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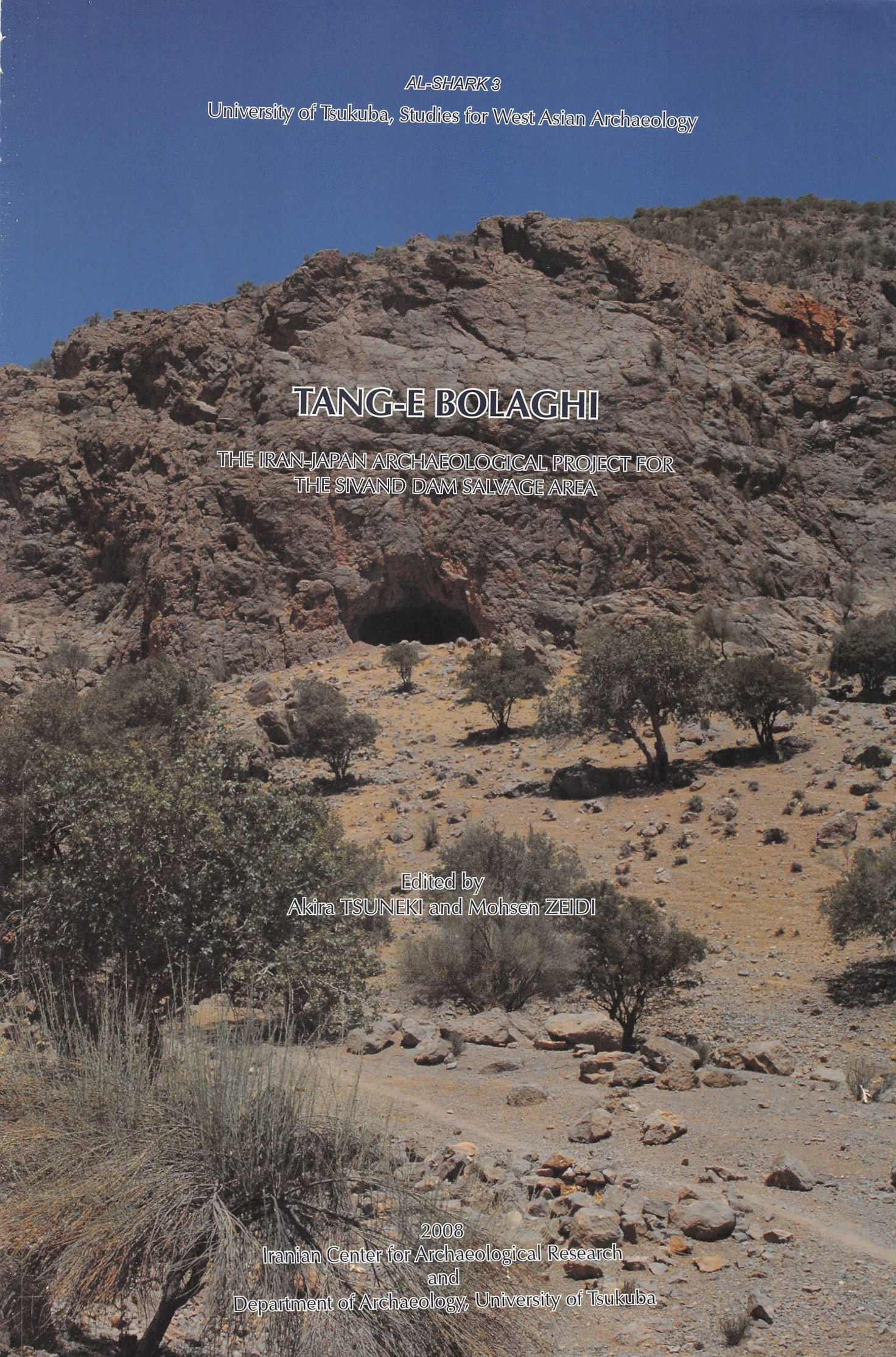

