan-i-Gavi (cow's saddle) is an inclined pit, with numerous stopes and tool marks, reaching a depth of 145 m and located just above the modern cerussite dressing plant. To the east is another shaft called Nahr-i-Tahar, which appears as a small canyon, with an estimated depth of 150 m.

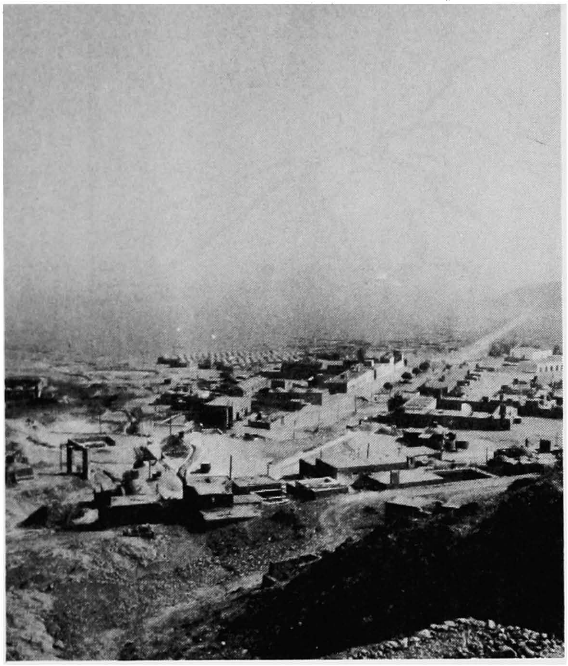
Some of the underground works now appear as clefts, others show traces of timbering. This area has never been mapped, and there is no correlation between the indications on the surface and the underground workings. In one of the old galleries we observed the

FIGURE 4. - NAKHLAK LEAD MINES

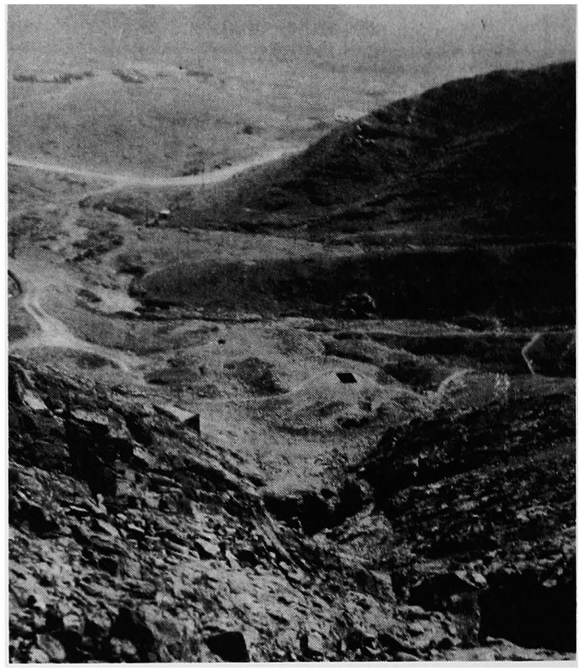


1. Panorama from east showing traces of ancient lead exploitation. 2. Remains of an old lead smelting furnace. 3. Iron sledge from Nakhlak mines. 4. Pottery vessel dug up at Nakhlak village.

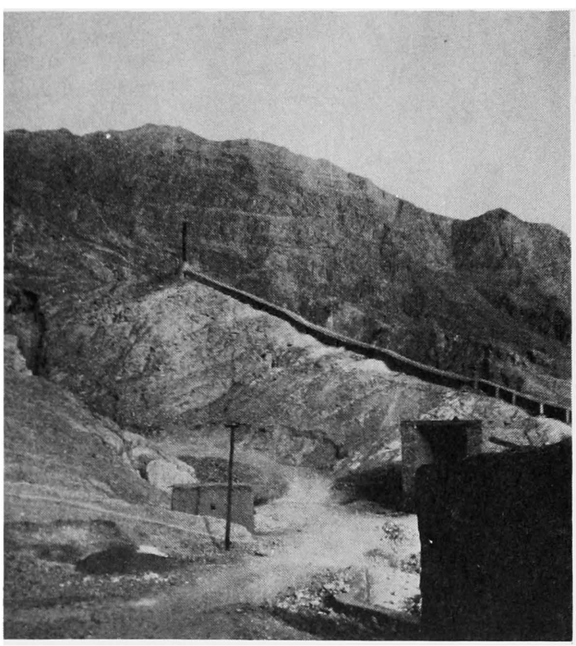
PLATE 3. - NAKHLAK LEAD MINES



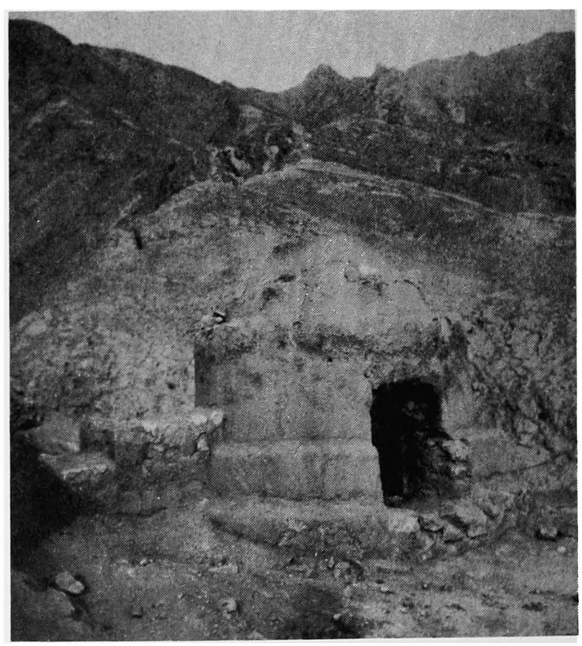
1. General view.



2. View from the slope with old mining traces to the valley.

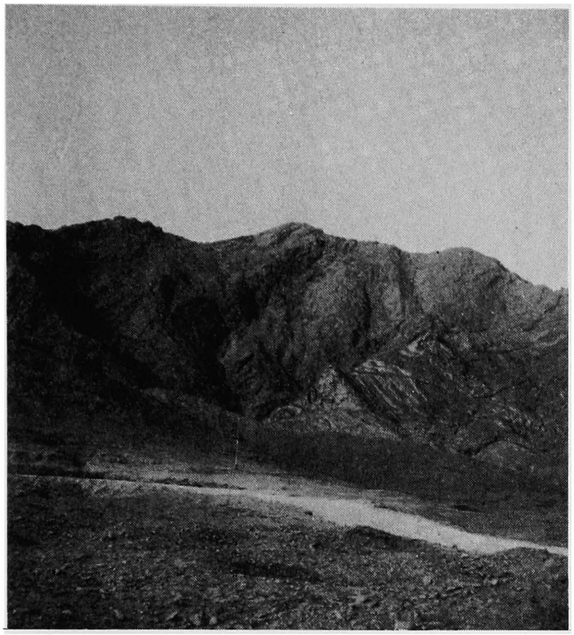


3. Lead smelting furnace.

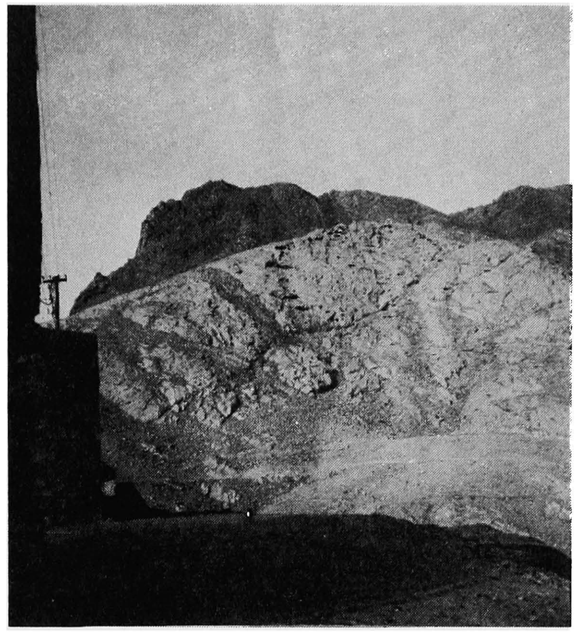


4. Limestone burning kiln.

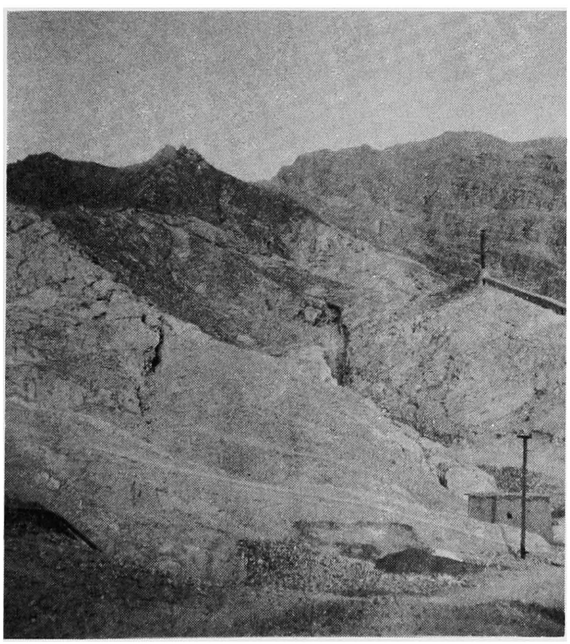
PLATE 4. - NAKHLAK LEAD MINES



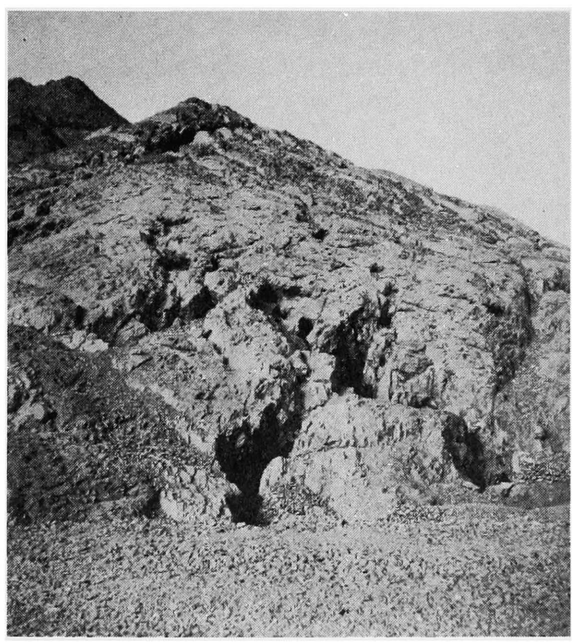
1. Hills and old mines to the left of the smelting furnace.



2. Hills and old mines to the right of the smelting furnace.



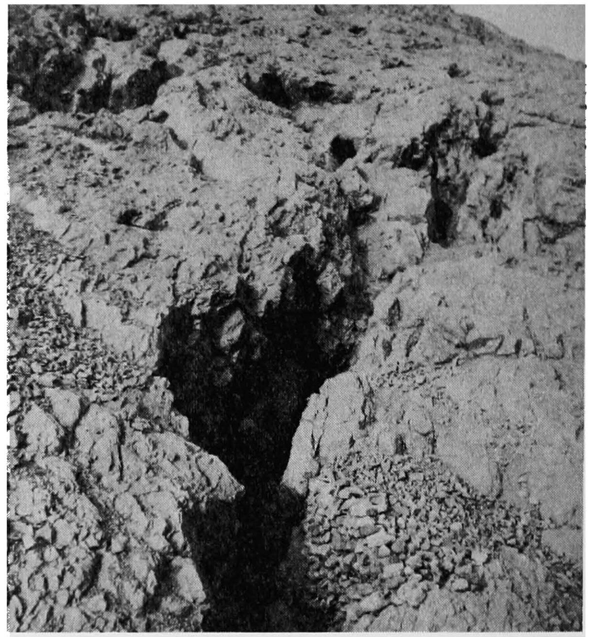
3. Vein ditches near lead smelting furnace.



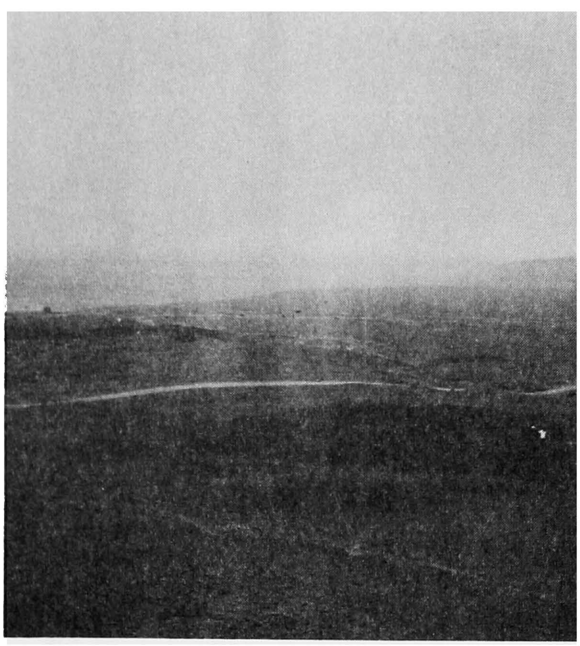
4. Vein exploiting.

PLATE 5. - NAKHLAK LEAD MINES

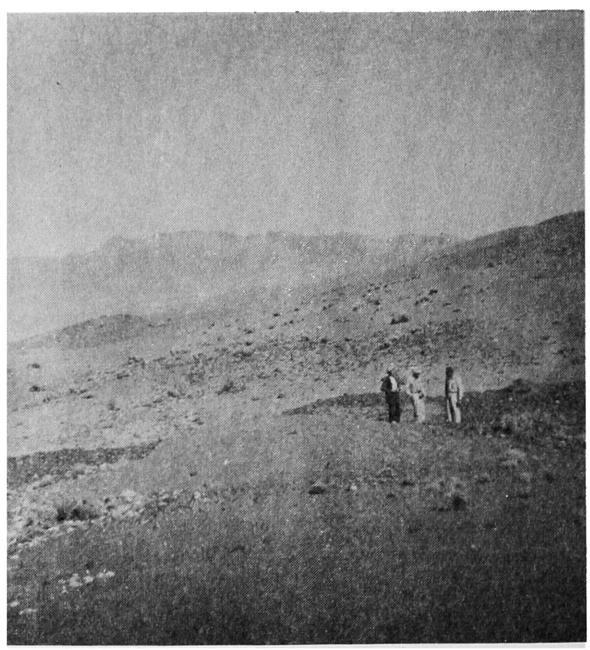
1. Adit entrance to the southern part Nahr-i-Tahar.



2. Vein exploiting below Nahr-i-Tahar vein.



3. General view of old lead smelting places and slag heaps on the edge of the desert.



4. Old smelting places: discussions and taking samples.

remnant of a vein, while traces of firing were visible at intervals. The Pirman workings are spread widely and are referred to as "pre-Anarak," i.e. as more than 100 years old.

Although no traces are now visible, according to information from Mr. Askari, foreman at Nakhlak, the ore used to be dressed at the mine sites and was then transported into an area now desert for smelting. Apparently the edge of the kavir at that time did not correspond to its present boundary and sufficient fuel was available. Mr. Askari reported many slag heaps in the desert, some exposed, some now covered with sand.

Beside the recent slag heaps close to the Nakhlak mine, there are others in the vicinity. Heaps of slag were reported at Chah Kharbuzeh (melon well) about 20 km southwest of Nakhlak. The date of these is not known, but a small mine there was completely exploited and closed only 15 years ago. Just as we entered the Nakhlak mining area we found two other slag heaps. These were small mounds about 7 m in diameter and were covered with a fine, (fractions about 7 mm) black, glassy slag. It is suggested that the gravel form was due to weathering under varying temperature conditions. Since other slag heaps contain large fragments of slag, it is thus implied that the slag gravel heaps are older. Areas of burnt clay were observed at intervals, having a diameter of about 150 cm; these are possibly the remains of smelting furnaces (Table 1, C). A third group of slag heaps were found just at the edge of the mountains behind an old nomad cemetery. Here there are six sites (Pl.5:4), each with black slag, burnt stone and burnt clay. Samples were taken of the slag, burnt clay and charcoal.

Slag Heaps in the Kavir between Nakhlak and Tabas

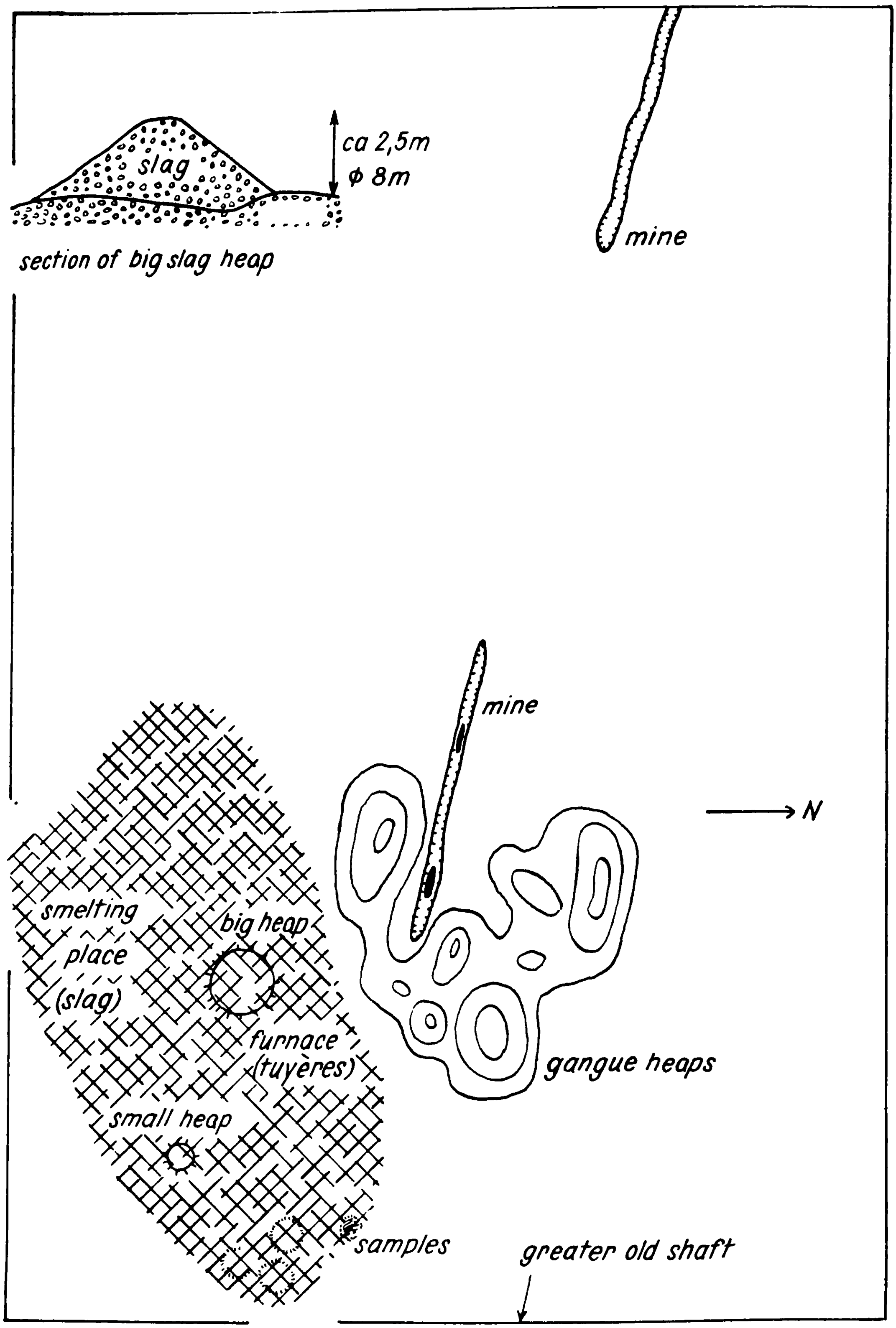
There are traces of slag heaps on the road from Nakhlak toward Chubanan about 30 km beyond Nakhlak. After passing Chubanan others were seen on the left, and still others may be hidden under the numerous dunes. Farther down the road were others, on the left at 16 km, and on the right 8 km farther on.

Later that day we encountered still another group of slag heaps and smeltery sites on the road from Akhrabad to Khur. Both sides of the road are bordered with slag heaps, which contain both slag gravels and larger fragments. Beyond this point more slag heaps are to be seen; one at 12 km and another at 16 km beyond Akhrabad. In the next 9 km there are six slag concentrations, the last of which consists of several heaps. Two km from there,is another large slag heap site which is 18 km from Farroukhi (Table 1, D). The interruption in the occurrence of slag heaps coincides with a valley. Beyond this there are slag heaps some 19 km from Baiazeh, altogether about 97 km from Akhrabad. These are no quite isolated and may be of some antiquity; they are about half covered with sand (Table 1, E). From this point eastward we observed no more slag heaps until reaching Naiband on the other side of the Dasht-i-Lut.

The Mines In and Near Naiband

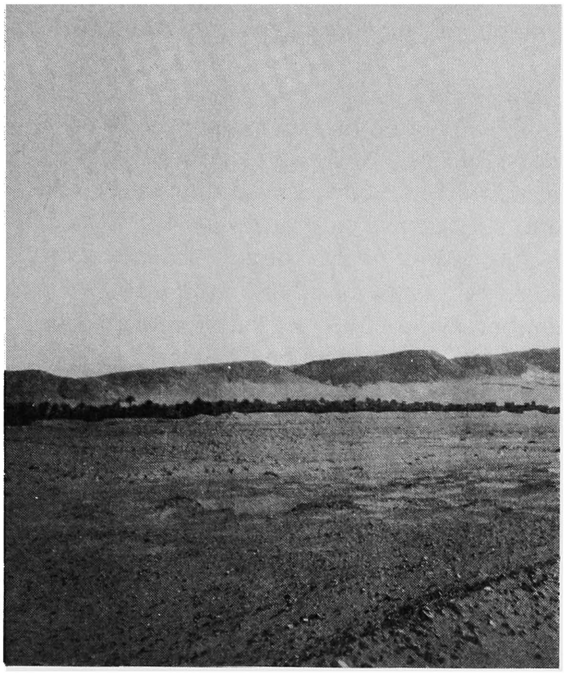
On the eastern side of the Dasht-i-Lut close to the Afghanistan border is a privately-owned lead mine known as Sehchangi (three prongs). The equipment here is similar to that of Nakhlak. There are three pits, some with galleries, a flotation plant, and a generator. Water is brought to the site in tank trucks. Close to the modern mine there are traces of the older exploitation of a surface vein. The area has some mountains, but the mine is on the plain below a series of hills, still about 1300 m above sea level. The vein is oriented north-northwest to south-southeast. A trench about 1 to 2 m wide and about 3 m deep follows the vein. Along the edges are heaps of finely crushed gangue.

FIGURE 5. SEHCHANGI LEAD MINES

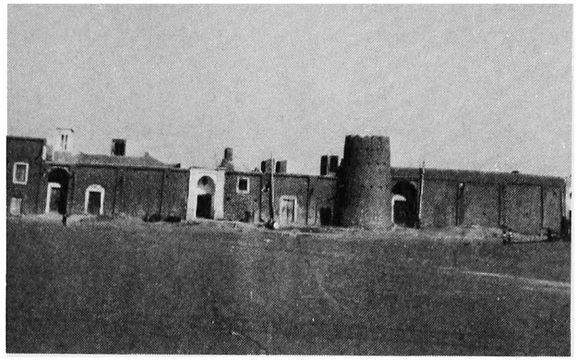


Sketch of the old mine vein exploiting ditch and smelting places.

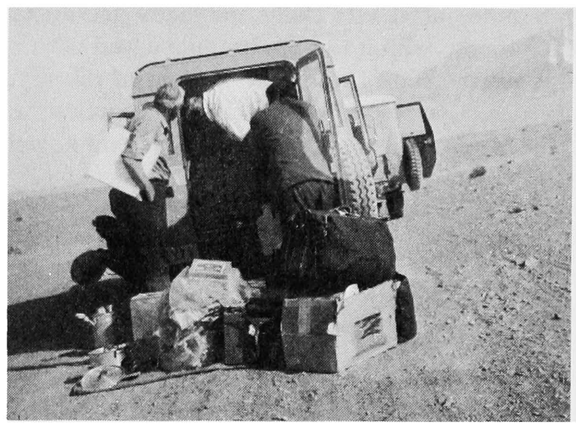
PLATE 6. - FROM NAKHLAK TO JANDAQ AND NAIBAND



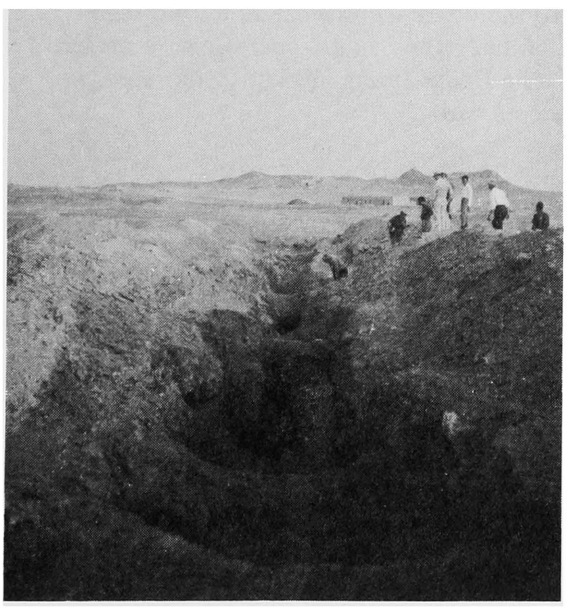
1. Chubanan oasis.