# TANG-E BOLAGHI

## THE IRAN-JAPAN ARCHAEOLOGICAL PROJECT FOR THE SIVAND DAM SALVAGE AREA

Edited by
Akira TSUNEKI and Mohsen ZEIDI

2008
Iranian Center for Archaeological Research
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Tang-e Bolaghi: Iran-Japan Archaeological Project for
the Sivand Dam Salvage Area.
Akira Tsuneki and Mohsen Zeidi (eds.)
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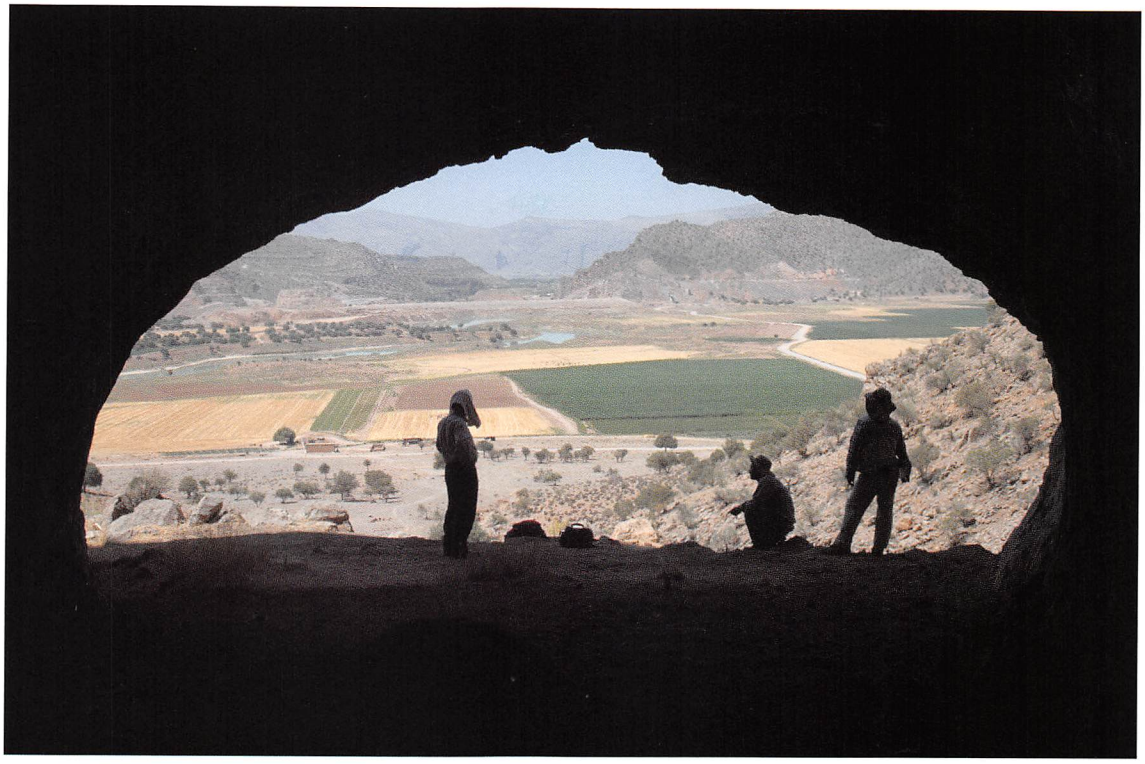

Outlook of the Bolaghi Valley from TB75

Digging trenches at TB75

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# PREFACE

This report is the culmination of cooperation between Iranian and Japanese researchers from 2005-2007.

In the autumn of 2004 we received a letter of appeal from the Iranian government to participate in work to be undertaken at Tang-e Bolaghi. Tang-e Bolaghi is an important area because of its location between Pasargadae and Persepolis and because it contains a lot of remains spanning from the Paleolithic to the modern times. Our research site on a hill overlooked the whole region of Tang-e Bolaghi. After discussion, cooperation and work with Iranian researchers we were able to discover many worthwhile archaeological finds.

I visited Iran after an interval of 30 years and saw that Iran is developing more day by day. I anticipate Iran's ongoing development and understand its aim of increasing agricultural production. The entire area of Tang-e Bolaghi will be under water when the dam is completed but the history of Tang-e Bolaghi will not be forgotten.

I thank the Government of the Islamic Republic of Iran for giving us the opportunity to work at Tang-e Bolaghi. I hope that this report represents a milestone on which to base further partnerships in archaeological research in the future.

*Kazutada KATAOKA*
Dean,
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University of Tsukuba

ACKNOWLEDGEMENTS

For the execution of our archaeological work in Tang-e Bolaghi, we are deeply grateful to the government of the Islamic Republic of Iran, especially Dr. Seyed Taha Hashemi, Director of the Research Center of ICHTO and Dr. Hasan Fazeli, Director of the Iranian Center for Archaeological Research. They have extended the greatest consideration and cooperation to us during the course of our work. We also offer appreciation to Dr. Masoud Azarnoush, the former director of the ICAR, for his kind permission and considerations to our project. We also express our special thanks to the staff of ICAR, especially Mr. Karim Alizadeh and Ms Mojgan Seyedin.

We deeply appreciate the great deal of help given by the Fars local government, especially Dr. Mohamad Hasan Talebian, Director of the Parsa-Pasargadae Research Foundation and Mr. Maziar Kazemi, Supervisor of the Persepolis World Heritage Complex. The Pasargadae World Heritage Complex afforded every facility for pursuing our fieldwork in Tang-e Bolaghi. We express our special thanks to Mr. Hosein Abbasi'mehr, Supervisor of the Pasargadae World Heritage Complex, and other staff, especially Mrs. Farzaneh Gerami.

Financial assistance for our research project came from ICAR and a grant under the International Scientific Research Program (2005-2007) of the Japanese Ministry of Education and Science (Grant no. 17401018).

CONTENTS

List of Figures

## List of Tables



## List of Plates

# CHAPTER 1

## INTRODUCTION

# 1. INTRODUCTION

Akira TSUNEKI

This volume is a final report of our archaeological investigation in the Bolaghi area, Fars province, southern Iran. A new Sivand Dam was planned at the southern exit of the Sivand River in the Bolaghi Valley, which is one of the small basins in the Zagros Mountains. The dam construction site is about 30 km northeast of Persepolis and about 12 km southwest of Pasargadae (Fig.1.1, 1.2, Pl.1.1). The Bolaghi area consists of a narrow

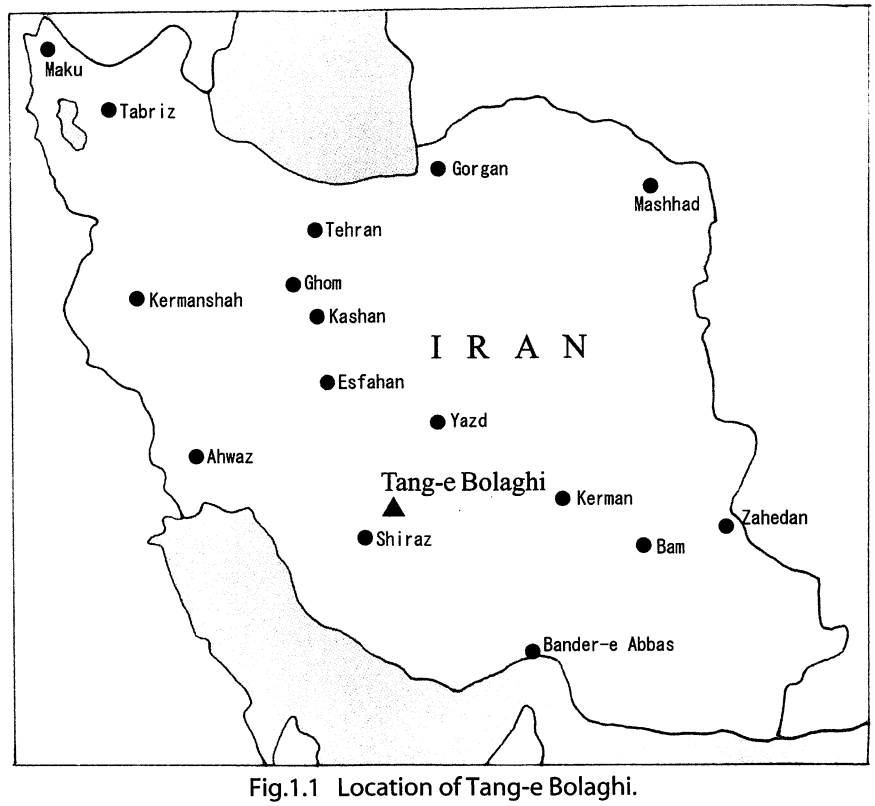


Fig.1.1 Location of Tang-e Bolaghi.