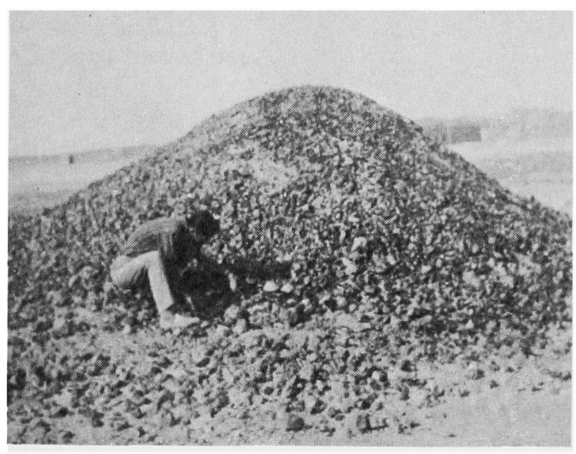
2. Chubanan village.



3. Reorganizing luggage.



4. Naiband. Sehchangi lead mines. Vein excavating trench in plain.



5. Sehchangi. Big slag heap on the lead smelting site.

The trench ends on the south end of the site at a shaft cut into the rock. The mouth is 6 m by 10 m and may have been originally about 30 m deep into the rock, but is now mostly buried. The underground galleries of this shaft encounter older workings. There are traces of timbering, some of which were collected for radiocarbon dating. The shaft mining would seem to be the most advanced of the older mining operations, and the most recent.

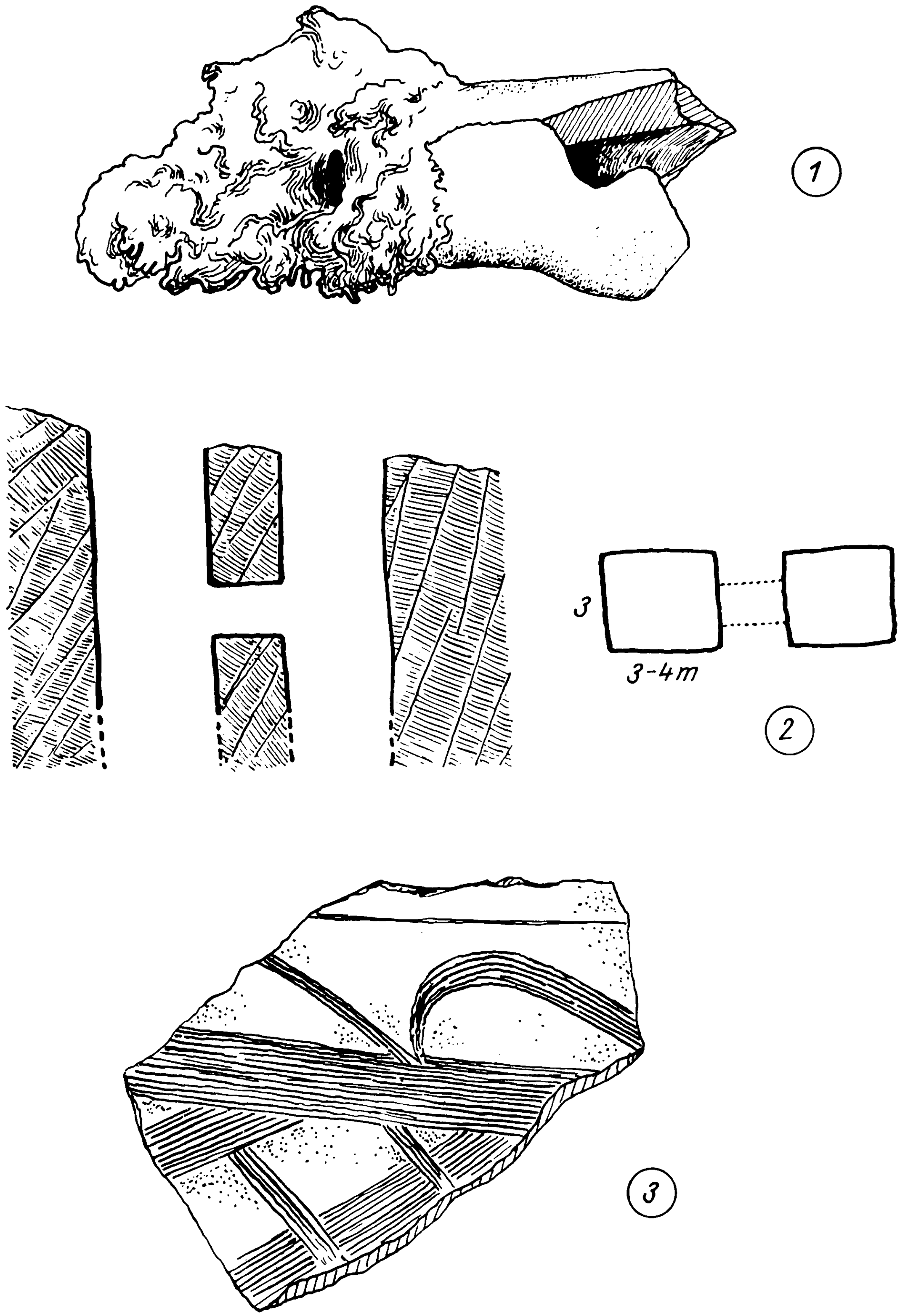
Near this old shaft are traces of a large smelting site. An area of approximately 60 by 100 m is completely covered with lead slag, occasionally in large heaps. Two of these were very striking (Fig.5). One near the center of the site is about 8 m in diameter, and about 2.5 m high. Another nearby is about the same height, but only three to four m in diameter. The variations in the appearance of the slag led us to the opinion that the heaps are of various dates, the two largest being the latest. Although all of this slag was present when the modern mine began, no one remembered the older period of operations. Adjacent to the largest slag heap there were fragments of tuyère nozzles (Fig.6:1) and we were told that the remains of a smelting furnace had been observed here. The preserved height was about 50 cm with a diameter of about 150 cm, the walls having an inner lining. Other smaller furnaces were reported with a diameter of about 60 cm. The tuyère fragments associated with these furnaces are about 20 cm in length, about 20 mm in diameter at the mouth, which is usually encrusted with slag. The tube itself is conical. Since a tuyère must reach nearly the middle of the furnace, the indication is that these are from a fairly recent period of operations, perhaps early 19th Century A.D., the end of mining activity here until the current operations began. Radiocarbon determinations might assist in dating this site (Table 1, F).

Adjacent to the modern Sehchangi mines are many old ones (Fig.7). A lead and copper mine is located about 1 km to the northwest. Four km to the east is the lead mine Garkheshti where three veins were exploited by trenches and twin rock-cut shafts. Here are the remains of a stone structure which yielded some glazed Islamic pottery with a black script which can be dated at about 1000 A.D. The shafts seem to represent a more advanced technique than the trenches. Three km to the south-southwest is an old lead mine which yields Islamic pottery. Another mine 60 km to the south-southwest is called Sorkh (red) mine and may have yielded hematite. The Houzi mine, 50 km to the east is known as a lead mine but may have produced copper as well.

Lead Mines near Chubanan and Tars

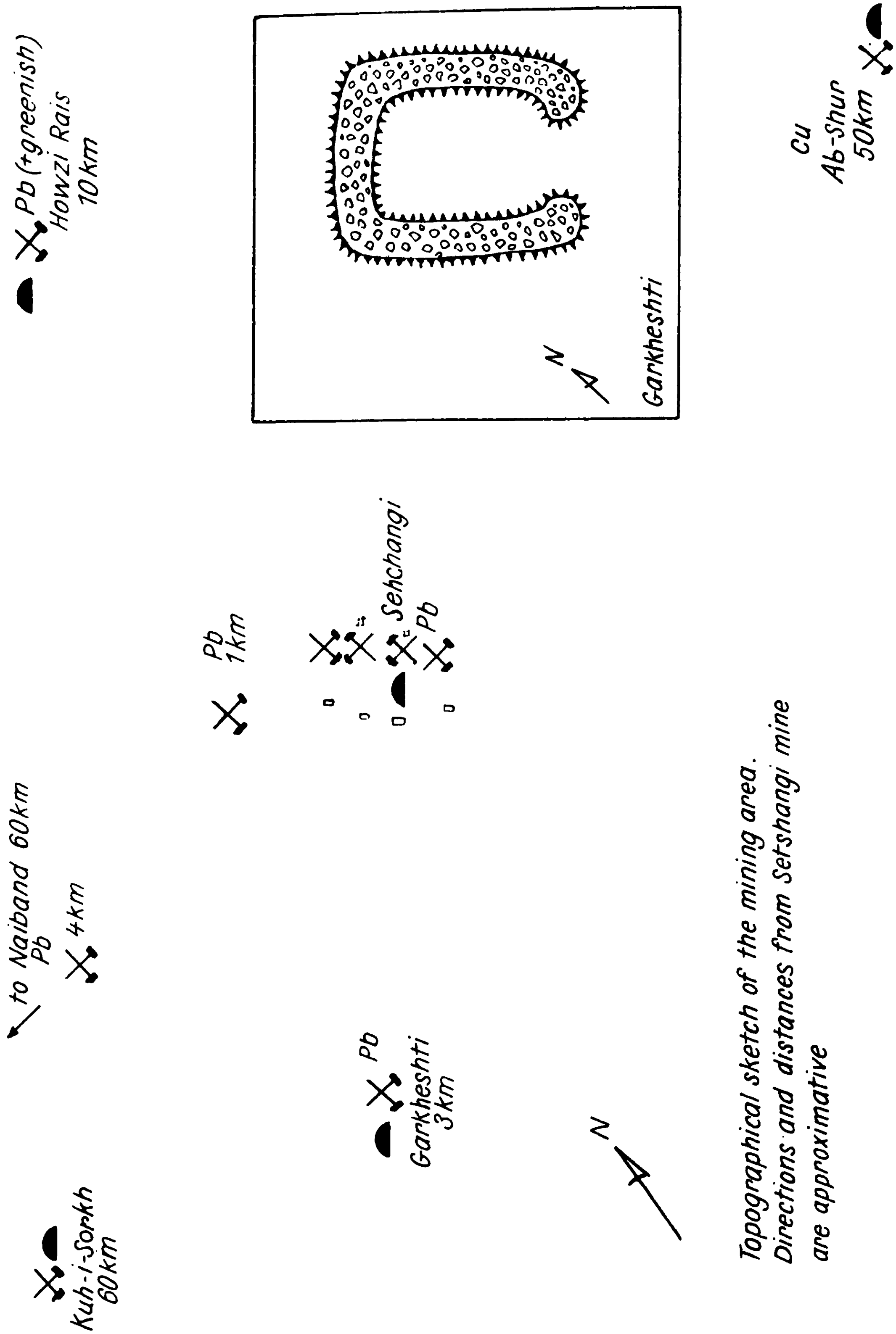
About 11 km west of Tars is a relatively new mine, worked some 40 years ago. On the mountain ridge above are two older inclined shafts. In one of these (Fig.8:2 and Pl.8) clay lamps, baskets made of palm leaves, and the mummy of a miner were discovered. These finds cannot be located at present. The shafts reach a depth of 50-60 m where they are broached by a modern gallery. A sample of timbering from shaft No. 2 is presently at the Geological Office in Kerman. Here also is an iron pick recovered from an old mine at Ravar (Fig.9:2). A sample could be obtained for metallographic examination. Two clay lamps, recovered from a mine at Gujer, some 36 km from the Tars mine, are in the possession of the expedition (Fig.10). There are reports of furnaces and mines at Jalalabad, including at least two furnaces, and other ruins, with clay miner's lamps. There is a map in the Geological Office at Kerman of an old series of pits for mining lead at a place called Qanat Marvan. There is still another center of lead mining near Yazd which we were forced to omit from our itinerary, but which previously had been visited by Smith and Wertime. Mr. Saidi, a foreman from this area, was with the team during our stay in Mashiz and participated in our experiments in smelting.

FIGURE 6. - NAIBAND LEAD MINING



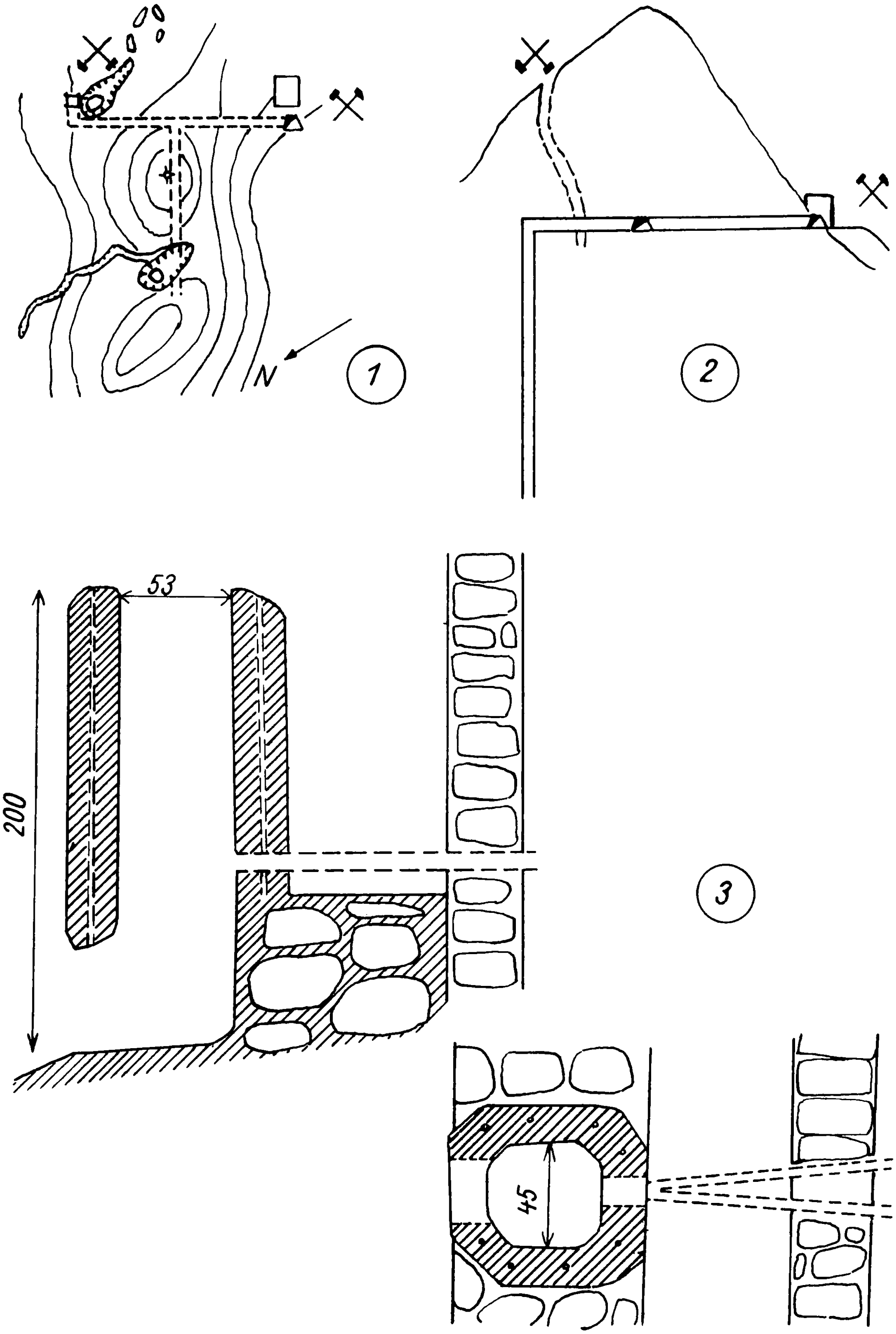
1. Sehchangi, tuyère nozzle from destroyed lead smelting furnace. 2. Garkheshti, scheme of twin rock-cut shafts. 3. Garkheshti, early Islamic pottery sherd. Tuyère slightly less than one half size; sherd slightly less than full size.

FIGURE 7. - GARKHESHTI AND THE SEHCHANGI LEAD MINING AREA NEAR NAIBAND.



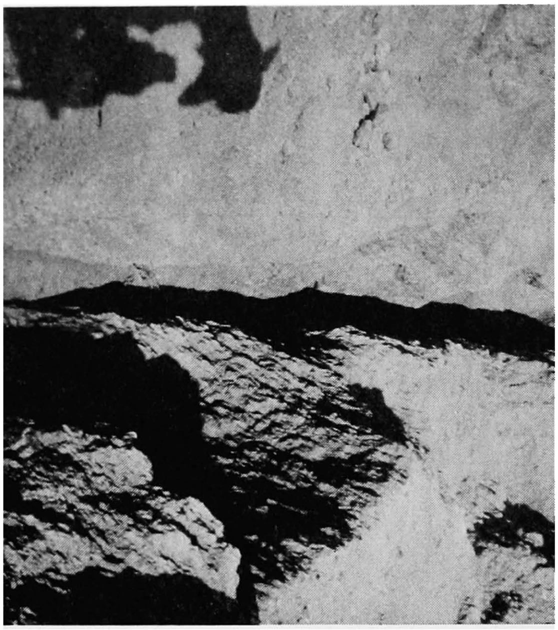
Sketch of location of old mines (according to Mr. Qorbani). In frame, house remains at the Garkheshti mine, about 3 by 4 m.

FIGURE 8. - TARS LEAD MINING AREA

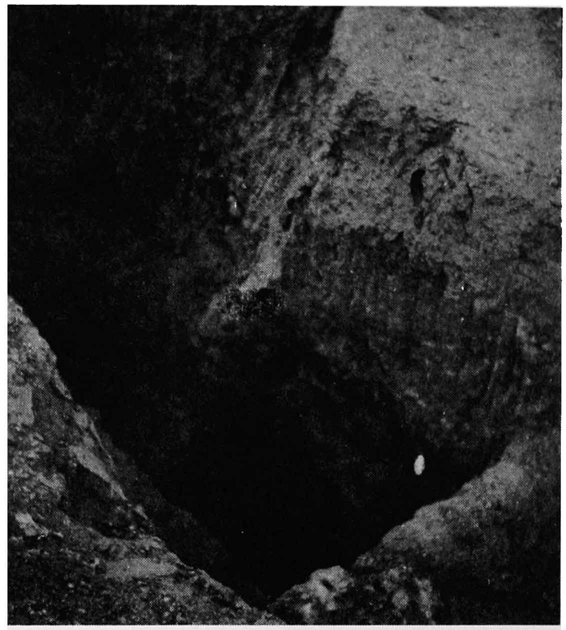


1. Position of two old lead mines near the present Tars mine. 2. Schematic section of the Tars mine. 3. Plan and section of the Tars lead smelting furnace which was never used.

PLATE 7. - NAIBAND MINING AREA. GARKHESHTI LEAD MINE NEAR SEHCHANGI.

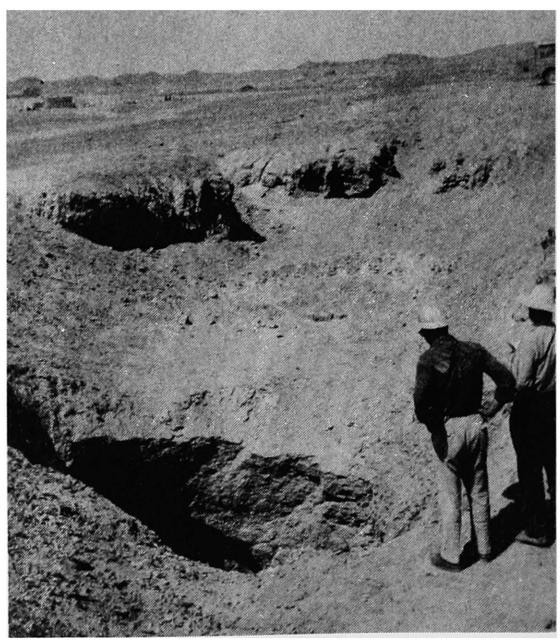


1. Vein excavating.



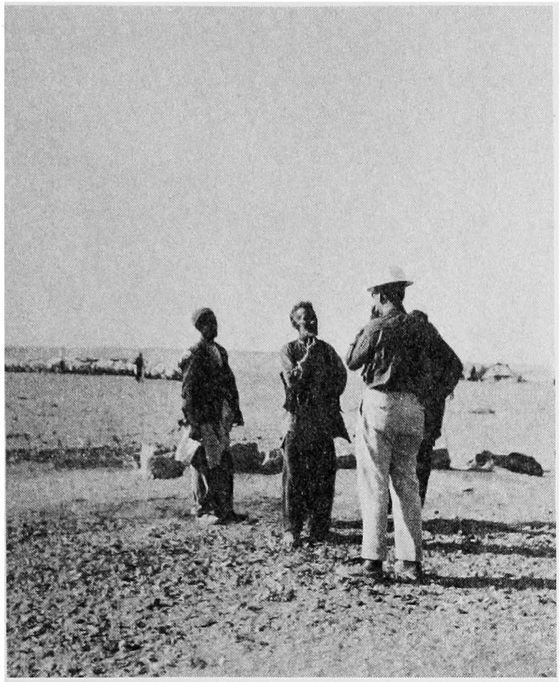
2. Twin shafts, rock cut.

3. Remains of Islamic house.

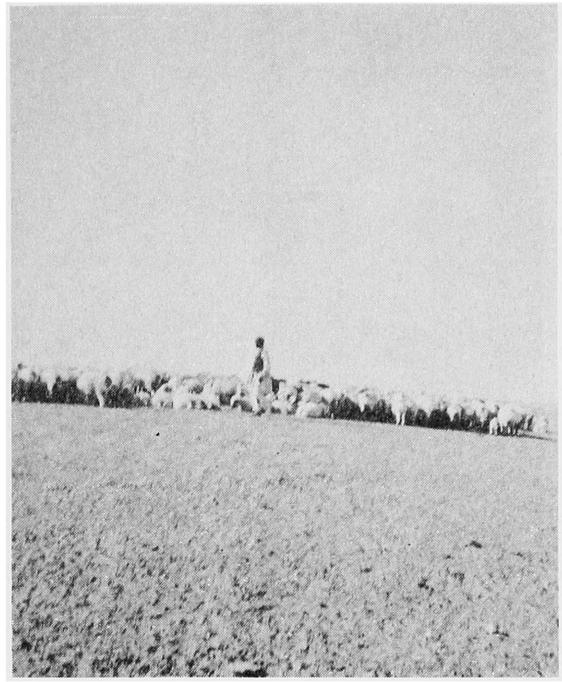


4. Sehchangi. Big shaft entrance in south part of site.

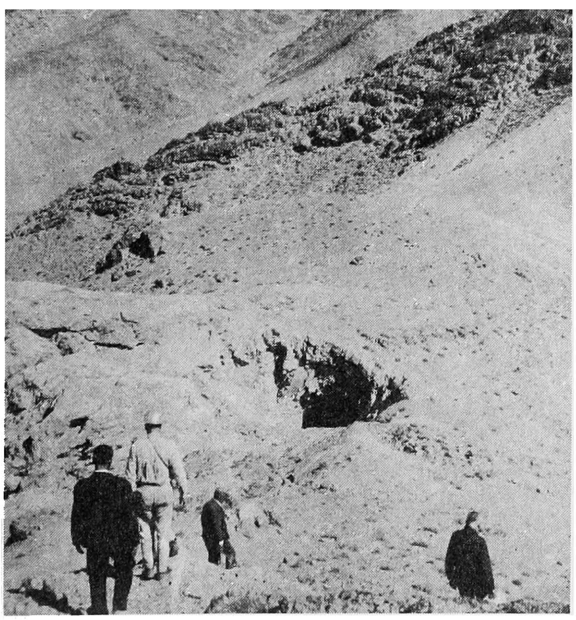
PLATE 8. - SEHCHANGI TO NAIBAND AND TARS LEAD MINES



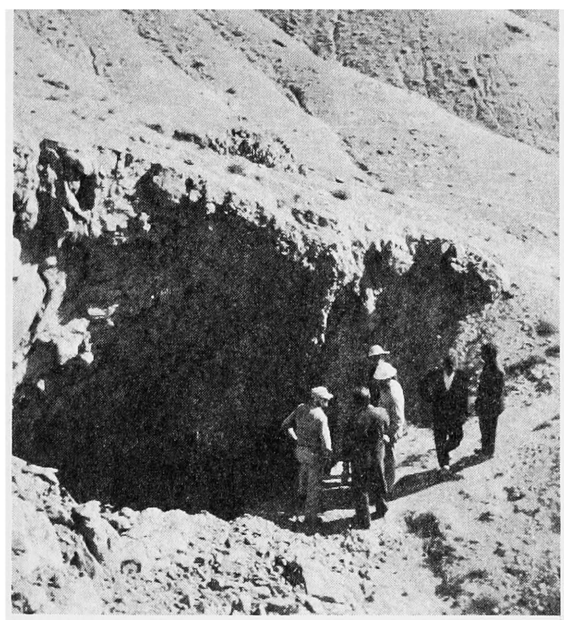
1. Between Sehchangi and Naiband.