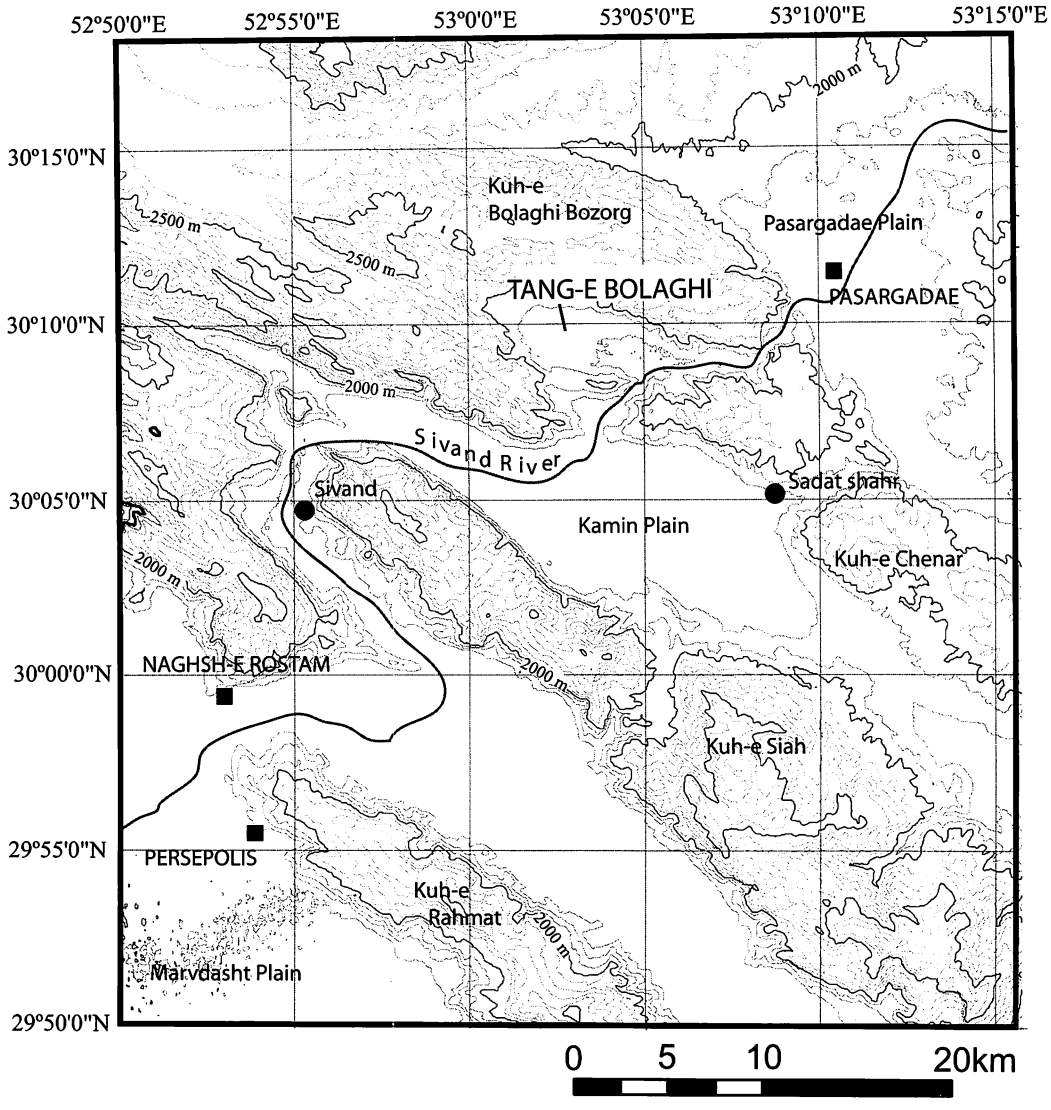


Fig.1.2 Tang-e Bolaghi and its neighboring area.

valley (Tang-e Bolaghi) and a small basin (Dasht-e Bolaghi). The valley and most parts of the basin will be flooded by the construction of the Sivand Dam (hereafter, we call both valley and basin together, Tang-e Bolaghi or the Bolaghi Valley). The Iranian Center for Archaeological Research (ICAR) appealed for an international salvage project for the archaeological sites of the Bolaghi Valley in 2004, and we were pleased to accept their proposal. Two of our members, Akira Tsuneki and Kazuya Yamauchi, went to the Sivand Dam salvage area to look around the archaeological sites and natural environment in January 2005.