2. Sheep and goats.

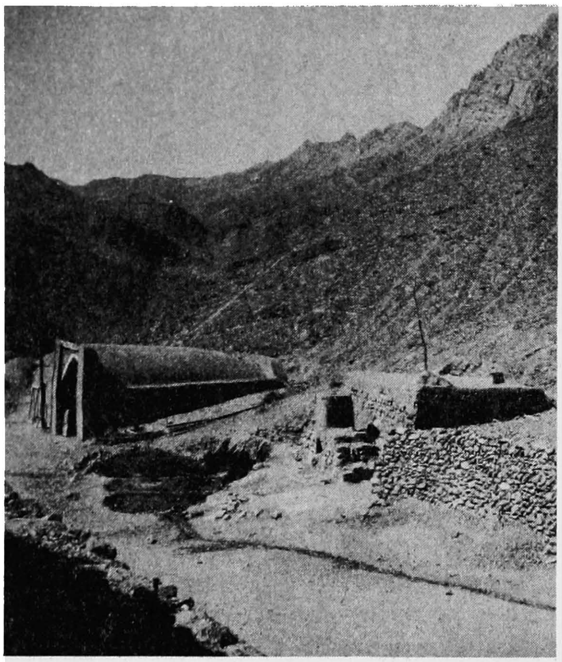


3. Tars lead mine. Old pit on the hillside.



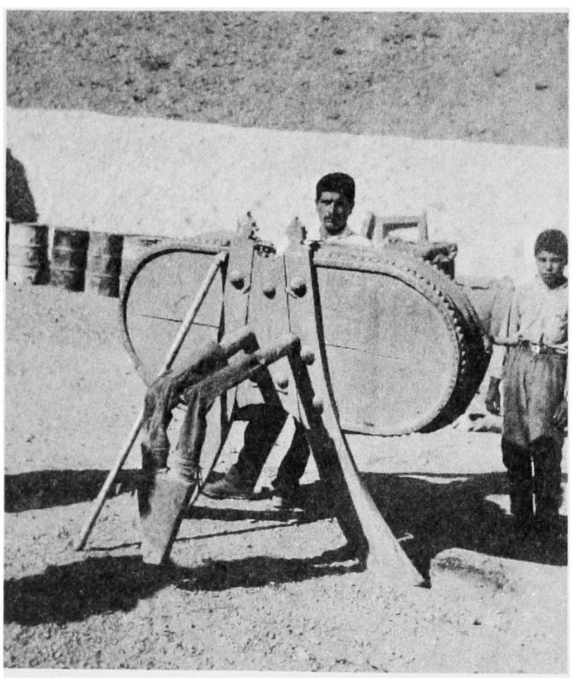
4. A closer view.

PLATE 9. - TARS LEAD MINES

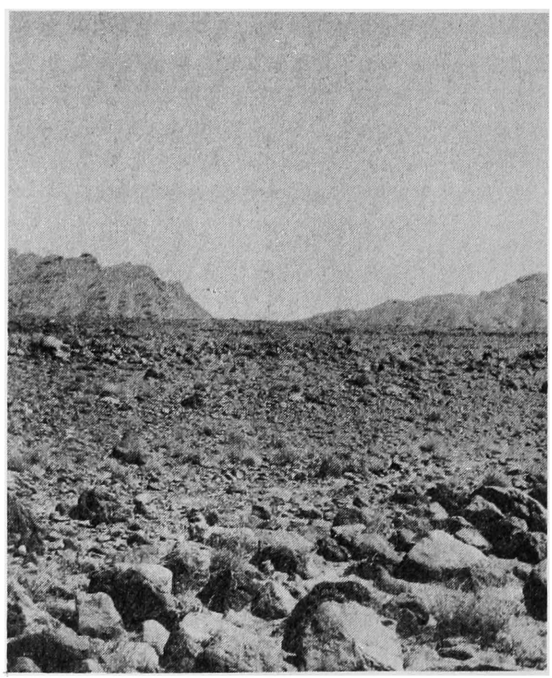


1. Lead smelting furnace. Never used.

2. Nearer view.



3. Twin bellows for the smelting furnace.



4. Ancient cemetery near the village.

The modern mine at Tars has an adjacent mining village where there is a well preserved specimen of a primitive lead smelting furnace (Pl. 9). For some reason this apparatus has never been used, and is an admirable study specimen. The walls are made of clay formed about an armature of wooden rods about 20 cm thick. The shape is rectangular with rounded corners. The furnace is about 200 cm high, with an inner diameter of about 18 by 21 cm. At the top of the basal third there is an iron tuyère leading from a twin bellows located in an adjacent hut. The outer span of this bellows is about 140 cm (Pl. 9:3). It has valves, the desks being in a vertical position.

Notes on the Metallurgy of Lead in Ancient Persia

All the modern mines of Iran are situated in places where the mining activity of earlier periods can be observed. The reopening of old sites is necessary in the absence of modern methods of prospecting and mapping, which are just now coming into use. (This observation applies not only to lead but to copper and other metals as well). The interest in historical references to metallurgy has resulted in the accumulation of a large body of information on past uses and sources, but has, unfortunately, done little to improve the annual output of the various mining enterprises.

The practices used in modern Iran in lead metallurgy are as ancient as the mining sites themselves. It is believed that without iron ores in the charge it is impossible to smelt any lead ore that is rich in zinc. The typical smelting operation uses a charge consisting of one-third iron ore, either hematite or, more lately, limonite. Modern metallurgy views this as a surviving practice. On the other hand the process is a typical precipitation reaction in which the iron takes part directly in the reduction of the lead ores. According to O. Quadrat: "During the precipitation process the lead from sulphidic ores (galenite) is replaced by iron; which is added either as scrap metal, or is simply introduced in the charge from added iron ore, or slag, and reduced in the furnace. The advantage of this process is that no roasting of the lead ores is necessary. The disadvantages are that galenite lacking in arsenic, antimony or zinc must be used, and that a great quantity of lead remains in the matte. The volatilization of the lead sulphide and the lead oxide, because of the high temperatures that must be used to reduce the iron ore, leads to further losses."[1]

It is possible that the iron ore was used as a flux, since lead slags are notoriously difficult to fuse. There is no shortage of iron ores in Iran, and their use in lead smelting seems to have great antiquity. Our experiments in primitive lead smelting, carried out at the prehistoric site of Tal-i-Iblis, used the traditional charge with its high iron ore content. This brings us to the problem posed to the primitive metallurgist by zinc.

The discovery of brass, an alloy of copper and zinc produced by melting copper and zinc ores (calamine), is very early in the history of metallurgy. It should be noted that the boiling point of zinc lies below the point at which it is reduced. Therefore, in an ordinary shaft furnace the zinc begins to evaporate early in the smelt, and is oxidized immediately on encountering the atmosphere. This brings us to the problem posed by tutia, presumably a form of zinc oxide, whose manufacture in the Chubanan area was

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1 O. Quadrat, Zaklady Metalurgie Kovu (Outline of Metallurgy), Prague, p. 75, 1948.

documented by Marco Polo in the 13th Century.[1] According to this account there was a mine near Kobinan -- modern Chubanan-- where a certain kind of clay was mined. This was roasted in a furnace with an iron grid; the vapor settling on the grid where it became hard after cooling, and was used as an eye medicine. The abundance of the product is especially mentioned in the Marco Polo reference. In view of the comments about the physical properties of zinc, and the fact that it was never widely produced in a metallic state until the advent of the distillation furnace, it seems unlikely that this product was metallic zinc.

Tutia itself was known in the west in the Renaissance period. Some authors take it to have been a form of cadmium. The sulphide and the carbonate of cadmium are often present in lead and zinc ores, and are reported to be present in the ores from the Tars area, but not in the ores from Nakhlak. However, zinc is normally present as a minority of all the lead ores of Iran so far analyzed by spectrograph. It is hoped that detailed chemical analysis of the orès from Tars, Nakhlak and elsewhere will shed some light on the early specialization in the manufacture of tutia at Chubanan. The slag of Naiband contains much zinc. Some samples of ore believed to be cerussite contain 38.5% of zinc.

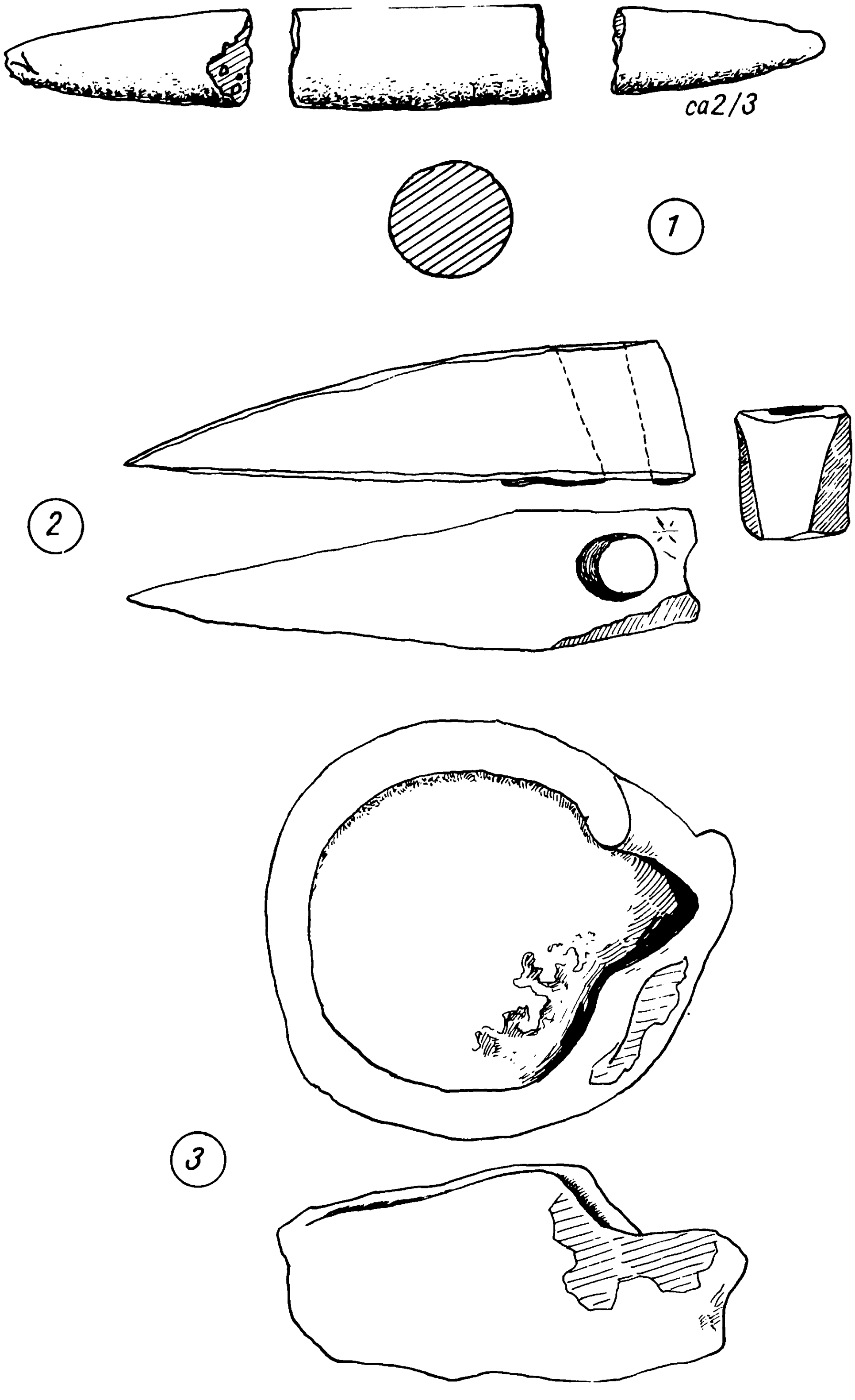
Still another metal normally present in the lead ores of Iran is silver. In the ores of Nakhlak,silver varies from 400 to 1600 gr per ton of ore. The older miners at the modern mine believe that the earlier operations were primarily concerned with the silver in the ore rather than the lead. However, one should recall the widespread use of lead as a building material during and since the 6th Century B.C. Silver was of course very important, having come to be a coinage metal, and it is almost certain that all the silver of the early periods, except for rare finds of the native metal, were recovered from the processing of lead. The standard process of separating silver from lead is called cupellation. In this process air is blown over the mixed melted metals, and as some of the lead is evaporated,the resulting mass, litharge, contains increasingly higher proportions of silver. Carried to the end point, only silver remains in the crucible. Litharge was recovered from many of the ancient slag heaps that we visited, but this is far from proof that the chief purpose of the many lead mining operations was the recovery of silver from the lead.

Mr. Saidi informed us that the Jews at Isfahan were reported to have refined silver according to a very secret recipe, which required the purchase of large quantities of the residue of vinegar production. Besides fruit pulp these would normally include a sizeable amount of acetic acid. Vitruvius, writing at the end of the 1st Century, B. C., describes a process in which white lead (lead oxide) is placed in a vinegar bath. The silver concentrates at the top of the bath as the lead salt is dissolved. Cyril Smith feels that this process may be chemically possible, if not very remunerative.

In connection with the confused interrelationships of silver and lead, the curious finds made at Saavand, a slag heap site near Tars, should be mentioned. Close to the village there was a slag heap simply covered with fragments of rods (Pl.10:1, 2) made of clay, pointed at both ends, and about 20 cm in length. The diameters varied from 2 to 2.5 cm (Fig.9:1). There were a great number of these, associated with a few bits of slag, some of which bore traces of burnt clay, the sure sign of a furnace. There were also some pieces of litharge. On the whole these curious clay artifacts, which are now the subject of an intensive study by Cyril Smith, do not tell us much at present about the metallurgical practices of the ancient Persians, but they are surely among the most fascinating

1 Henry Yule, The Book of Ser Marco Polo, Vol. II. London, Murray, pp. 125-6, 1929.

FIGURE 9. - FINDS FROM TARS LEAD MINING AREA AND RAFSANJAN.

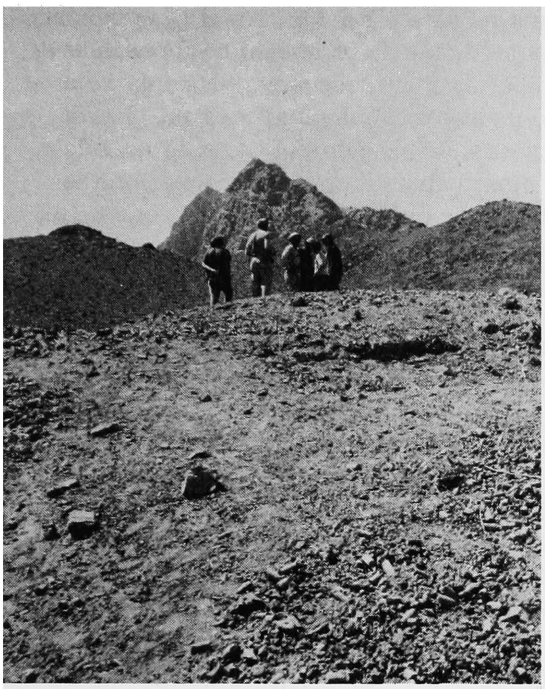


1. Saavand. Specimen from the heap of clay rod fragments. 2. Iron pick from Abbad lead mine with traces of bitumen (?). 3. Pottery lamp from the Chah Gaz copper mine near Rafsanjan. Pick slightly less than one half and lamp slightly less than full size.

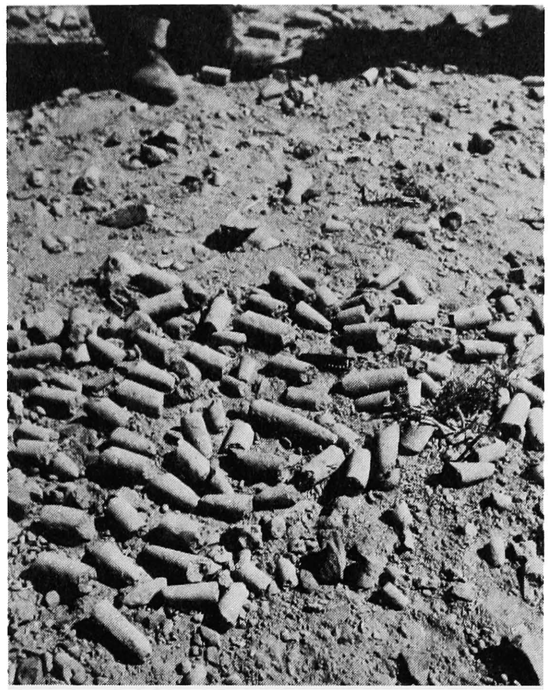
FIGURE 10. TARS AREA. POTTERY LAMPS FROM GUJER MINE.

Lamps slightly less than full size.

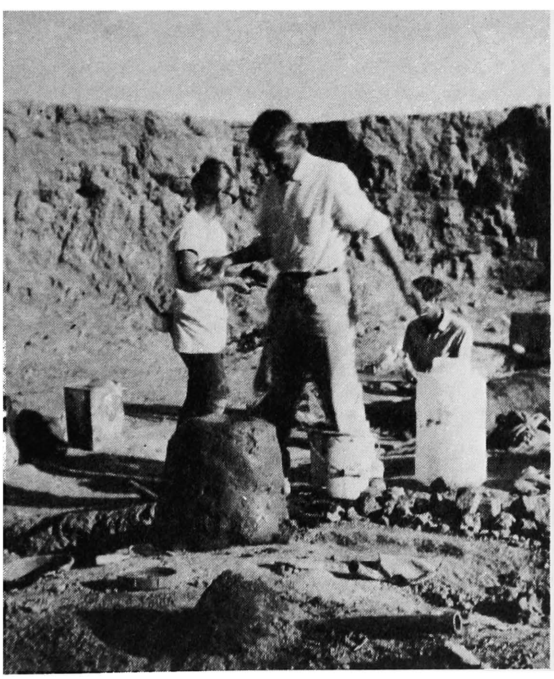
PLATE 10. - SAAVAND AND IBLIS



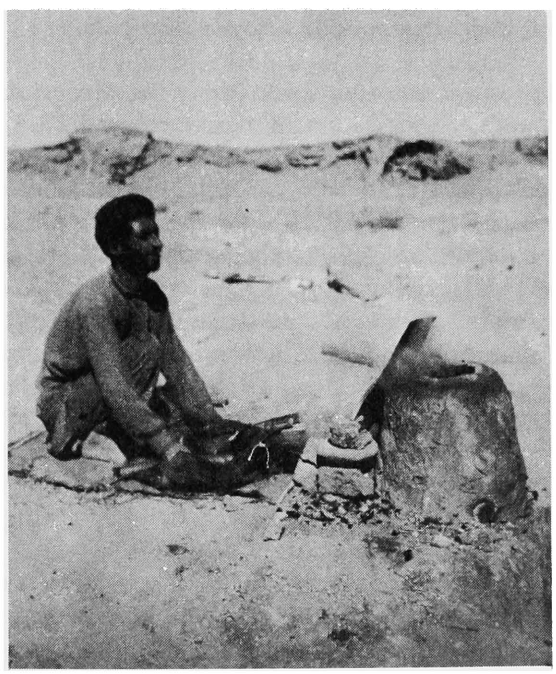
1. Saavand near Tars. Clay rod fragments, litharge and slag.



2. Closer view.



3. Iblis. Mr. Saidi building small shaft furnace for smelting lead.



4. Furnace in operation using goat-skin bellows.

objects that we encountered in our itinerary. It is to be hoped that the detailed and exhaustive analyses planned for these objects, so far unique, will provide a new contribution to our knowledge of an ancient technology.

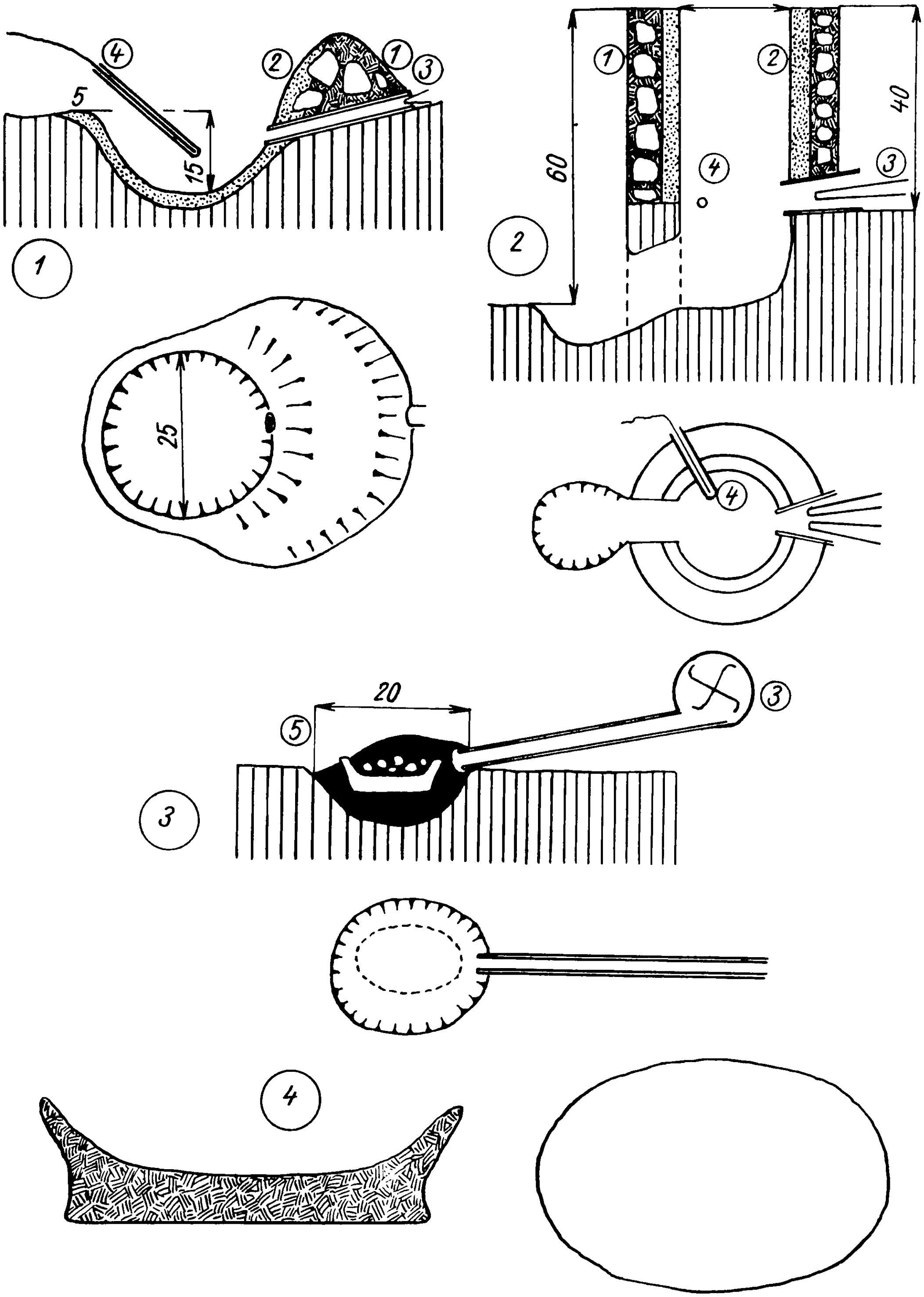
As a further footnote to the finds at Saavand it must be noted that Mr. Nafadjijan reported dozens of such sites in the neighborhood, and stated that there should be thousands in the adjacent desert near Anarak and Nakhlak, indicating that these were probably related to the smelting of lead, although he could not give us any technological details. It was once thought that these helped the draft in the furnaces, being piled in the combustible materials, but perhaps Mr. Nafadjijan gave us a most valuable clue in stating that the sites that yield such clay rods also always have large deposits of litharge, appearing as a reddish material with a matt lustre, in large pieces about 50 cm in diameter. As is so often the case in research operations, we seem to have raised more interesting questions than we have answered, especially since so many of the detailed analyses are yet to be done. These will appear in due time, and should offer some new ideas on the development of metallurgical techniques in early Iranian history.

During our visit to the site Tal-i-Iblis we conducted many experiments (Pl.10:3, 4 and Figs. 11, 12) including the smelting of lead ores, using the traditional proportions, in a simple low shaft furnace and an open hearth, with a goatskin bellows. The purpose was to learn whether such a simple furnace or hearth could develop efficient temperatures, and whether the iron, present as limonite ore, about one-third of the charge, would produce crystals or grains in the resulting slags. Some of the lead ores used were from the mine at Naiband, and others from those at Tars. Both contain about one quarter galenite, the balance being cerussite. Apparently the samples contained a large quantity of zinc, causing problems as we sought to reconstruct primitive smelting conditions. About one third of the charge was iron ore, in the form of limonite, and charcoal was added in the ratio of 1:1, later changed to 1:0.75 (Table 1, G). It was decided to carry out two smelts, one in each of the furnaces, the first a low shaft furnace, a miniature of the furnace recorded at Tars, and a second in a simple hearth. The charcoal used in both smelts was purchased from the bazaar at Mashiz and the type of wood is not known, but this should not have appreciably affected the results.