## Natural Environment of the Bolaghi Valley

The Bolaghi Valley is one of the small basins formed by the Zagros Suture, which has been developed by movement of the Zagros thrust. (see chapter 2 of this book.) The Sivand River flows into the valley from the northeastern Pasargadae Plain (Morghab Plain) (Pl.1.2). It meanders to the southwest in the narrow valley between Kuh-e Bolaghi Bozorg and Khu-e Bolaghi Kuchak. After 4 km, the river flow turns in a western direction (Pl.1.3). Then, the small basin opens out surrounding Kuh-e Bolaghi (Pl.1.4). The river flow turns again in a

Table 1.1 Annual and monthly mean temperature and precipitation at Shiraz 1951-2005.

| | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sep. | Oct. | Nov. | Dec. | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Air Temperature (°C) | 5.7 | 8.0 | 11.8 | 16.6 | 22.7 | 27.9 | 30.0 | 29.0 | 25.0 | 18.9 | 12.1 | 7.4 | 17.9 |
| Minimum Temperature (°C) | 0.2 | 1.8 | 5.1 | 9.0 | 13.7 | 17.6 | 20.6 | 19.5 | 15.1 | 9.7 | 4.5 | 1.4 | 9.8 |
| Maxmum Temperature (°C) | 12.1 | 14.7 | 18.7 | 24.1 | 30.5 | 36.0 | 37.8 | 37.0 | 33.7 | 27.9 | 20.4 | 14.5 | 25.6 |
| Precipitation (mm) | 90.2 | 52.6 | 56.2 | 26.7 | 7.0 | 0.2 | 1.2 | 0.7 | 0.0 | 3.9 | 28.9 | 78.4 | 346.0 |

Source: Islamic Republic of Iran Meteorological Organization Data Processin Center

southwestern direction in the middle of the basin, where it then outflows from the basin at its southern edge. This is where the Iranian government is now constructing the Sivand Dam. After leaving the basin, the river flows to the south through a narrow valley and into the Kamin Plain. The area of the Bolaghi Valley covers about 25km$^2$. Its central basin measures 9 km from east to west and 3 km from north to south. The altitude of the valley bottom is around 1800m.

The modern temperature and precipitation of the Bolaghi Valley is estimated from the meteorological data of the Shiraz weather station (Table 1.1). The mean annual air temperature of Shiraz between 1951 and 2005 was 17.9°C. The coldest month is January and the mean air temperature is 5.7°C (The mean minimum air temperature is 0.2°C.). The hottest month is July and the mean air temperature is 30.0°C. (The mean maximum air temperature is 37.8°C). The difference in temperature between day and night is large, varying between 11.9°C (January) and 18.6°C (September). The rainy season in this region is during winter from December to March. The annual precipitation of Shiraz between 1951 and 2005 was 346mm, and most of the rainfall is concentrated in the winter months. Sometimes rainfall changes into snowfall. The summer season is extremely dry. The altitude of the Shiraz weather station is 1484m, and it is about 400m lower than the altitude of the Bolaghi Valley. Therefore, the climate of the Bolaghi Valley can be considered severer than that of Shiraz. We can conclude that the climate of Bolaghi Valley is an inland one, experiencing drastic temperature changes during the day and between seasons. The precipitation reaches the very limit for dry-farming. The people must irrigate paddy fields or vegetable gardens. The surface of the soil is heavily covered with many limestone pebbles. Therefore, the valley provides relatively poor conditions for agriculture.

Vegetation in the Bolaghi Valley comprises an oak steppe-forest type. The oak trees are distributed very sparsely on the mountain slopes. On the other hand, wild pistachio and wild almond trees are conspicuous on the mountain slopes and on the edge of flat land within the valley. This kind of vegetation is suggested as *Pistacia-Amygdalus* Steppe-Scrub, and *Pistacia* steppe bush is a derivative of a Zagros steppe-forest which has been deprived of its oaks (Zohary 1973: 583-588). Local people sap wild pistachio trees for chewing and medicinal usage (Pl.1.5, 1.6), and small wild almond nuts are gathered and eaten by them (Pl.1.7, 1.8). If the prehistoric vegetation of the Bolaghi Valley was the same as the modern one, it might be suitable for hunter-gathers or pastoralists rather than for farmers.