The shaft furnace, built under the direction of Mr. Saidi, consisted of a bowl-shaped hearth, about 35 cm in diameter, and 27.5 cm in depth. Over this a chimney was erected of sun dried clay bricks, 70 cm in height, 12.5 cm thick. The diameter of the top opening was 27.5 cm. A tunnel was dug between the depressed hearth and the exterior, which was left open during the period the furnace dried, but was closed with clay during the smelt. The base of the hearth pit was flat and inclined toward this hole, which was designed to tap the furnace. Opposite the proposed tapping hole, and slightly above, was situated the nozzle of the tuyère, 4 cm in diameter, conical in shape, with an outer diameter of 7.5 cm. A twin goatskin bellows was used, operated by one man. The volume of this bellows is not known, but the apparatus was returned to the United States to be measured and further studied by Cyril Smith. The rhythm of the bellows was 35/37 seconds from both bags. The same bellows was used in furnace No. 2, which was a simple hearth 20 cm in diameter, and about 10 cm in depth. The hearth was lined with a sandy grog, and had a low protecting wall through which the tuyère projected.

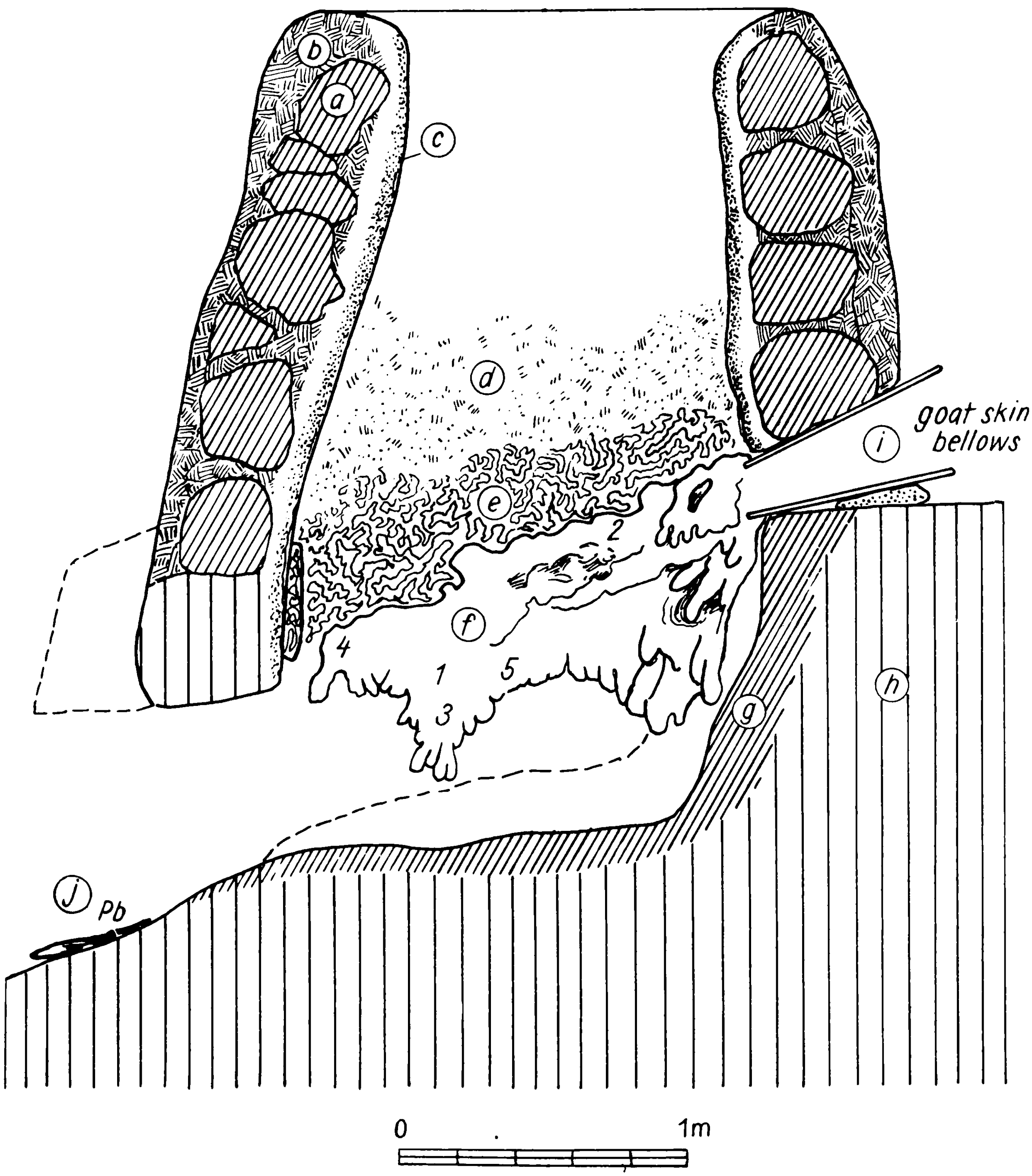
The individual charges were prepared by weighing the components. A set of Pt/PtRh thermocouples with a millivoltmeter were used to measure the temperatures at about one third of the height of the furnace, and at the tuyère in the simple hearth. All observations, times and measurements were recorded in tables, and will appear with the results of the chemical and metallographic analyses of the resulting slags. The operations were photographed in black and white, in color, and in part on 8 mm cinema

FIGURE 11. - TAL-i-IBLIS SMELTING EXPERIMENTS



1. Open hearth with goatskin bellows: clay, sand and straw protecting wall (1), sand and clay lining (2), tuyère (3), and thermocouple (4). 2. Shaft furnace with goatskin bellows, walls from brick, sand, clay and straw (1), sand and clay lining (2), zinc sheet tuyère (3), position of the thermocouple (4). 3. Open hearth for copper ore smelting in crucibles (5), with ventilator (3). 4. Reproduction of a crucible according to the find at Tal-i-Iblis lower, layers (clay and straw).

FIGURE 12. TAL-i-IBLIS SMELTING EXPERIMENTS



Section of the small shaft furnace used for lead smelting. (a) dry bricks, (b) clay, sand, straw, (c) sand and clay lining, burnt, (d) yellow and grey oxides on the inner walls, (e) slagged, (f) lead slag, iron oxide and lead conglomerate, (g) burnt loess, (h) loess, (i) tuyère (zinc sheet box), (j) lead. Numbers: samples for analyses.

film. After dismantling, the furnace and hearth were measured and sketched in cross section, with the contents in situ, and samples were taken.

Beginning on the evening of the 28th, after some sun drying and the use of a small brush fire, the furnace was fully loaded with charcoal and fired to preheat. The addition of fuel was required during the night as well. The following morning at 9 a.m. the furnace was refueled, a charge placed in the throat and the tapping hole sealed. At 9:10 a second charge was added and black smoke boiled out of the mouth of the furnace, smelling strongly of sulphur. At 9:25 a third charge was added and temperature at the check point was noted at 1010°C, rising to 1080°. At 9:40 a fourth charge was added, the temperature being 1100° C. At this point a yellow deposit formed on the inner surface of the throat. At 10:00 the temperature was 1120°, at 10:05 1130°, and at 10:10 a sixth charge was added, with charges number 7, 8, 9, added at ten minute intervals. At 11:25 the temperature at the check point was 1175°. A tap was made, and a small quantity of lead appeared in the depression below the hearth. Apparently the zinc content of the ores was too high, and the remaining slag and lead solidified in the furnace when it was left to cool. On the 30th, we removed half the shaft, the inner surface of which was discolored grey and blue. At the level of the tuyère there was a conglomerate of slag and lead. Some magnetic fractions were noted, evidence of the reduction of the iron ores included in the charge. The base of the hearth was covered with ash. The smelt consumed 8.25 km of ore (lead to iron 2:1), 7 km of charcoal. The proportion of charcoal was later reduced because of its volume.

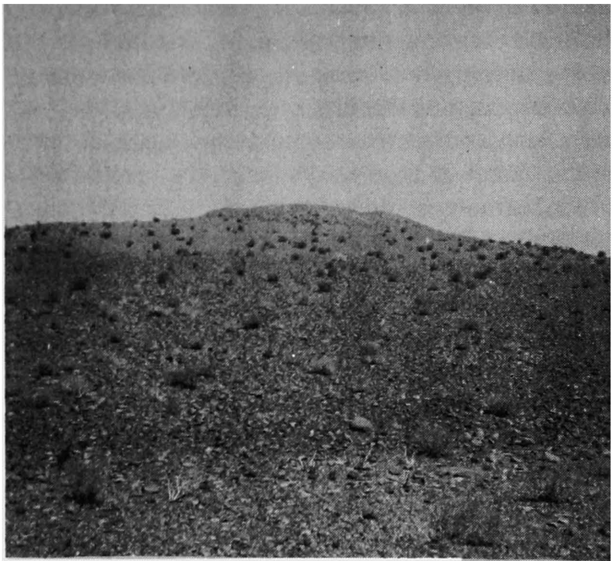
The smelt in the simple hearth required only one hour, the hearth being preheated for some six hours. At 14:45 hours the resulting ash was cleared away and fresh charcoal added. At 14:50 the first charge of ore and fuel were added, 0.6 kg of ore and some pieces of limonite. The bellows was brought into operation at 15:00 hours. A second charge (0.4 kg ore and charcoal) was added; at 15:07 a third charge. At 15:15 the temperature was 1160° C, at 15:30 it was 1130°. At 15:34 a fourth charge was added with a double ration of charcoal. About 16:00 hours this last charcoal was consumed. This smelt was not successful. Neither slag nor metal was observed, only sintered ore. Much more experience will be needed to smelt successfully on such a small hearth.

A full set of conclusions is not possible until the analyses have been made of the materials produced by these experimental smelts. It can be stated that Smelt No. 2, in the simple hearth, was not successful, that the lead ores such as we used can only be handled in a larger and hotter furnace. Perhaps we simply lacked experience, since someone, somewhere, once smelted ore without benefit of a fairly sophisticated furnace, sophisticated that is, as compared to an open fire. The process in the small shaft furnace proceeded more normally, but the yield was poor. However, we had set out to test the furnace, the bellows, and the process, not so much to determine what the output would or could be but rather to observe the nature of the various components in operation. It does seem quite clear that the use of a simple goatskin bellows produced, in a shaft furnace, adequate temperatures, 1200°C or thereabouts, to reduce any metal known in antiquity. Analyses of some products of the experimental smelting in the low shaft furnace are given in Table 1, H.

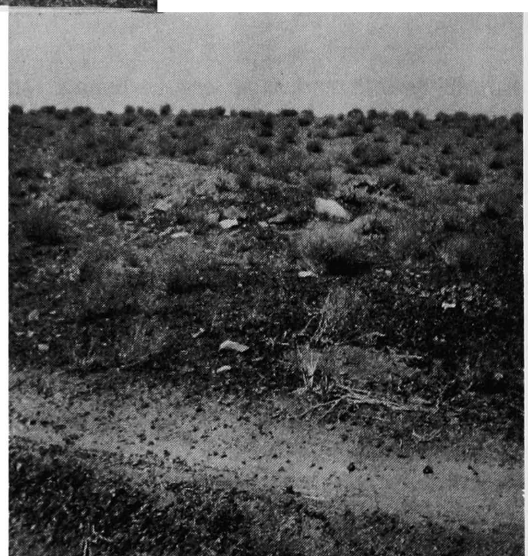
Copper Mining and Metallurgy in Ancient Iran

Copper was the first metal to appear in the development of civilization. Evidence of the use of native copper occurs in the Middle East from the sixth millenium B. C. and earlier according to various radiocarbon determinations. The copper found in the lower levels of Sialk and Tepe Hissar are native coppers according to Smith and Wertime (communication). The copper from Tal-i-Mess (copper mound) near Anarak corresponds

PLATE 11. - TORSHAB IN THE BARD SIR VALLEY



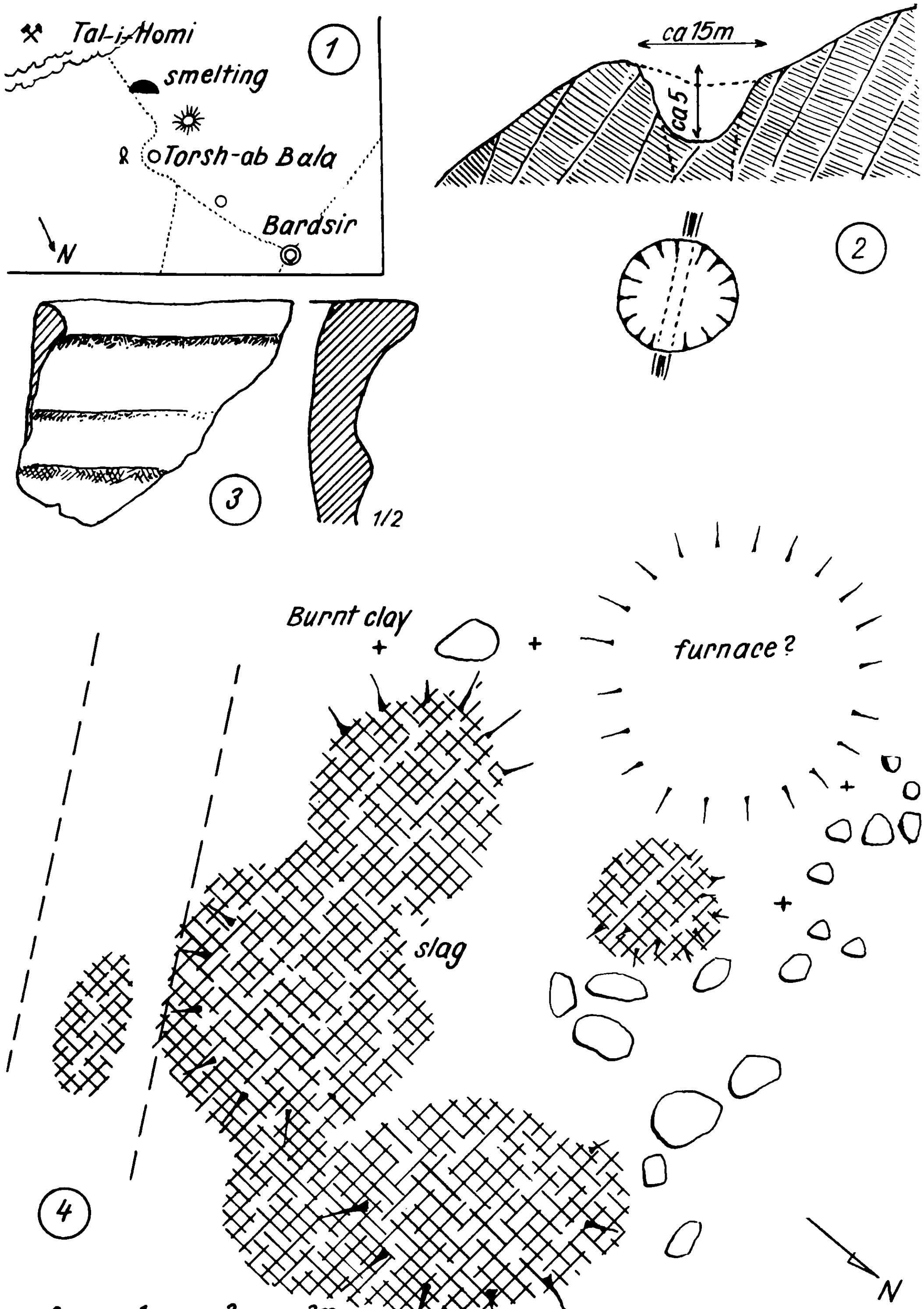
1. Possible fortification or Zoroastrian tower.



2. Copper smelting slag heap.

3. Detail of slag heap.

FIGURE 13. - COPPER MINING AND SMELTING IN THE BARD SIR VALLEY.



1. Sketch of the area. 2. Scheme of one of the pits in Tal-i-Homi (copper mining). 3. Pottery sherd from the mine. 4. Copper smelting site near Torshab (one of many in the vicinity according to the landlord, Mr. Bahaduri).

very closely to that of Sialk according to spectographic analysis made by Smith. Anarak was an important copper producing center till recent times, and was doubtless exploited in early times. The prosperity of the toreutic craft in Kashan was based on Anarak copper. In recent years the mining of lead has come to be of greater importance in the Anarak area, which has also begun to export craftsmen to such areas as Nakhlak, from whence almost all of the foremen of modern mining operations throughout the nation are derived.

While at Sehchangi we were told of two old copper mines, one of them called Ab Shur (salt water). The distances were such, about 50 to 60 km over rugged terrain, that we were unable to fit them into our crowded itinerary.

A large copper mine has also been reported in the vicinity of Sirjan, and another far to the northwest near Abarqu and Yazd, from 200 to 400 km distant from our appointed route.

On the mountain ridge just south of Tal-i-Iblis, a part of the Kuh-i-Chehelitan some 30 km from Bard Sir, there are old mining and smelting sites. The mines are at a place called Tal-i-Homi (Fig. 13). There are two pits dug into the vein, which is oriented north-south. There were pieces of malachite found in the gangue heaps, and several sherds. These are not very suitable for dating, but they seem to be rather ancient. One of the fragments is part of a vessel with a thickened rim and a molded band (Fig. 13:3). The two pits are quite similar, about 15 m across and about 5 m deep at present. According to Mr. Bahaduri, son of the landlord, there is another mine just at the top of Kuh-i-Chehelitan itself.

At the foot of the mountain there are numerous slag heaps (Pl. 11:2, 3). One of these sites visited by Smith and myself consisted of four heaps of reddish glassy slag. In one part of the complex there was a heap of clay containing many pieces of charcoal, which we thought to be the remains of the smelting furnace. Immediately adjacent we collected fragments of burnt and slagged clay, and some pieces of copper ore. The entire complex is about 10 m in diameter and about 1 m high (Fig. 13:4). Mr. Bahaduri, who resides at Torshab, told us that there are about 20 such sites separated by distances of 1 to 2 km along the entire foot of Kuh-i-Chehelitan.

Mr. Saidi told us that eastward of Bard Sir, there was another site where a hundred furnaces for the smelting of copper are to be seen. The distance given was about 60 km, on the western edge of Kuh-i-Jupar. At the Kerman Geological office we were informed by Mr. Azarin that to the northwest there are old copper mines between Rafsanjan and Shahr-i-Babak. Mr. Azarin has an open lamp of the same type as those from the lead mines at Tars (Fig. 9:3). According to Dr. Ezat O. Negahban, such lamps are in the collections of the Pars Museum at Shiraz and dated circa 11th Century A.D.

One of our principal concerns was an investigation of the metallurgical crucibles and copper objects found at Tal-i-Iblis. The evidence implied that copper had been produced here since late in the 5th millenium B.C. Although only one crucible fragment has been subjected to analysis,[1] it seems certain, in the light of the number of crucible fragments, that the Iblis copper was being reduced from an ore, probably the carbonate ore, malachite, fragments of which occur on the site. The crucibles, found almost without exception in prehistoric dumping areas, show a slag deposit on the inner surfaces. It seems likely that small lumps of ore were reduced in the crucibles in a simple fire, a proposition we tested using crucibles produced by Miss Hildegard Wulff, an experienced potter.

1 See Dougherty's paper, this volume.

Smith organized these experiments, as well as those with the primitive blast furnace.

For the experimental reduction of copper in clay crucibles, such as those used in the 5th millenium B.C., we placed small malachite nuggets gathered from the site in the crucibles, which were then placed on a simple hearth, the only type the site has yet produced. The fire was blown by a simple bellows, the temperature at the tuyère being recorded at about 1100° C (Fig. 11:3). The refractory qualities of the crucibles proved to be very low, and perhaps the ore samples were not of the best, perhaps rejected by the early metallurgists. In any event there were some grains of copper in the resulting slag. The entire experiment lasted only a half hour at most. From this it seems probable that this method could have produced in one crucible the small amount of copper needed to produce the kinds of artifacts that so far have been found at Tal-i-Iblis.

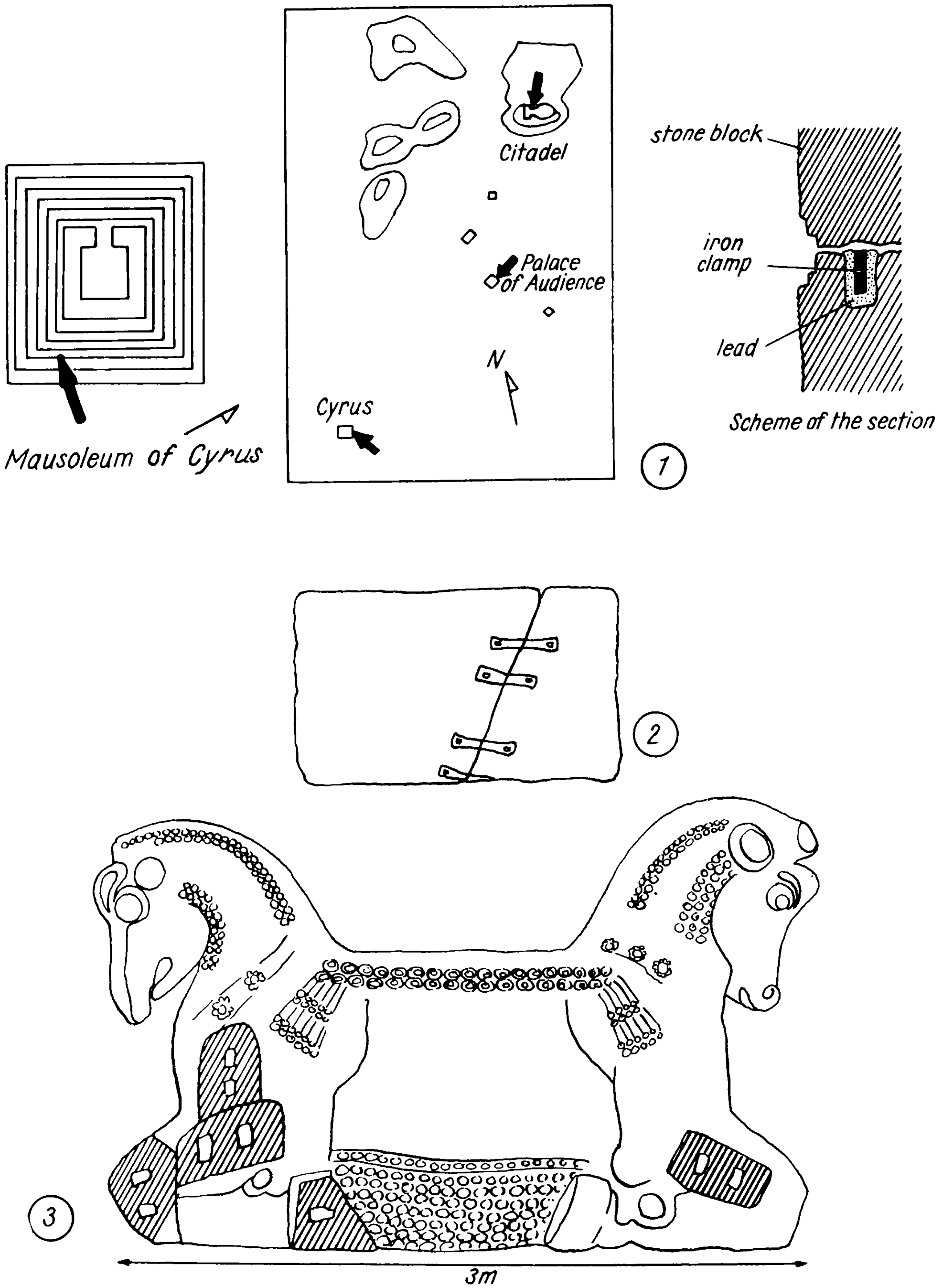
Compared to the Anarak area, Kerman province is fairly rich in copper ores. It seems likely that these were widely exploited in past times, and that the ancient metallurgy at Tal-i-Iblis was based on ores located near the site.

The Iron Age in Iran

The problem of the origin of iron metallurgy is far from a solution. The chance smelting of iron from hematite ores in a camp fire seems unlikely since the necessary temperatures are not produced in an open fire. It would be possible, however, to reduce iron ores under optimum conditions in a pottery kiln. Again it would be possible to smelt iron in the processes used for chalcopyrite sulphide copper ores. The observations of Smith and Wertime in 1964 led them to postulate a third possible method of discovery. Iron ores are a standard ingredient in all Iranian lead smelting operations. The iron oxides formed bond easily to the silica content of the lead ores, assisting in the precipitation of the lead. Bits of iron sponge form in the lead slag when the temperature of the furnace reaches 1200° C. Such bits of iron sponge were found in the old slag heaps at Yazd in 1964, and at Nakhlak in 1966. The question remains whether this accidental formation could take place in a small low temperature furnace, which might not produce the temperatures necessary for the iron sponge to separate from the lead slags and thus be observed. It is not important, at this moment, where such a discovery took place, but simply whether it is possible, with a primitive furnace.

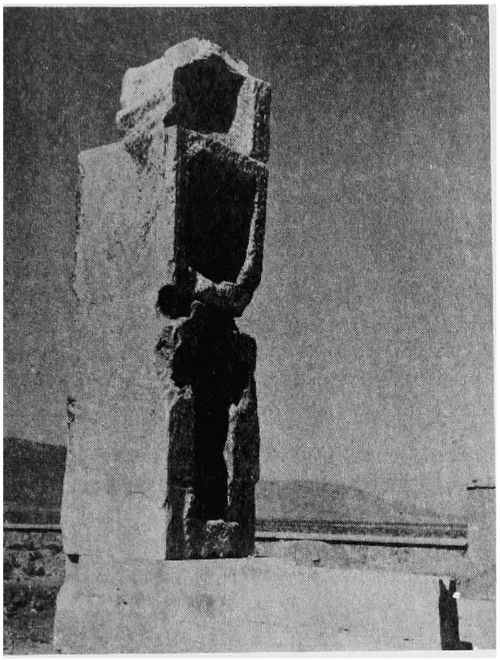
It is not out of the question that Iran may yet prove to be the place where iron was first discovered. At Geoy Tepe in northwestern Iran iron slags and pieces of white cast iron were found in levels dating to the 3rd millenium B.C. Although the iron age proper began relatively late throughout Iran, there is an earlier and interesting period, dated by some about 1000 B.C. and others 600 to 500 B.C. During this period the makers of the famous Luristan bronzes were also working with iron, actually a sort of steel with an unhomogeneous carbon content. Swords, ax-heads with an iron edge, bracelets, pins, and arrowheads were among the artifacts produced. In relation to the bronze castings the iron production was very small. At Tepe Sialk cemeteries A and B and at Hasanlu, dated variously from 800 to 700 B.C. there are iron blades, forks and phalerae. Their frequency corresponds very well to that in the later Hallstatt period in Europe. Thus the early development of iron metallurgy may be a full 100 years earlier in Iran than in Europe. The full development of the Iron Age in Iran is associated with the Medes and the Persians. Iron was in sufficient production to be used as structural clamps in stone masonry buildings during the Achaemenian period, although, curiously enough, archaeological work on sites of this period has produced relatively few iron objects of other types.

FIGURE 14. STRUCTURAL IRON IN ACHAEMENIAN IRAN.

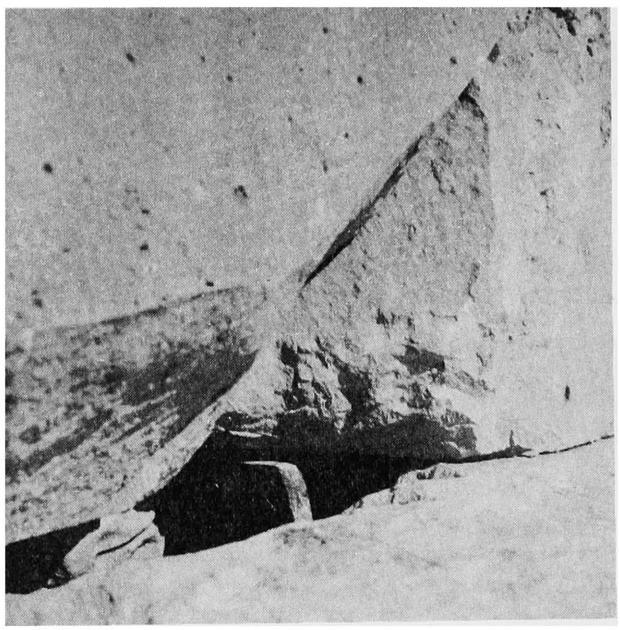


1. Pasargadae situation of the preserved iron clamps. 2. Persepolis stone block with iron clamps from the southwestern wall of the Hundred Columns Palace. 3. Persepolis, bull capital of a column with restored parts. Joints with iron clamps and lead.

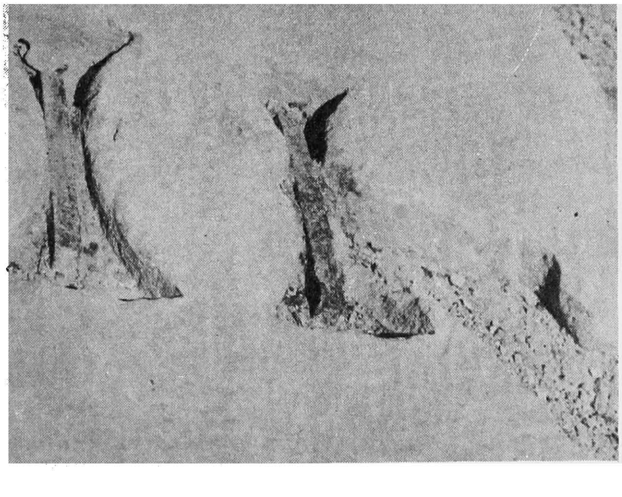
PLATE 12 - PASARGADAE



1. Column in the Palace of Audience.



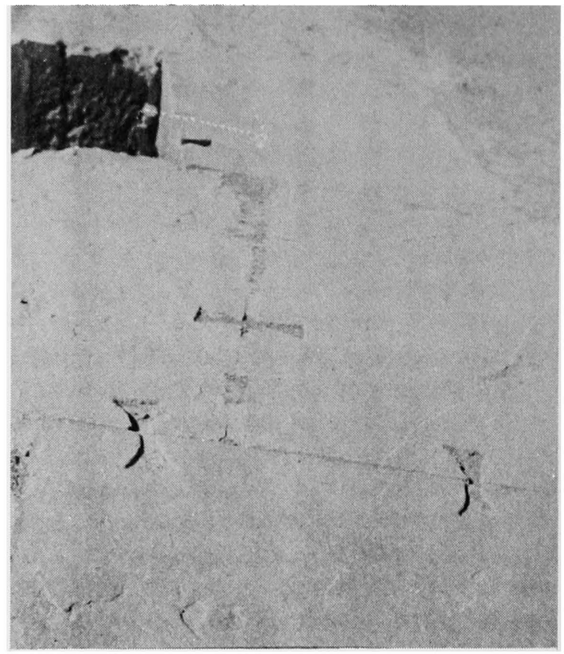
2. Iron clamp in the Mausoleum of Cyrus.



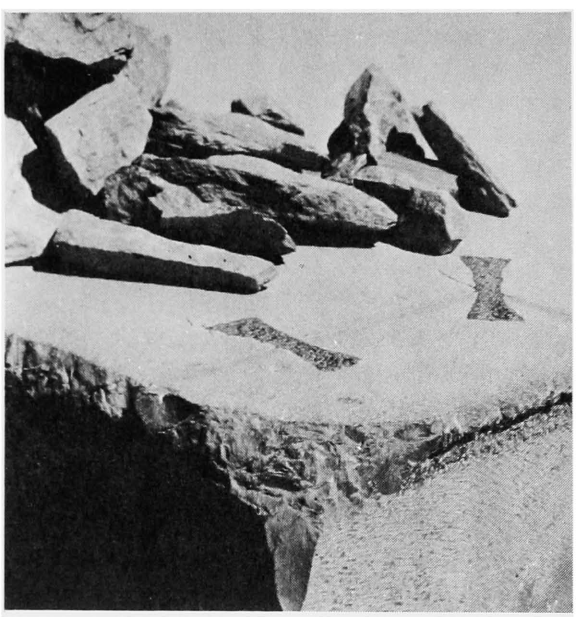
3. Iron clamps preserved in the lead beds in the Palace of Audience.

PLATE 13. - PERSEPOLIS

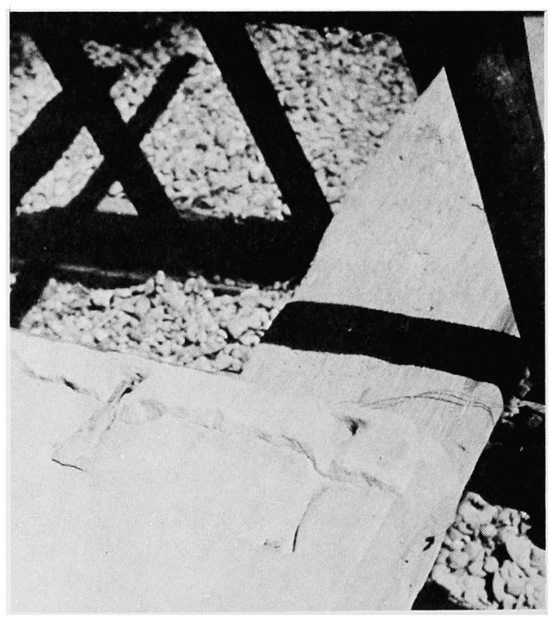
1. Apadana Palace.



2. Stone blocks of the great platform with cavities for iron clamps and lead.



3. Lead cast over iron clamps joining two stone blocks. West of Column Palace.



4. The same technique used in restoring the stand of a horse capital.

Structural Iron at Pasargadae and Persepolis

The residence of Cyrus the Great at Pasargadae was built of large stone blocks, which were joined with iron clamps let into mortised holes, and sealed with lead. The amount of iron and lead used in this single structure must have been considerable. The greater number of these clamps have been removed, and at the present time they are visible in only three places. A single iron clamp is preserved in the third step on the south side of the mausoleum of Cyrus. This is about 1 cm square in section (Pl.12:2). In the Palace of Audience there is a pair of clamps along with traces of the lead used to seal the cavity near the north entrance (Pl.12:3). In section these are 1.7 and 2 cm square, and 20 cm in length. A third clamp is mentioned by Stronach in staircase A on the northern face of the citadel.[1] There are numerous cavities everywhere.

The same situation is to be observed at Persepolis, sometimes known as Takht-i-Jamshid; stone clamps are used in the huge stone wall of the city platform (Pl.13). The same technique was used to assemble the monumental stone decorations and bas reliefs and to repair flawed stones and damaged pieces. For example there is a cracked block in the eastern outer wall of the Hundred Column Palace which was repaired with four clamps; a cornice in this same building has small clamps, only about 4 cm long, and a doorway exhibits the mortised holes for clamps 24 cm long with two teeth 2 cm long. The pedestal of a horse capital now situated in front of the museum has a split edge which was repaired with four clamps, one of which is preserved together with the lead. The opposite edge of the pedestal has been repaired with two clamps. The pedestal of a second marble has been repaired in two spots with clamps and the huge recumbent bull, once a capital, is similarly repaired (Fig.14:3). Iron dowels were used to join the sections of the columns. In addition we are informed that there were building blacksmiths referred to as door makers. The Treasury Tablets also refer to armorers.[2]

An interesting footnote to the entire problem of early iron metallurgy in Iran is that Treasury Tablet 52 informs us that the above mentioned armorers worked at a place called Hankurrsha under the direction of a foreman who resided in Narisi (now Niriz). Iron mining in that region has also been documented by the Arab geographers Muqadasi and Ibn Al-Balchi.

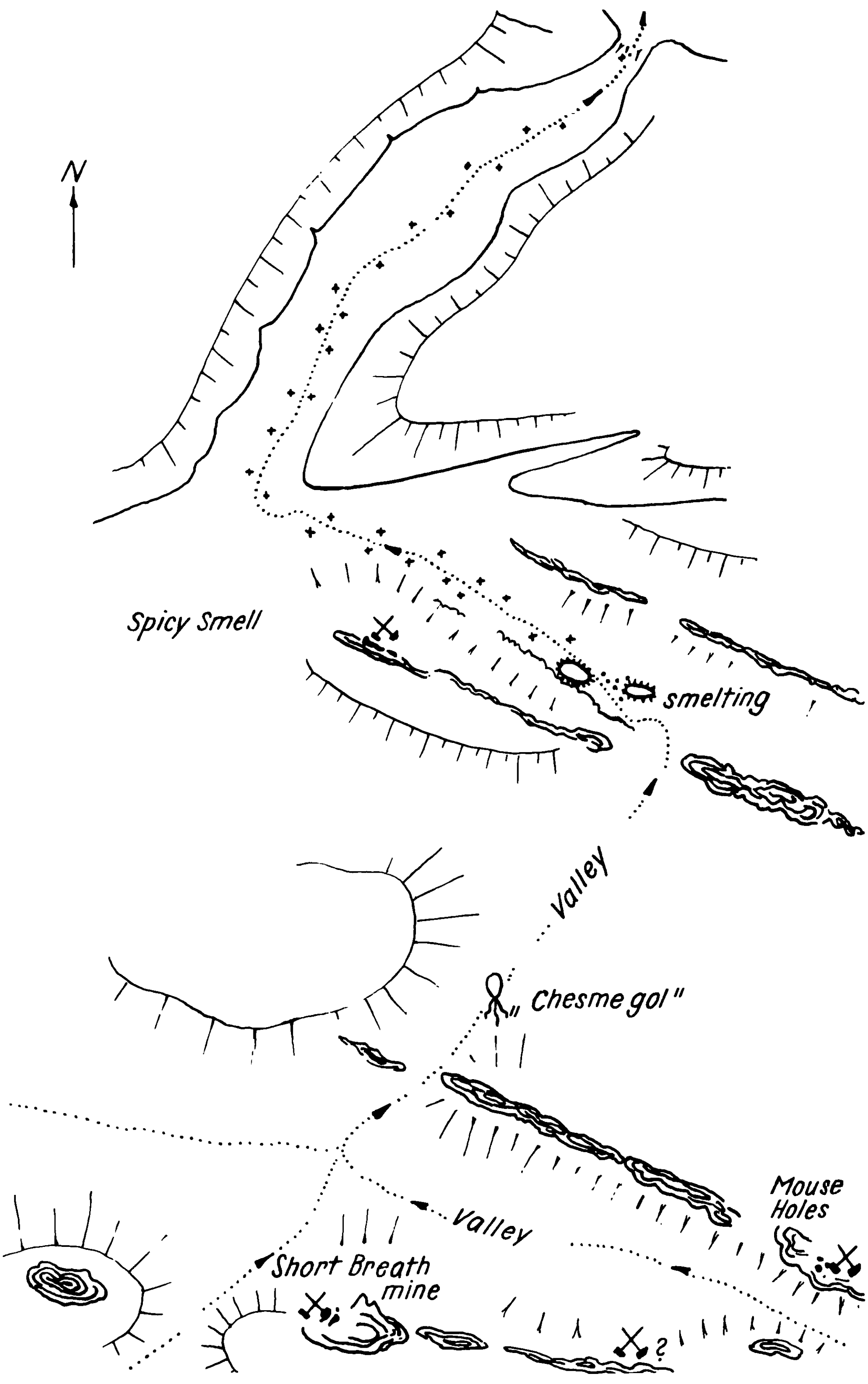
Iron Mining and Smelting near Hanashk

Haneshk is in the Goli Mountains about 100 km southwest of Pasargadae. About 5 km southwest of the village there is a valley called Chesmeh Gol, where there is a complex of traces of old mining and smelting operations. Four mines were visited. All of these exploited hematite ores, the veins appearing on the surface, on the rocky hills and crossing the valley. The veins are oriented approximately from south to west (Fig.15, 17). Mine No. 1, Spicy Smell, is situated on the second vein to the west from the entrance to the valley, about 40 m above the floor. The cut into the vein is about 35 m in length, and at the northern end there is a small excavated cave about 3 m high (Fig.16). We made a trench in the layers of ash and dust on the floor, digging to about 1 m below the present surface. We found no sherds, but they can be obtained from the slope nearby, together with the gangue and rejected ore from the mine. It appears that the early miners used only pieces of soft rich ore, harder specimens being discarded (Table 1, I).

1 D. Stronach, Excavations at Pasargadae I, Iran, Vol. I. 1963.

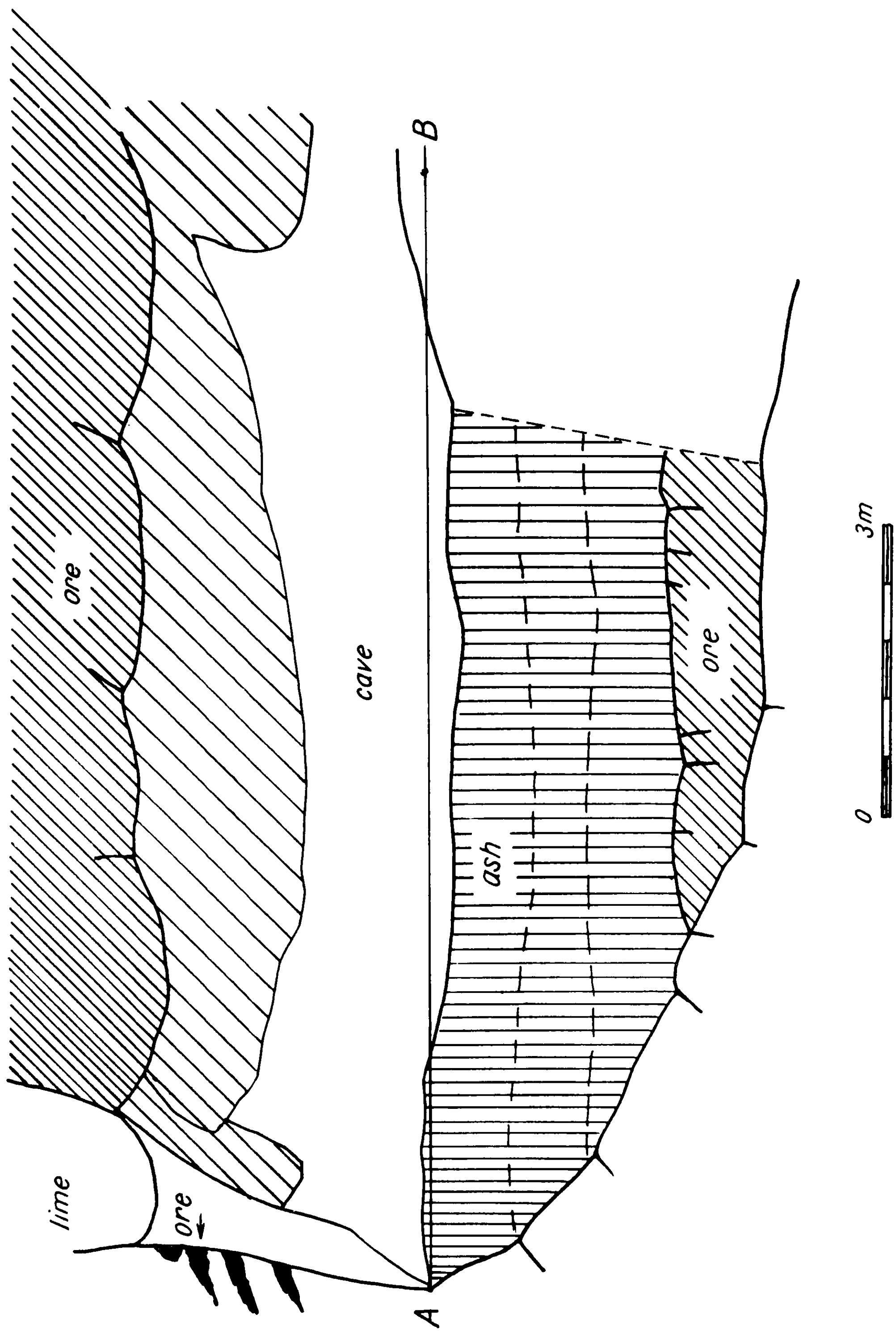
2 G. G. Cameron, Persepolis Treasury Tablets, Chicago, 1948.

FIGURE 15. - HANESHK IRON MINING AND SMELTING



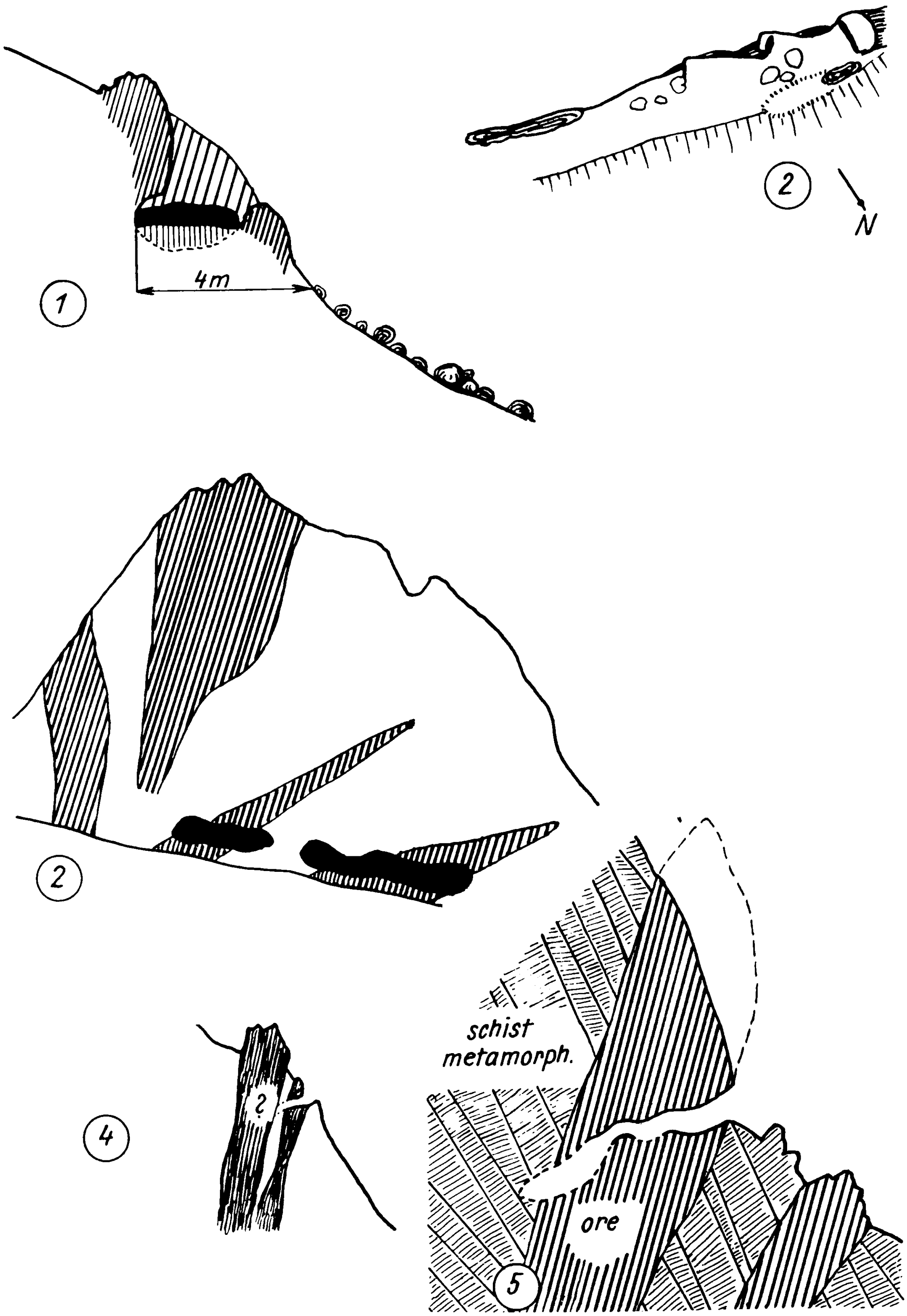
Cheshme Gol Valley showing smelting places and mines. Slag occurrences along the main hematite vein are shown by crosses.

FIGURE 16. HANESHK IRON MINES



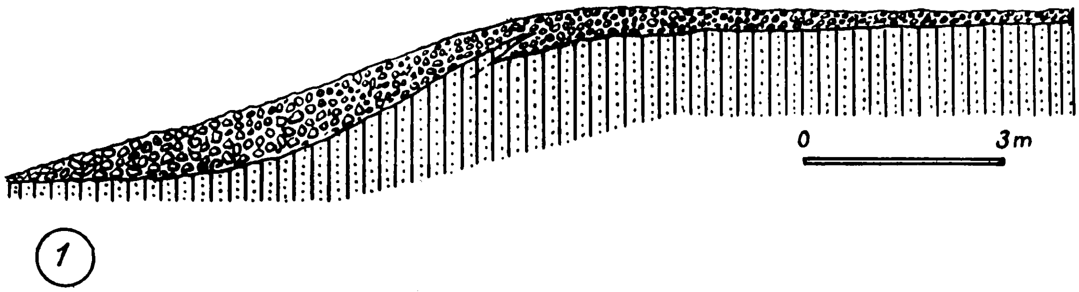
North profile of our sondage in the cave of mine 1 at Spicy Smell.