## Archaeological Sites in the Bolaghi Valley

According to previous general surveys carried out by M. Ata'i (2003), there are over one hundred archaeological sites in the Bolaghi Valley. Within this number, modern nomadic camp-sites and graveyards were included. Ata'i recorded the most important twenty-four archaeological sites (Fig.1.3), and it is suggested that these sites must be investigated before dam construction commences. Because of our restricted visiting time and topographical difficulties, we could only visit half of these important sites in January 2005.

The most dense site concentration is in the north-central part of the basin. A series of

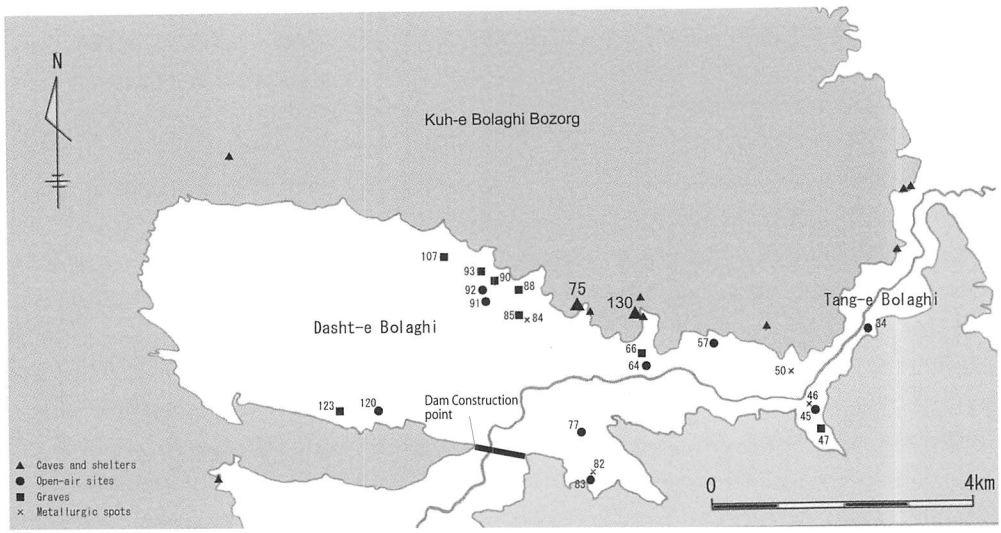


Fig.1.3 Archaeological sites in Tang-e Bolaghi (modified from the map of Ata'i 2003).

cairns (TB107, TB93, TB90, TB88), which probably date from the Sasanian to the early Islamic period, are located along the foot of the northern mountains (Pl.1.9 – Pl.1.12). The low tappehs and the building foundations (TB91, TB92), dating to the almost same age, are visible in front of these cairn graveyards (Pl.1.13, 1.14). This kind of pair, i.e. cairn and small settlement or camp-site, is recognizable not only in this area but also in other parts of Dasht-e Bolaghi (e.g. TB66 and TB64, TB45 and TB47).

Besides Sasanian and early Islamic artifacts, some low tappehs (i.e. TB91) and camp-sites (i.e. TB92) also produced older materials, including Achaemenid bricks and typical Bakun A type potsherds (Pl.1.15, 1.16). Therefore, the settlements in the salvage area date back to at least the Chalcolithic period. However, evidence of these earlier occupations is relatively poor.

Some sites produced iron slags and they indicate the evidence of metallurgical work in the area. The low tappeh of TB84 is one of these specimens, and we could collect much iron slag from its surface (Pl.1.17, Pl.1.18). Though we cannot determine the exact age of these sites, some of them belong to the Islamic period. During our short visit we discovered a low and small tappeh located south of TB84. It was not registered by Mr. Ata'i and it was probably a newly discovered site at this time (Pl.1.19, 1.20).