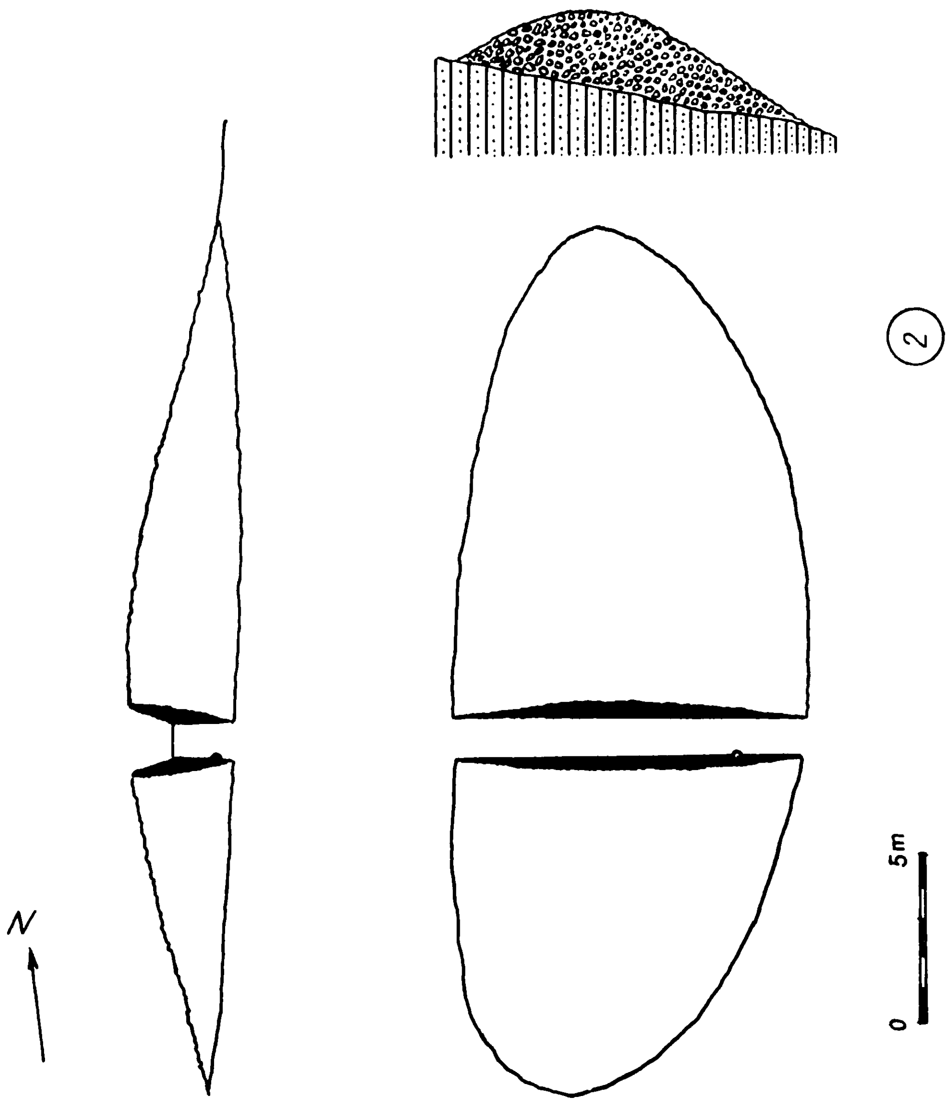
FIGURE 17. - HANESHK IRON MINES



1. Section of mine No. 1 (Spicy Smell) black: cave; hachured: hematite vein; down the slope are gangue and sorted material. 2. Plan of the same mine. 3. Mine No. 2 (Short Breath), hematite veins and caves. 4, 5. Sections of the same mine.

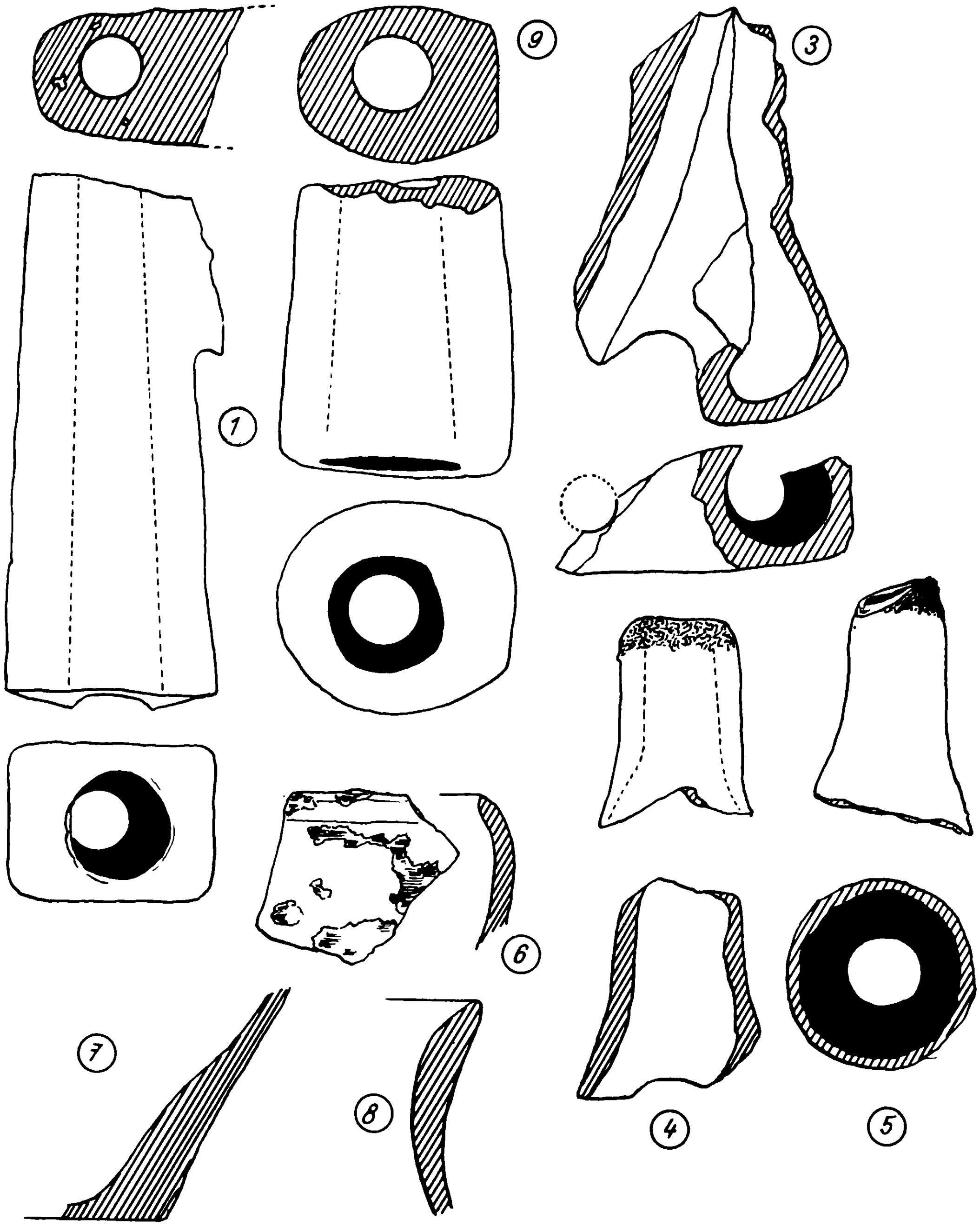
FIGURE 18. HANESHK IRON SMELTING





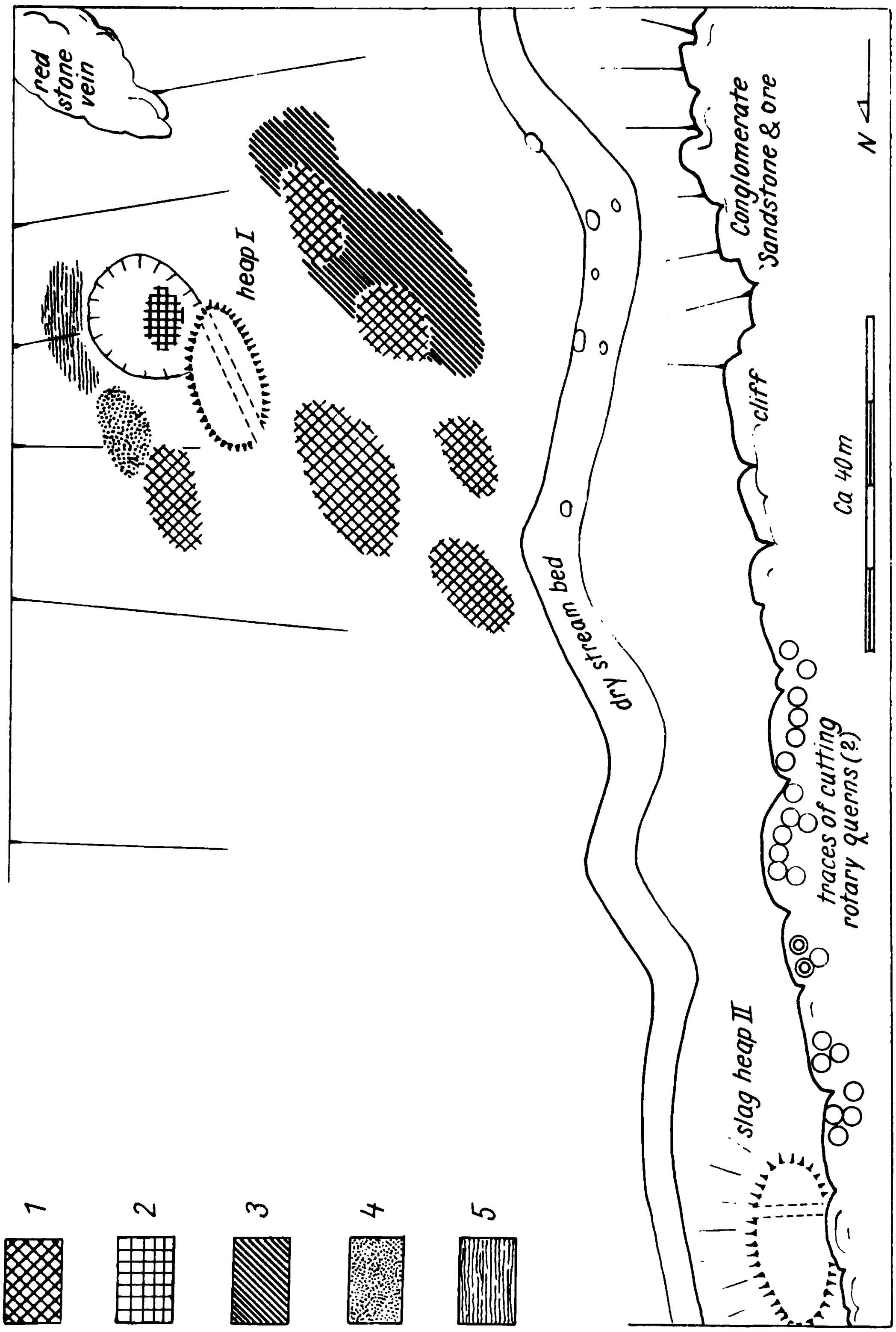
1. Sections of cinder heap No. 1. 2. Heap No. 2.

FIGURE 19. - HANESHK IRON SMELTING: FINDS IN CINDER HEAP NO. 2



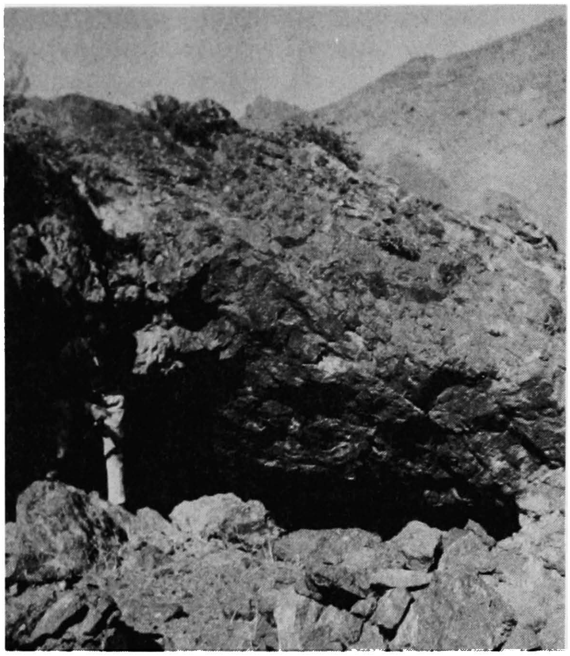
1. Fragments of double pipe tuyère. 2. Tuyère nozzle fragment. 3. Joint of the pipes of a double tuyère. 4, 5. Small brittle nozzle fragments. 6. Pottery sherd. 7, 8. Sections of pottery sherds. Tuyères slightly less than one half and sherds slightly less than full size.

FIGURE 20. - HANESHK IRON SMELTING

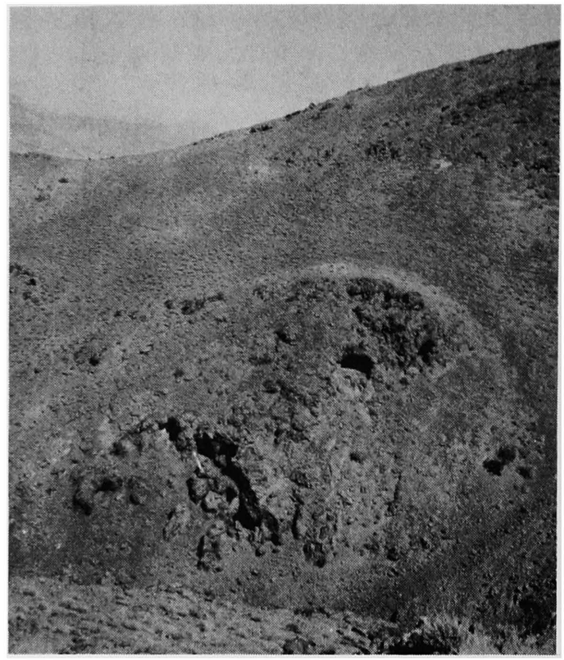


Key to symbols: 1. Smelting furnace areas: slags burnt stones and clay. 2. Burnt stones. 3. Spread slag. 4. Area of dark soil. 5. Brown soil.

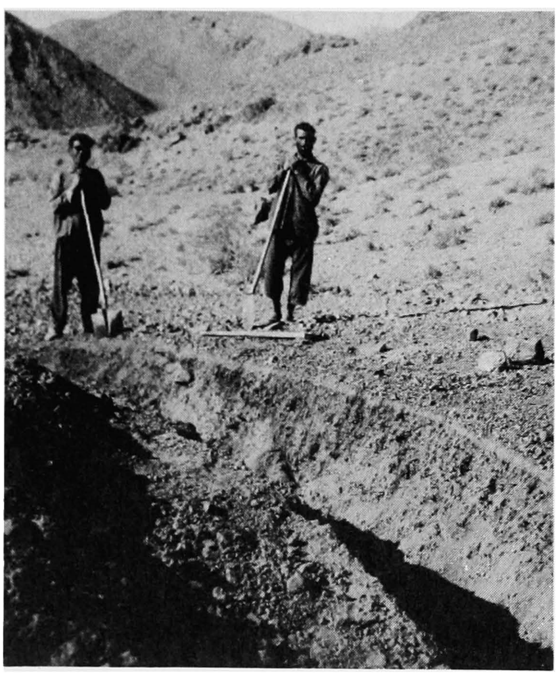
PLATE 14. - HANESHK, FARS, IRON SMELTING



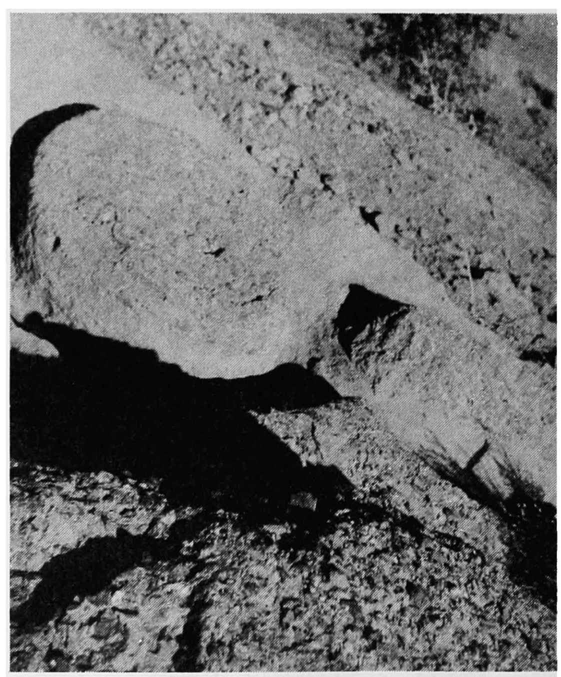
1. Spicy Smell mine.



2. Mouse Holes mine.

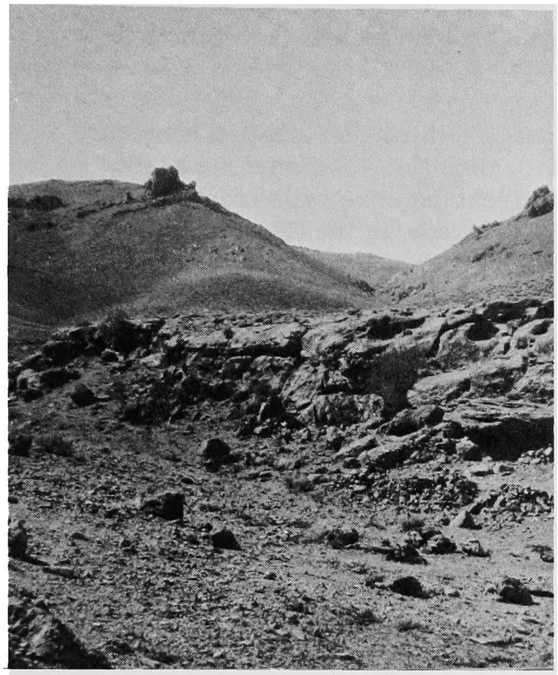


3. Our trench through cinder heap No. 1.

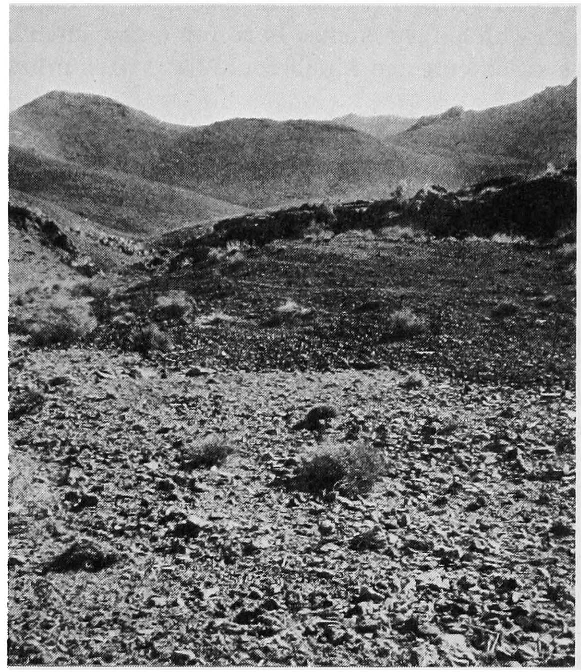


4. Rock cut unfinished rotary querns on the cliff.

PLATE 15. - HANESHK IRON SMELTING

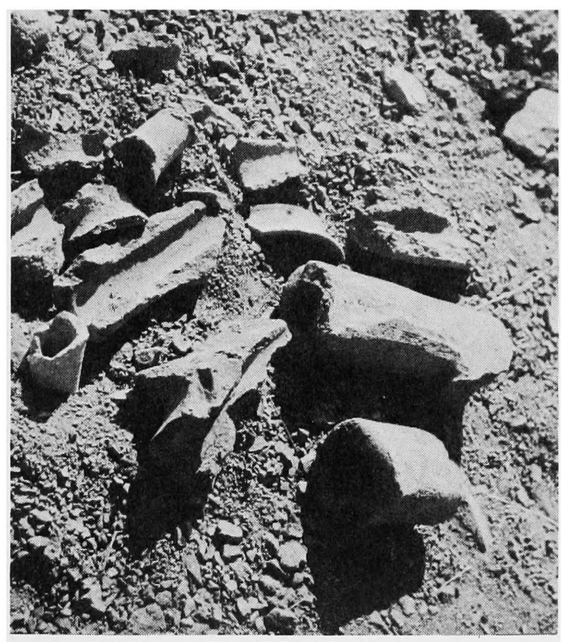


1. Stream bed with mine Short Breath on the horizon.



2. Big slag heap in the stream bed.

3. Furnace fragments from the smelting place.



4. Tuyère fragments and sherds from slag heap No. 2.

Mine No. 2 is known as Short Breath; this mine is located high over the valley, nearly at the top of the ridge. It consists of a system of caves cut across the vein (Fig.17, Pl.14). The stope is 2 to 3 m high and is inclined downward. Although the depth is unknown, it was more than 15 to 20 m. The floor is covered with a thick layer of ash from shepherd's fires which have burned here for many generations. Two hundred m to the south there are other cuttings which could have been mines.

Mine No.3, called Mouse Holes (Pl.14:2), is situated on a third vein and lies between Nos. 1 and 2. Several stopes or caves are visible. Mine No. 4, about 2 km to the south, was visited by Mr. Vossouqsadeh. The ore from the mines was transported down to the bed of the valley. There were bloomeries downstream of the Chesmeh Gol spring, which is now nearly dry. The site consists of two slag heaps and the area where the furnace once stood. Heap No. 1, 20 m in diameter and 7 m high, is on the right shore just at the foot of the valley, near a small pit or depression. A trench was made across this heap, which was reaching to undisturbed soil (limestone and sand). This heap consisted of some sort of waste material, apparently sintered, mixed with ash and charcoal. Sherds were scarce and not useful for dating purposes. (Pl.14:3, Fig.18:1) (Table 1,J).

Slag Heap No. 2 lies about 70 m downstream from No. 1. A trench was dug about a meter wide, through the heap which is about 25 by 10 m across, and 150 cm thick (Fig.18). The material is regular bloomery slag in fragments of varying dimensions, the larger ones about 20 by 30 cm. The lower surfaces of the slag fragments show impressions from some kind of container, pit, or hearth. The upper surface is a sort of smooth material with solidified wave patterns indicating a tapping process (Table 1 K). In addition to the slag there is much charcoal and pottery. The yellow glazed fragments were identified by Dr. Negahban as Islamic of the 11th Century A.D. In addition there are very interesting tuyère nozzles having a single mouth (Pl. 15:4, Fig.19). The present indications are that the two heaps are contemporary, representing two operations, in the second of which the smeltery slag was concentrated.

Close to the streamside, which is seldom watered, there are several areas where burnt stones, slagged clay, slag balls, tuyère fragments, etc., can be found. There are six areas ranging from 5-10 by 2-5 m in diameter. The entire area is much eroded. Winter showers have transported slag fragments far downstream. At a narrow throat of the valley a natural dam has developed, and here we found the most distant occurrence of slag, about 1 km from the site. (Fig.20).

The Y shaped tuyère nozzles are of some interest (Fig.19). The channel is from 2 to 3 cm in diameter, and slightly conical in shape. The standard tubular tuyère is also found on the site, thin walled, made of a good refractory clay, the mouths slagged, about 8 cm in length and the mouth 2 cm in diameter. Possibly both types of tuyère belong to a single system of smelting, but this poses some difficulties. In view of the differing natures of the associated slag heaps, I am inclined to believe that the Y shaped and tubular tuyères were parts of distinct operations.

In summary, the iron mining and smelting at Haneshk appears to have been a limited operation, taking place entirely in the 11th Century A.D. The ore was mined in simple pits, carried to the floor of the valley where it may have been roasted and smelted (Slag Heap No.1), and the slag concentrated, perhaps with the aid of the twin tuyère, at Slag Heap No.2. At least six furnaces were in use throughout the operations, which may have been seasonal since there is no trace of any sort of settlement nearby.

Iron Smelting in the Baft Area

Marco Polo,in describing his travels,made two notes on iron and steel in Iran. The first of these, in describing the mineral resources of Kerman, states: "There are enough of steel and andinaco veins for manufacturing weapons."[1] The second remark concerns the crafts of the town of Kobinam, modern Chubanan, where he reports the making of mirrors of the finest steel, and the abundance of andanico.[2] What the andanico of this reference represents is not very clear. Perhaps it is wootz steel, with its typical wave pattern after etching. Persia, after all, was at a much later date famous for its makers of "damascene" blades such as the Khorrassan steel sabres. Neither Chubanan nor Kerman today have any traces of an iron working tradition, nor were iron slag heaps or smelteries reported to us. There were reports of iron mining and smelting in the Halil valley which is southwest of Kerman city. Both iron and lead slag heaps were reported from Dehsart, Mesarbe, Sehchah, Gushk, and Sharia, each about 20 km apart, in the mountain ridges of Kuh-i-Khabre, south of Baft. At Gushk there are reported to be two mine pits, about 20 m deep, together with other traces of mining. There was no mention of smelteries. Unfortunately we were unable to visit these sites, which lie 50 to 60 km from Baft.

We learned of iron mining and smelting operations in the Kuh-i-Hazar north of Baft, at Bideshk, Shurah, Zaringeran and Piruje (Fig.21:1). The last two mentioned were visited. Zaringeran is in a rocky valley about 15 km southeast of Baft, where there are four or five areas of a brownish tapping slag, along with bits of hematite ore and a few sherds. The slag closely resembles the bloomery slag of medieval European furnaces where fluxes were in use. The slag is fine and crystalline and might be a copper slag; however, it is not glassy like the copper slags of Torshab. The hematite ores are found on the surface of the valley among the rocks (Fig.21:2).

Returning to Mashiz over the Kuh-i-Hazar we located the smelting site reported at the village of Piruje. Just north of the village at a site called Chah Mess (copper well) there are several slag heaps. Some of the heaps contain slag gravels, others larger sized fractions, suggesting a long period of use. The best preserved and probably the youngest of the slag heaps is actually a group of heaps, the largest a long mound about 50 m in length, with four depressions in the summit (Fig.21:3). The slag is of the same character as that at Zaringeran, except that some samples have the needle shaped crystals found at Haneshk (see Table 2).

The Ethnological Aspects of Metallurgy in Iran

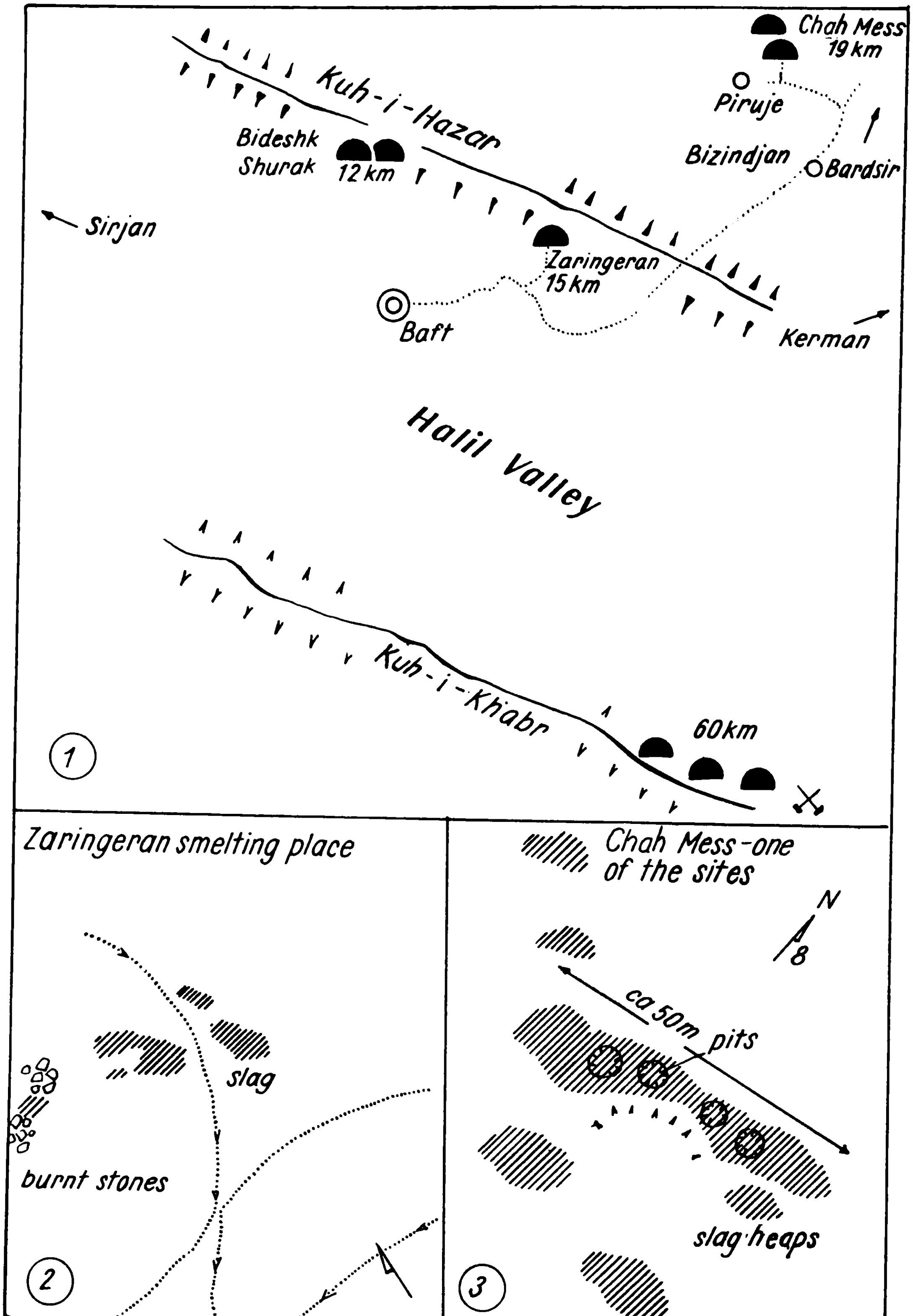
In all our discussions with mining people at Anarak, Nakhlak, Naiband, Tars, Yazd and in Baft, we always put to them the same question, "How old are the mines and smelteries?" The answer was always the same, "We don't know but they are from the time of King Shaddad." This story is told everywhere practically without variations:

> King Shaddad once lived and reigned in Persia, and he wished to build a paradise on earth. Therefore he sent people to look for metals. The people went into the mountains in all parts of the country and found metals. Then Shaddad made the paradise on earth, and at the moment of completion he died.

1 Keirman I 13 in Ramusio's version.

2 Marco Polo I 19, or I 21 Lemke, Hamburg 1908.

FIGURE 21. - BAFT MINING AREA



1. Sketch of mine locations: Southeast (lower right), iron and lead mining. North, iron or copper smelting. 2. Zaringeran smelting places. 3. Slag heaps at Chah Mess.

Perhaps this legend was spread throughout the present areas of mining operations by the skilled workers from Anarak, from which area the foremen of many mines were drawn. We were unable to locate any single source of the legend, nor any indications of possible written accounts. It is interesting to speculate whether this legend may in fact have an historical background and, if so, which of the many Shahs of Iran might have instituted such a program of prospecting. Certainly this legend is worthy of further study.

Still another aspect of our travels brought us into contact with metalsmiths in the bazaars of many of the towns and villages that we visited. Among these crafts were coppersmithing, blacksmithing, and file making. Many of the tools and techniques still to be observed are doubtless very old and may offer important clues to the archaeologist interested in the development of technology, especially metallurgy.

The coppersmiths' workshops in the bazaar at Kashan have a number of specially shaped anvils (Fig.22:2, 6) set into a Y shaped wooden beam, which also serves the smith as a place to sit while working. Some of these anvils were decorated (Fig.22:3). The hammering technique (toreutics) of the brass-smiths is of special interest. Their work is done with a chisel, the piece being placed over a wooden form covered with tar. The finished product first has the wood and tar burned off, and the item (candelabra, vase, etc.) is then cleaned and polished. We also observed the soldering process, in which the soldering iron is heated in a thick-walled crucible, over a fire blown with a special bellows, the heated solder being carried on the point of the iron to the work being done. Since all bellows are made by special craftsmen, it is interesting to note that in Isfahan the typical bellows is a pointed disc bellows, while at Kerman a simple goatskin bellows is in use. In our travels we visited the shops of coppersmiths, brass-smiths and jewelers in Kashan, Isfahan, Yazd and Shiraz.

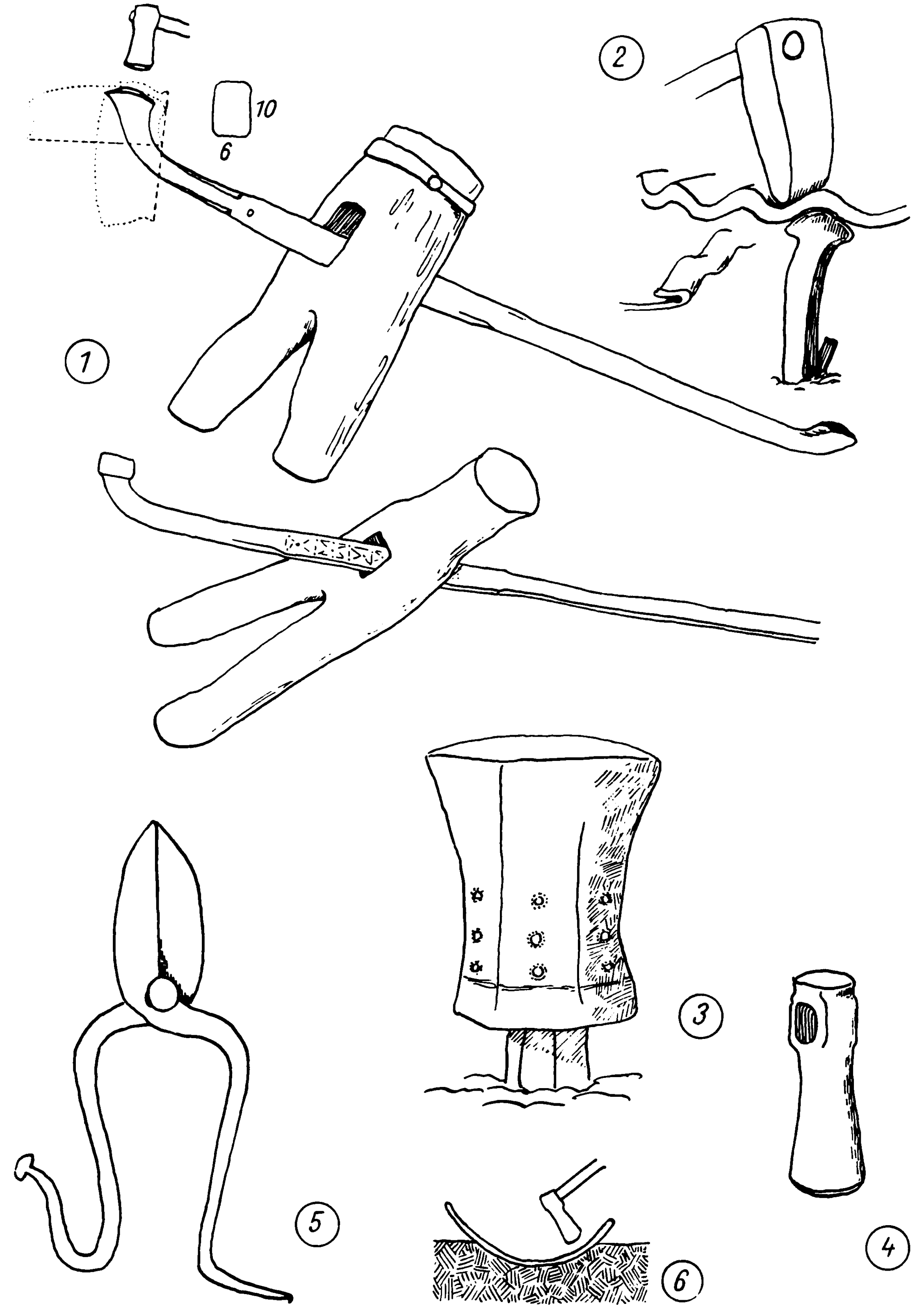
The blacksmiths of Iran deserve special study. We had time only to make a few notes. The equipment and techniques vary from town to town.

The blacksmiths of Isfahan are concentrated along a main street of the bazaar. Their hearths, which are equipped with modern electric blowers, are of some interest, in that no two are alike. We saw one in the shape of a clay cube with the grid on the upper surface, another in a cupola shape, and still others were cone or beehive shaped (Fig.23:1, 5). This rather disturbs the theory of deep rooted origins for this vital part of the smith's equipment. The hammers here were of the eccentric eye type noted at Kashan, and the horns and the block anvils were of the types noted elsewhere. The hearths, of whatever type, were elevated as the smiths here stand at their work in a small pit, about 150 cm square. This arrangement closely resembles a forge discovered at Lebedka, USSR, and dated to the 8th to 10th Century A.D. In one smithy we observed nails being forged in dies (Fig.23:6).

In Nakhlak we found a smith repairing mine tools. The smithy was equipped with a large twin horizontal bellows such as those used on the smelting furnaces.

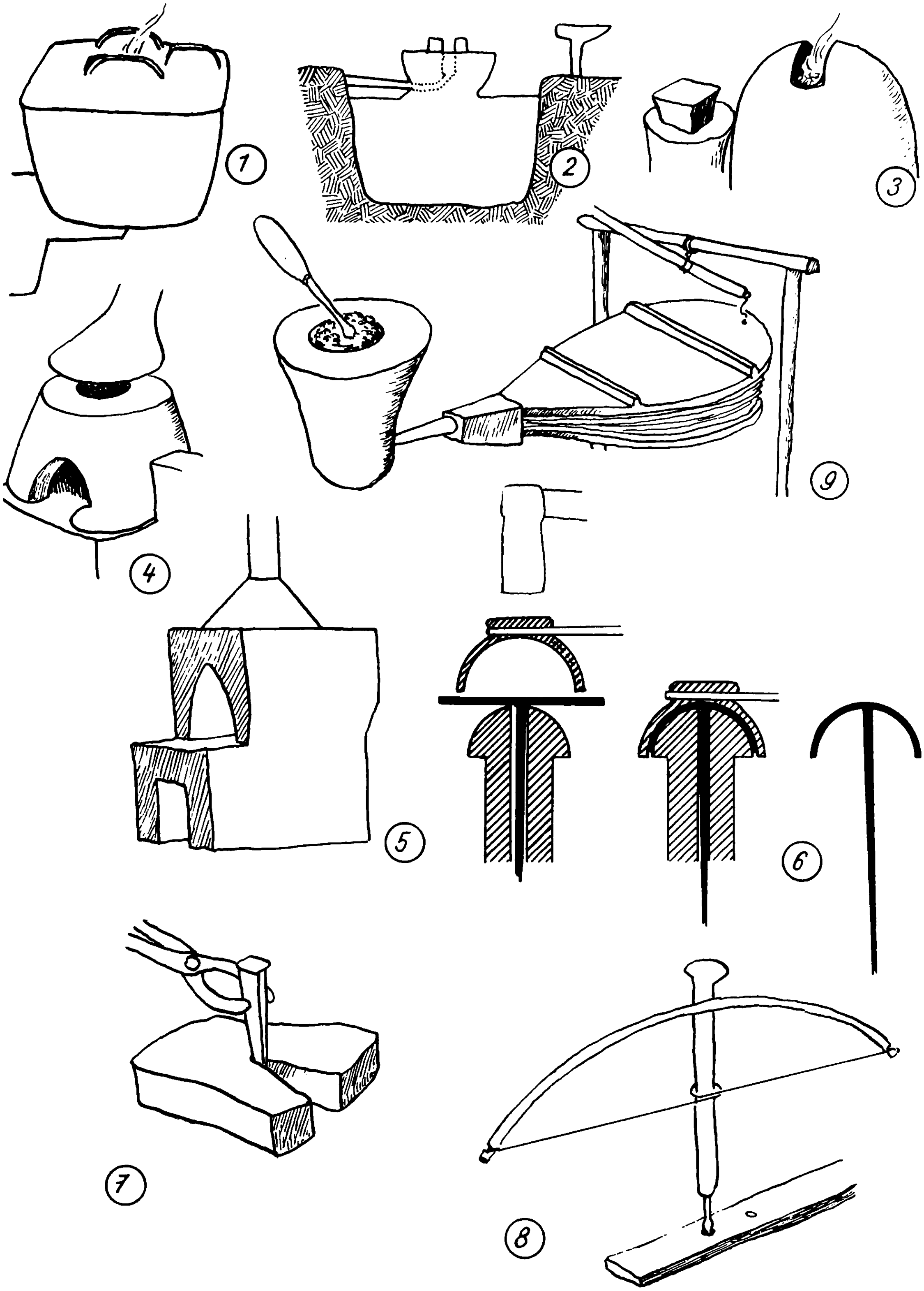
In Kashan the smithys are located here and there, and use various tools to produce various sorts of finished objects. The hearths are not very interesting, using an electric blower. They are usually situated in the center of the room whereas in Europe they are along a wall, or in a corner. The hammers have an eccentric eye, like those shown on the black-figured Greek wares (Fig.22:4). In addition to horns, the Kashan smiths use small block anvils, either a cube or a truncated pyramid. This sort of anvil was in use in Europe from Hallstatt times until the 13th Century A.D. (Fig.22:3). The iron is split by a simple chisel, held in tongs (Fig.23:7), tools also in the equipment of the medieval European smith.

FIGURE 22. TOOLS USED BY COPPERSMITHS IN THE BAZAAR AT KASHAN.



1. Anvils for toreutic work. 2. Making the waved border of copper dishes. 3. Anvil. 4. Hammer. 5. Shears for cutting sheet copper. 6. Hammering sheet in floor cavity to make copper bowl. Scale variable.

FIGURE 23. - TOOLS USED BY BLACKSMITHS IN THE BAZAAR AT ISFAHAN.



1, 3, 4. Varieties of hearths. 2. Blacksmith's stand at the hearth. 5. Box hearth (furnace). 6. Making door nails with dies. 7. Splitting iron. 8. Drilling iron with a bow. Scale variable.

A truly primitive smithy was recorded at the town of Jandaq. The working place of the smith was sort of a low podium set next to the wall of the house (Fig. 24). There was a small hearth nearby, set into the floor, about 11 cm in diameter and 20 cm in depth. The iron grid over the top had 21 openings. The mouth of the tuyère was just below the grid. The draft was supplied by two simple goatskin bellows operated by one man. The smith and the bellowsman sat at their work. Just beside the smith there was a quenching tank set into the floor, by it a small supply of charcoal. Close to the hearth there was a simple fireplace for soldering operations, tinning and toreutics. Near the door a small horn was mounted on a wooden block, and another held a block anvil. All the tools and some finished products were hung on the walls. This blacksmith is also a coppersmith and tins copper and brass vessels as well. These are elsewhere separate crafts done in different shops.

In sum we observed that, with the exception of the primitive smithy at Jandaq, the Iranian smith stands at his work, using a variety of hearths, blown by a variety of bellows, using usually a hammer with an eccentric eye, a simple horn, and a block or truncated pyramidal shaped anvil. Everywhere that we noted the operations of a smith, we found the iron to be split with a simple chisel held in tongs, tools likely to be found in a medieval European smithy. Except for the introduction of electric or hand-driven blowers at Kashan and Isfahan, there is very little evidence of the modernization of the working equipment of the present day Iranian smith over those in use in Europe 600 or more years ago.

There is some degree of specialization in the metal working arts of the blacksmith. In Mehriz there are cutlers, whose knives are to be found in the shops of Yazd and elsewhere.[1] The file cutters, whose shops we visited in Isfahan, also use broken automobile springs, of which there is, in view of the state of the roads, an inexhaustible supply, to produce wood rasps and metal cutting files. These are cut and shaped by forging. The tooth is cut with chisels, which are sharpened on wet amphibolite whetstones. The finished files are heated to a black-red heat, the wood rasps being quenched at a lower temperature than the metal cutting files.

In conclusion, there are several types of smiths at work in modern Iran whose specialized crafts have some antiquity; jewelers (silver and gold smiths), blacksmiths, coppersmiths, although these two may be combined, and specialized craftsmen such as cutlers and filemakers. Except for the introduction of spring steel and the electric blower, both of recent and entirely imported origin, the smith of modern Iran uses tools and methods surviving from the medieval stage of metallurgy and the metalworking craft.[2]

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1 The variety produced ranges from the simple sheath knife to a multiple-bladed knife rather like the traditional penknife. These are made of spring steel and are rather unsatisfactory for the usual purposes for which one purchases a knife for they will not stay sharp. (Ed.)

2 In Tehran and other large towns a new group of metal workers is growing. These men work with steel I beams and L beams to produce both the high rise structures and the more common housing of the flat roofed type, and the frames for the enormous doors and windows which are so characteristic of the contemporary architecture. Again the materials and the techniques for using them, acetylene welding, are imported, but the artistry and skill with which the new methods and materials are put to use are as old as Iran. (Ed.)

FIGURE 24. - PRIMITIVE SMITHY AT JANDAQ

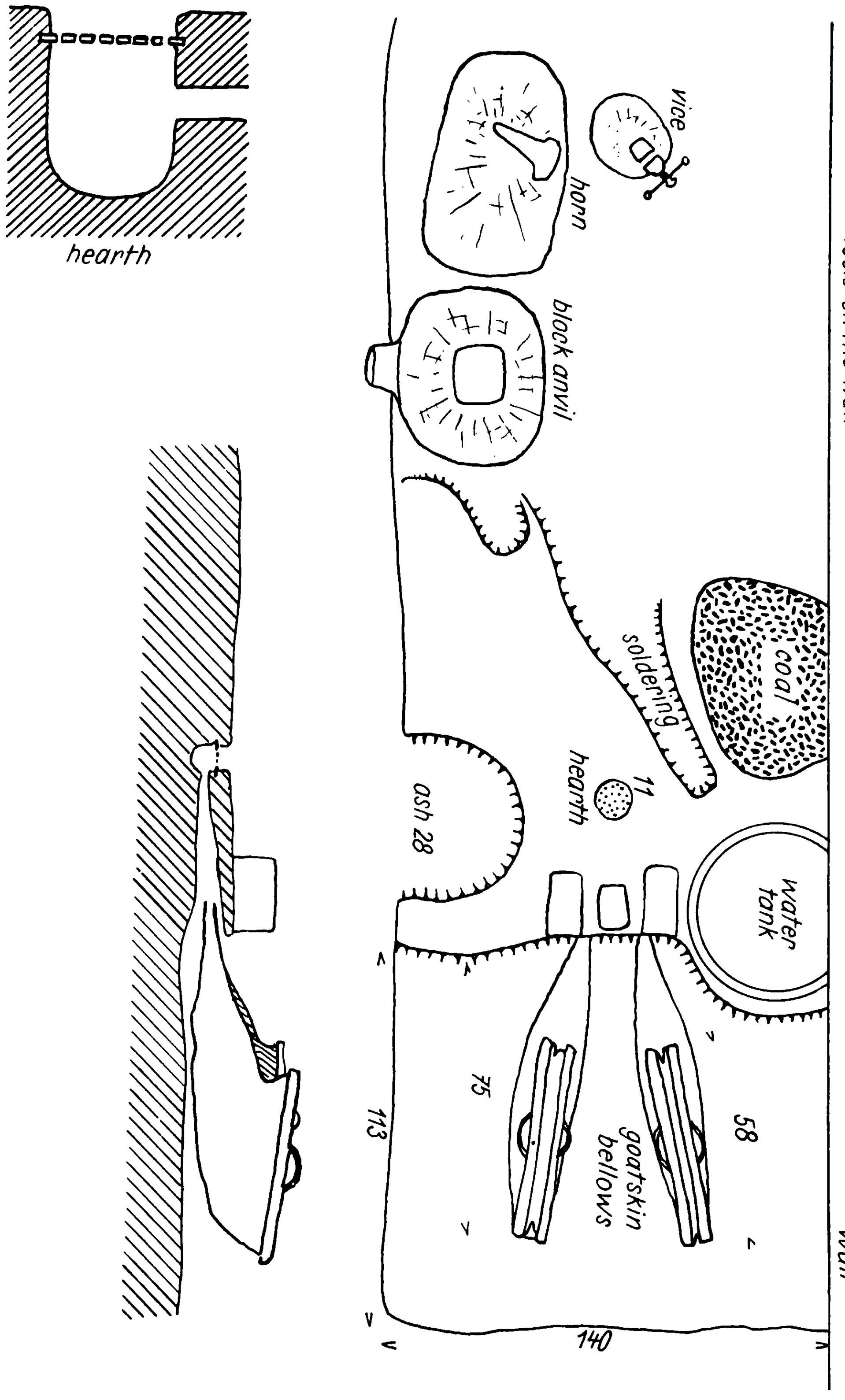
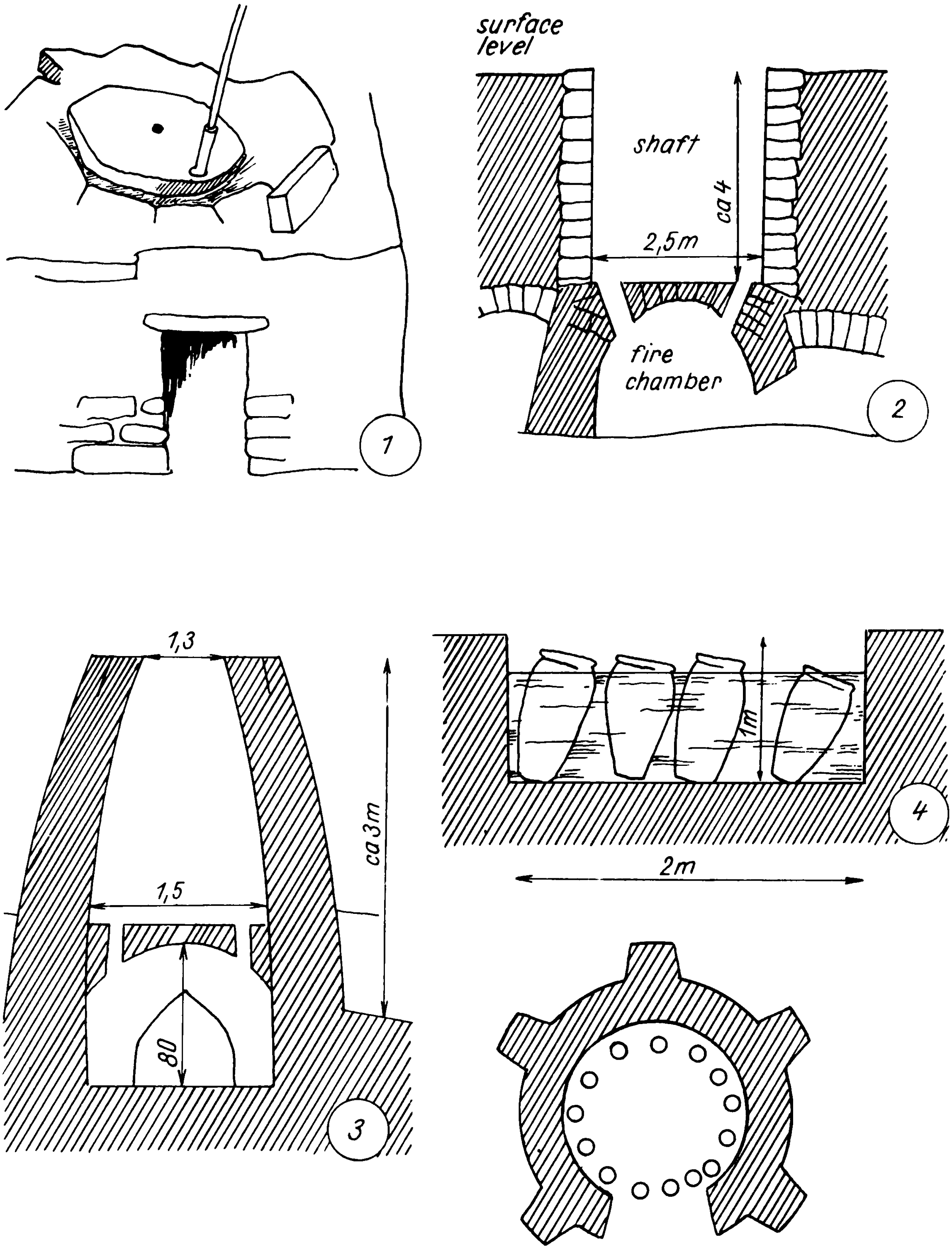


FIGURE 25. - POTTER'S WORKSHOP IN THE BAZAAR AT KASHAN.



1. Rotary quern for powdering clay. 2. Large kiln. 3. Smaller kiln. 4. Water tank containing fired pots.

Additional Note

The development of smelteries is paralleled by the changes in pottery kilns, which can be traced from the 5th millenium B.C. An interesting example of a pottery kiln is located in the bazaar at Kashan. The kiln itself is located in a courtyard, other parts of the manufactury occupy adjacent buildings. A rotary quern for grinding the clay sits on a mudbrick podium, just beside which the clay is mixed for the potters whose wheels are nearby (Fig.25:1). The foot-driven wheels are enclosed in a small structure of mud brick. Large vessels are built up of large strips of clay, the erected jar being finished on the wheel. After drying the raw vessels are sent to the kiln.

One of the two kilns was built above ground, the other, of the shaft type, was built below the surface. The underground furnace has a cylinder shaped shaft lined with bricks. (Fig.25:2). Four m below the surface there is a grate, about 2.5 m in diameter, with circular holes at the edge. Below the grate is the firebox, more than 1 m in height,which is fed from a cellar, the fuel being wood and oil. This kiln is used for firing large vessels.

The shaft of the above-ground kiln is cone shaped, about 130 cm at the opening, which is 3 m above the grate. The grate is circular, 1.5 m in diameter with 14 holes along the rim (Fig.25:3). The raw vessels are put in, and are fired several times, 24 hours of heating and 48 hours to cool.

The interiors of some vessels are glazed a greenish-blue. The greener shades of glaze are prepared from copper hammer-scale lead from old batteries and crushed glass. An older recipe uses tin and lead. The bluish tones consist of copper hammer-scale and crushed glass only. The glazed vessels were formerly fired in a special kiln, and those sorts intended to store liquids soaked in a tank, 2 m in length and about 50 cm in depth (Fig.25:4).

A Note on Chemical and Spectrographic Analyses.[1]

According to the results of spectrographic analyses,the treated samples were divided into several groups.

a) Lead slags -- determinations: gravimetrically SiO_2, titrimetrically Fe_2O_3 and MnO, chelametrically sum of CaO + MgO (in No. 5 and 6 also Zn by the same method). The determination of FeO was not possible because of the liberating of H_2S in an acidic milieu. Samples: 1-6, 19-22, 27.

b) Lead ores. Determinations: PbO, Fe_2O_3, in the case of No.16 also CO_2 and Zn, in the case of No. 17 also sulphur S. Samples 16-17.

c) Iron or copper slags -- determinations: gravimetrically SiO_2, P_2O_5, titrimetrically Fe_2O_3 and MnO, chelametrically Cao + MgO and Al_2O_3, polarographically CuO. Samples: 7 a-d, 8 a-c, 10 a-b, 11a, 12.

1 Professor Pleiner's analyses were received too late to be incorporated into the body of his manuscript as he would have wished. Instead we had to use the less convenient method of presenting them in tables, cross-referenced to the text. (Ed.)

d) Iron ores -- determinations: gravimetrically SiO_2, BaO (No. 9c), P_2O_5 titrimetrically Fe_2O_3, MnO, chelametrically CaO + MgO, polarographically CuO.
Samples: 9 b-c, 14 b, 18, 23 (also Fe_2O_3 and FeO).

e) Rock -- (No. 9a), determination: SiO_2 and sum of MgO + CaO.

Samples sub c, d, e were analyzed according to well known methods. In the case of the materials sub a, b, such methods were not available. The method of the analytical treatment was newly developed. The principle was separation with the aid of hydrogen sulphide, after which normal determinations followed (Cu -- polarographically Zn -- chelatometrically).

The analyses were carried out by Ing. M. Soudny, Mrs. A. Dlouha and Mrs. M. Hermova on the staff of the Archaeological Institute at Prague.

In addition to chemical analyses all specimens were examined by qualitative spectrographic analysis. These served also as an orientation for the chemical analyses.

The specimens were put into the electrode pi-hole (mark: Elektrokarbon Topolcany, 5 mm) and excited in the alternating arc 220V, 9A during 1 min. The apparatus was of Zeiss Qu 24 type. The plates were Gewaert Scientia, developed according to N. H. Nachtrieb with solutions D 19 and F 5. In the case of specimens 1a and 1b, separate analyses were made of the different components: slag-powder 1a and forgeable metal 1b.

The analyses were done by Ing. M. Soudny of the Archaeological Institute, Prague.

TABLE 1

A. Analysis of slag (specimen 27) from easternmost heap on plain near Muteh (see p.347). For spectrographic analysis see Table 3. (In percentages)

SiO_2	Fe_2O_3	MnO	CaO + MgO	PbO
39.61	27.94	0.91	26.35	6.61

B. Iron sponge from the disused furnace at Nakhlak (see p.348) was composed of the following (specimen 1a). (In percentages)

SiO_2	Fe_2O_3	MnO	CaO + MgO	PbO
1.35	76.65+	1.00	2.46	27.03

+ = iron content sum

The remainder of lead is very high. The analysis of the separated iron (specimen 1b) is: (In percentages)

P	Cu	Ni	Mn
tr.	0.022	0.35	0.006

C. The analysis of one of the lead slag specimens (No. 2) (see p353) is: (In percentages)

SiO_2	Fe_2O_3	MnO	CaO + MgO	PbO
41.05	7.18	0.39	26.35	10.03

This might be an example of normal lead slag of the area with a relatively high lead content.

D. Lead slag analysis (specimen 3) from the Farrokhi heap (see p.353) indicates a better extraction of the ore: (In percentages)

SiO_2	Fe_2O_3	MnO	CaO + MgO	PbO
39.69	12.77	0.87	30.84	3.66

E. Analysis of specimen No. 4 from one of these heaps (p.353) is: (In percentages)

SiO_2	Fe_2O_3	MnO	CaO + MgO	PbO
44.28	24.75	1.09	19.06	tr.

F. Lead slag analyses from Setshangi mine, Naiband area (see p.356): (In percentages)

	SiO_2	Fe_2O_3	MnO	CaO + MgO	PbO	Zn
Specimen No. 5 Big heap	35.02	19.96	0.95	19.62	2.11	17.07
Specimen No. 6 Edge of the smelting place.	38.19	11.97	1.17	20.74	3.40	8.49

The high content of Zn components proves that among the ore must be some zinc-bearing material, probably zinc ore.

G. Analyses of raw materials used in lead smelting experiments (see p.368): (In percentages)

	PbO	Zn	S	CO_2	Fe_2O_3	SiO_2	CaO	MgO
Specimen No. 16 cerussite	5.03	38.5	-	10.64	2.80			
Specimen No. 17 galenite	78.80		10.04	-	2.50	-		
Specimen No. 18 limonite	-				70.30	17.77	2.24	0.32

Sample No. 16 held for cerussite, which, according to its composition, could correspond more to the zinc ore, perhaps calamine or smithsonite ($ZnCO_3$), which might have more than 50% of Zn and occurs sometimes together with galenite ores.

H. Analyses of some products of the experimental smelting in the low shaft furnace (see p.371): (In percentages)

		SiO_2	Fe_2O_3	FeO	Fe met.	MnO	CaO + MgO	PbO	Zn spectr.
Pb slags	Specimen 20 upper surface of the conglomerate	28.19	23.95	-	+	3.50	25.06	4.10	++
	Specimen 21 tip of the same	26.77	21.56		+	2.66	19.17	7.38	++
	Specimen 22 middle of the same	29.95	20.76	-	+	1.97	34.99	5.42	++
	Specimen 19 lower drops	28.01	24.75	-	+	5.89	19.29	4.06	+++
	Specimen 23 magnetic fractions	-	16.14	0.77	++	-	-		-

	Si	Fe	Mn	Ca	Mg	Pb
Specimen 24 lead (spectr.)	10^{-1}	10^{-1}	tr.	1-10	10^{-1}	+++

Explanation: Fe met + or ++ = metallic grains
Zn ++ = minor components
Zn +++ = major component
Pb +++ = main component

According to the analyses, I believe that in small metallurgical furnaces of the shaft type, equipped with the simplest types of bellows, it was possible under good conditions (suitable lead and iron ore, dry fuel, skilled smelter and a well-going lead smelting process) to reduce not only lead but small samples of metallic iron. It is not out of the question that such small pieces (grains, pieces of sponge) could be observed in the slag, occasionally collected and worked as curious materials. Repeated tests would be necessary to check this opinion.

I. Analyses showed the following composition of the vein (see p.379) (In percentages)

	SiO_2	Fe_2O_3	MnO	CaO	MgO	P_2O_5	CuO	BaO
Specimen 9a lime rock	56.47	-		17.09		-	-	-
Specimen 9b hematite	6.77	74.27	5.90	2.24	0.60	0.15	0	0
Specimen 9c red ochre	22.36	30.36	3.72	12.05	2.23	0.07	0	3.27
Specimen 10 hematite, vall.	5.62	78.30	3.93	13.43	0.32	0.24	0	

J. It seems that because of a very low FeO content this material is rather well dressed and roasted rich ore. Analyses of specimen 12 (p.388): (In percentages)

SiO_2	Fe_2O_3	FeO	Fe met.	MnO	CaO	MgO	CuO	P_2O_5	Al_2O_3
7.67	84.65	12.48	0.11	1.76	2.38	0.20		1.55	2.05

K. Analyses of samples from the heap II (p.389): (In percentages)

	SiO_2	Fe_2O_3	FeO	Fe met.	MnO	CaO	MgO	CuO	P_2O_5	Al_2O_3
Specimen 10b slag	23.63	6.36	39.70	2.68	4.95	4.62	0.50	tr.	0.04	9.52
Specimen 10a slagged lining	36.34	2.56	3.95	1.28	9.28	13.09	3.05	tr.	0.07	10.83

The vein contained a very good and rich ore with a high iron and low silica content.

Prefatory Note to Table 2.

It is very well known that copper slag from chalcopyrite ore normally contains a substantial amount of iron oxide (tens of %) and a very slight quantity of copper (tenths of % or maximally low %) and that it is very difficult to distinguish copper slags from bloomery ones (cf. W. Witter, Die alteste Erzgewinnung im nordisch-germanischen Lebenskreis I, Leipzig, 12-13, Anal. 8-9, 18-19, 1938; R. F. Tylecote, Metallurgy in Archaeology, London, 34, 1962; R. Pittioni, "Der Schmelzplatz No. 13 des Bergbaugebietes Jochberg bei Kitzbuhl, Tirol," Archaeologia Austriaca Beiheft 3, Wien, 36, 1958. Therefore, in relation of some copper slags, there are presented analyses from Zaringerani and Piruje.

CuO was checked for Cu content; Jochberg after Pittioni, Apliki after Tylecote, Muhlbach, Lerchenfeld and Ranis after Witter.
According to Tylecote, it is necessary to check the higher content of sulphur when distinguishing sulphide copper slags from iron bloomery waste products. But also the sulphur content of the copper slags could be very low (see Jochberg No.1 and 3), so that distinguishing them is very difficult. The samples from Zaringerani and Piruje are extremely low in copper, but very high in sulphur, which is not the case in bloomery slags. Therefore the Zaringerani and Piruje sites are to be classified as copper smelting places.

TABLE 2 (In percentages)

		SiO_2	Fe_2O_3	FeO	Fe	MnO	CaO	MgO	CuO	P_2O_5	Al_2O_3	S
Baft	7a upper surf. (cristal.)	43.00	21.56	14.37	1.30	0.51	6.95	4.20	0.098	1.08	9.68	0.35
Zarin-gerani	7b lower surf.	26.89	73.46	62.15	3.02	tr.	5.04	0.40	0.064	0.15	4.09	-
	7c upper surf.	32.99	54.30	42.39	2.23	0.13	5.60	1.00	0.094	0.28	0.80	-
	7d lower surf.	29.89	56.69	36.64	4.68	0.11	2.66	0.30	0.094	0.25	12.96	-
	8a upper surf.	33.44	57.49	39.52	1.96	0.15	2.52	2.40	0.24	0.21	7.63	1.24
Piruje	8b middle	23.43	63.08	53.89	2.40	0.17	1.82	1.17	0.075	0.18	7.44	-
	8c lower surf.	33.67	75.86	43.83	6.30	0.06	8.24	0.026	0.026	0.18	2.92	-
various copper slags:												
Jochberg, Austria	1	31.64	-	44.51	-	-	7.40	-	0.30	-	-	0.06
Bronze Age	2	30.25	-	56.67	-	-	1.85	-	1.35	-	-	0.54
	3	59.75	-	19.78	-	-	2.96	-	0.52	-	-	0.10
	4	57.45	-	26.33	-	-	2.03	-	0.20	-	-	0.23
Apliki, Cyprus	B.A.	21.30	34.80	30.80	-	tr.	1.14	tr.	1.13	-	1.14	1.14
	Roman	28.80	35.10	-	-	-	4.53	3.53	0.87	-	3.95	1.28
	modern	33.00	-	46.50	-	-	6.75	-	0.43	-	8.10	0.45
Muhlbach, Germ.	8	23.16	-	55.14	-	-	-	-	4.28	0.00	4.59	1.98
	9	37.79	-		-	-	-	-	0.56	-	-	2.25
Lerchenfeld, G.	19	14.98	-	49.68	-	-	4.30	-	0.56	-	-	1.50
Ranis, Germany	18	59.84	-	29.32	-	-	-	-	3.25	-	-	-

TABLE 3 -- Spectrum Analyses

Specimen	Locality	Object	Main Components	Minor Components	Between Main and Minor	Traces
1a	Nakhlak	Pb-slag	Pb	Fe, Si, Ca, Zn, As, Ba	Mg, Al, Mn, Cu	P, Ag, Ni, Ti, V, Sr, Cr, In
1a	Nakhlak	Pb-slag	Pb	Fe, Si, Ca, Zn, As, Ba	Mg, Al, Mn, Cu	P, Ag, Ni, Ti, V, Sr, Cr, In
1b	Nakhlak	Fe in Pb-slag	Pb	Fe, Si, Ca, Zn, As, Ba	Al, Mg, Mn, Cu	P, Ag, Ni, Ti, V, Sr, Cr, In
1b	Nakhlak	Fe in Pb-slag	Pb	Fe, Si, Ca, Zn, As, Ba	Al, Mg, Mn, Cu	P, Ag, Ni, Ti, V, Cr, In
2	Nakhlak	furnace slag(Pb)	Pb	Fe, Si, Ba, Ca, Al, Zn	Mg, Cu	As, Mn, Ti, Ag, Cr, Ni
3	Farrokhi	Pb-slag	Pb	Fe, Si, Ca, Zn	Mg, Cu, Al, Sb	As, V, Ti, Ag, Cr, Mn, In, Ni
4	Baiazeh, Dasht-i-Kavir	Pb-slag		Si, Fe, Zn, Ca	Al, Cu, Cr, Sn, Sr, V	As, Mn, Pb, Mg, Ti, In, Ag, Ni
5	Naiband, big heap	Pb-slag		Pb, Si, Fe, Ca, Mg, Al, Zn	V, Cu, Ti, Cr	As, Mn, Mo, Ni, Sn, In, Ag
6	Naiband, smelting place	Pb-slag		Pb, Si, Fe, Ca, Mg, Zn, Al	V, Ti, Cu	As, Mn, Sn, Mo, Ni, In, Ag, Cr
7a	Baft, Zaringeran	Cu-slag		Fe, Zn, Si, Ca	Pb, Cu, Mg, V, Cr, Al	As, Mn, Ti, Ag, In, Ni
7b	Baft, Zaringeran	Cu-slag		Fe, Si, Ca, Zn	Pb, Cu, Al	As, Sn, Mg, Ti, Ag, Mn, Ni, V, Cr, In
7c	Baft, Zaringeran	Cu-slag		Fe, Si, Ca, Zn, Mg	Al	As, Cu, Pb, Sn, V, Ti, Cr, Mn, Ni,(In, Ag)
7d	Baft, Zaringeran	Cu-slag		Fe, Si, Ca, Zn	Mg, Cu	As, Pb, Sn, V, Mn, Ti, Ni, Cr,(Ag, In)
8a	Chah-Mess, Piruje	Cu-slag		Fe, Si, Zn, Ca	Cu	Pb, Sn, Mg, Ni, V, Cr, Ti, Mn,(In, Ag)
8b	Chah-Mess, Piruje	Cu-slag		Fe, Si, Zn, Ca	Cu, Pb	Sn, As, Mg, Ni, V, Cr, Mn, Ti,(In, Ag)

TABLE 3 -- Spectrum Analyses (Cont'd.)

Specimen	Locality	Object	Main Components	Minor Components	Between Main and Minor	Traces
8c	Chah-Mess, Piruje	Cu-slag		Fe, Zn, Si, Ca	Cu	Sn, As, Mg, Pb, Mn, Ni, V, Ti, Cr,(In, Ag)
9a	Haneshk, mine No. 1	rock	Si, Al, Ca	Mg, Fe, Ba	Ti, V, Cu, Cr	Sn, Mn, Zn, Ni
9b	Haneshk, mine No. 1	rock		Fe, Ca	Si, Ba, Mn, Mg	As, Al, Cu, In, Ti, Cr, Ag
9c	Haneshk, mine No. 1	rock		Ca, Mg, Fe, Ba, Si	Pb, Mn, B, Na	Sn, As, Cu, Ti, P, Zn, Ag, Ni, Cr, K(Co, V)
10a	Haneshk	Fe-slag		Fe, Ca, Mg	Si, Al, B, Mn	P, As, Ti, Cu, V, Pb, Ag(Ni, Sn, Zn, Co)
10b	Haneshk	Fe-slag		Ca, Fe, Na	Mn, B, Al, Si	Ni, Cu, Cr, P, As, Pb, V, Ag(Sn, Zn, Ti, Co)
11a	Haneshk	Fe-slag		Si, Fe, Ca	Al, B, Ba, Mg, Mn, Cu	As, Bi, Ag, Cr, Zn, Sn(V, Ti, Ni)
12	Haneshk, slag from heap No. 1	Fe-slag				
14b	Haneshk, below the mine No. 1	iron ore		Fe, Ca	Si, B, Mn, Mg, Ba, Cu	As, Pb, Bi, Al, Ti, Ag, Ni
16	tested raw material	Cerussite	Zn, Pb	Ca, Si	Fe, As, Al, B	Cu, Mn, Mg, Ti, Ag
17		Galenite	Pb	Ca, Si	Sb, Ba, Zn, Cu, Al, Mn, Fe	Mg, Cd, As, B, Bi(Ti, V)
18		Limonite		Si, Fe, Ca	B, Zn, Mg, Pb	Ba, As, Cd, Mn, Cu, Ni, Ti(Bi, Al, Ge, Ag)
19	Iblis, experim. smelt.	3 drops slag	Pb, Zn	Ca, Al	Fe, Si, B, Sb, Mg, Ba, Cu	Mn, Ag, As, Sn, Ti, V, Cr, Mo, Ni, Bi
20	Iblis, experim. smelt.	2 slag upper surface	Pb	Zn, Fe, Ca, Al, Mg	Si, Sb, Ba, As, B, Cu, Ag	Mn, Sn, Ti, Ni, Cr, Cd, V, Co, Ge
21	Iblis, experim. smelt.	4 slag from tip	Pb	Zn, Ca, Fe, Al, Mg, Si	Sb, As, Ba, Mn, B, Ag, Cu	Sn, Cd, Bi, V, Co, Cr, Mo

TABLE 3 -- Spectrum Analyses (Cont'd.)

Specimen	Locality	Object	Main Components	Minor Components	Between Main and Minor	Traces
22	Iblis, experim.smelt.	1 slag from middle	Pb	Zn, Ca, Mg, Fe, Al, Si	Sb, As, B, Mn, Cu, Ag	Sn, Ba, V, Ni, Co, Cr
23	Iblis, experim.smelt.	5 magnetic fractions lower surf.	Pb	Fe, Zn, Ca, Al, Mg	Si, Sb, As, Ba, Cu, B, Mn	Ag, Sn, P, Ti, Cd, Ni, Cr, Co, Mo, Ge
26	Iblis, experim.smelt.	slagged wall fragm.	Pb	Zn, Ca, Fe, Mg, Al	Si, Sb, Mn, Cu, B	Ag, As, Sn, Ti, Cd, Cr, Ba, Mo
27	Muteh	Pb-slag	Pb	Si, Fe, Ca, Mg, Al	Sb, Zn, Mn, Ba, Ag	Cu, B, As, P, Sn, V, Bi, Cd, Ti, Ni, Cr, Co, Ge

ADDENDA

REGISTERED STONE OBJECTS IDENTIFIED BY MR. RICHARD LEARY, CURATOR OF GEOLOGY, ILLINOIS STATE MUSEUM

Number	Object	Period	Identification
9	bead	Iblis I	turquoise
11	slag	surface	unidentified ore
27	bead	Iblis I	bone or ivory
45	bead	Iblis I or II	bone or ivory
55	vessel fragment	no context	sandstone
57	knife blade	Iblis I	quartz
65	knife or spatula blade	Iblis I or II	slate
93	hollow bead	Iblis IV	gold
101	bead fragment	Iblis I	basalt
103	disk	Iblis I	marble
111	bead	Iblis I	turquoise
113	polished fragment	Iblis I	rose quartz
115	bead	Iblis I	marble
125	pendant	Iblis I	turquoise
127	polished crescent	Iblis I	carnelian
129	bead	Iblis I	bone or ivory
137	bead	Iblis I	turquoise
139	vessel fragment	Iblis I	slate
145	cup	Iblis I	rhyolite
147	celt	Iblis I	felsophyre-porphyritic igneous rock
151	semi-lunar blade	Iblis I	quartz
161	bead	Iblis I	carnelian
165	flake blade	Iblis I	amygdaloid basalt
167	pestle	Iblis I	basalt

Number	Object	Period	Identification
169	bead	Iblis I	smithsonite
177	polished crescent	Iblis I	marble
179	disk	Iblis I	smithsonite
181	bead	Iblis I	turquoise
183	disk	Iblis I	smithsonite
187	cruciform object	Iblis I	bone, ivory or shell
189	drill	Iblis I	chert
195	bead	Iblis I	carnelian
211	polished fragment	Iblis I	turquoise, weathered
219	bead	Iblis I	turquoise
223	bead	no context	turquoise
265	bead	Iblis I	turquoise
269	bead	Iblis I	turquoise
272	arrow shaft straightener	Iblis I	shale
273	pestle	Iblis I	basalt
279	bead	Iblis II	turquoise
283	bead	Iblis VI	bone or ivory
285	chisel	Iblis I	slate
293	"zoomorphic object"	Iblis I	marble
301	pestle	Iblis I	quartzite

REGISTERED SHELL OBJECTS IDENTIFIED BY R. TUCKER ABBOTT, ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

Number	Object	Period	Identification
15	cut shell section	no context	fragment of pearl oyster, Indian Ocean, *Pinctada margaritifera* Linné.
59	bead	Iblis I	*Cypraea annulus* Linné. A common Indo-Pacific cowrie.
83	bead	Iblis I	*Dentalium bisexangulatum* Sowerby (fragment). Indian Ocean Tusk shell.
105	bead	Iblis I or II	*Nerita albicilla* Linné. A common intertidal Indo-Pacific species.
109	bead	Iblis I	*Conus ebraeus* Linné. Reef species, common.
117	bead	Iblis I	*Oliva bulbosa* Röding. An Indian Ocean species. This shell more closely resembles specimens coming from the Arabian Sea than those from the Persian Gulf.
149	cut shell	Early Iblis IV	Piece of pearl oyster, *Pinctada margaritifera* Linné (probably originally 6" across).
197	bead	Iblis I	*Polinices mammilla* Linné. A common, white, glossy snail shell of the Indo-Pacific.
213	bead	Iblis I	? Fragment of mammal bone.
225	cut shell	Iblis I	Fragment, possibly of large *Turbo* snail.
261	bead	Iblis I	*Nerita albicilla* Linné.
271	bead	Iblis I	*Nerita albicilla* Linné.
289	bead	Iblis I	*Nerita albicilla* Linné.
303	bead	Iblis I	*Cypraea (Erosaria) ocellata* Linné. Arabian Sea to Bay of Bengal.