Not a few caves and shelters were recognizable at the foot of the surrounding mountain around the Bolaghi Valley. As most of them have been used as animal refuges, dung deposits cover the caves' interior and terraces. Therefore, we could find prehistoric material in a few caves and shelters. Among them the shelter above TB66 is the most notable, because Epi-Paleolithic or early Neolithic lithic artifacts were collected on the terrace in front of it (Pl.1.22 – 1.24). This evidence indicates that the human presence here dates back to at least the early Neolithic period. As this shelter was not named by Ata'i, we named it TB130. Although there are more caves and shelters at lower altitudes in the surrounding mountains, it was not easy to find prehistoric objects from them because of thick later deposits. However, some of them are favorably located within the basin. Among them TB75 is the most conspicuous cave, located at the center of the northern fringe of the basin (Pl.1.25 – 1.29). Islamic potsherds are the most remarkable surface materials on the terrace. However, we expected to encounter rich deposits with prehistoric human evidence, because we collected a few lithic artifacts which seemed to belong to the Epi-Paleolithic/Neolithic periods.

In the narrow valley of Tang-e Bolaghi, famous rock-cut passages were constructed on

both sides of the river. They have been studied by Iranian and foreign scholars repeatedly. They are preserved relatively good condition (Pl.1.30 - 1.32). We could not determine the exact date of this so called *Dokhtar Bor*, but the rock-cut surface still retains the traces of the cutting chisels (Pl.1.33).

Our short trip to the Bolaghi Valley revealed the following conclusions regarding the archaeological characteristics of the valley. In general, the valley contains many temporal settlements or graveyards, such as camp-sites and cairns. In contrast, there is a dearth of permanent and large tappehs in the valley. As the valley is located between Pasargadae and Persepolis, it must have been one of the extremely important traffic routes during the Achaemenid period. The archaeological evidence within the area indicates that the area played an important role not only in the Achaemenid period but also in other periods, at least from the Epi-Paleolithic to the Early Islamic as a transfer route. Therefore, we concluded that the Bolaghi Valley has great potential archaeologically for the study of transhumance and trade activities in both prehistoric and historic periods.

Thereafter, our conclusion would be encouraged by the results of many archaeological works carried out by Iran-foreign archaeological missions in the Bolaghi Valley (ICAR 2006).

## Operations

Based on the results of our short visit and advice by Dr. Azarnoush, a former director of ICAR, we proposed an enforcement plan of our contribution for the Sivand project. Fortunately, this application was accepted by the ICAR, and the research was undertaken and executed as an Iran-Japan joint project from 2005 to 2007.

Our contribution to the Sivand Dam salvage project consisted of two main operations, i.e. 1) Excavations at two caves, TB75 and TB130, and 2) Investigation of travel routes and site distribution pattern in the Bolaghi Valley.

### 1) Excavations of two caves, TB75 and TB130

The first operation was planned based on our original belief that the Fars province is one of the important archaeological areas for the study of Paleolithic and Neolithic periods. In the Fars province, especially the Marvdasht plain, many Paleolithic cave sites had been reported. Some of them, such as Eshkaft-e Gavi, were excavated (Rosenberg 1985), and many other Middle, Late and Epi-Paleolithic caves were surveyed intensively (e.g. Rosenberg 2003). In the Arsanjan area, southeast of the Marvdasht plain, a Japanese archaeological mission had previously carried out an intensive general survey and found 144 caves and shelters which date from the Middle Paleolithic to the modern periods (Ikeda 1979, Nishida et al. 2007).

Many Pottery Neolithic tappehs have been excavated, especially in the Marvdasht plain. Excavations and surveys at sites, such as Tal-i Mushki (Fukai et al. 1973, Alizadeh 2006), Tal-i Jari B (Maeda 1986, Alizadeh 2006), Toll-e Bashi (Abdi et al. 2003), Kushk-e Hezar (Alden et al. 2004), revealed the earliest phases of the Pottery Neolithic period in this region.

All of these investigations indicate that the Fars province has good potential for further Paleolithic and Neolithic studies. However, curiously enough, the sites between the Epi-Paleolithic and Pottery Neolithic periods have not been reported in the Fars province until now. This era is very important in human history, because the era spans food gathering to food producing societies.

As mentioned above, not a few caves and shelters were recognizable at the foot of the surrounding mountain around the Bolaghi Valley, and they are threatened by the construction

of the Sivand Dam. Some of them produced lithic objects dating to the Epi-Paleolithic and Neolithic periods. Therefore, we planned to undertake the excavations at two of these sites, i.e. TB75 and TB130. This operation shed new light on the transitional period from the Epi-Paleolithic to the Early Neolithic in the Eastern Zagros region (Tsuneki et al. 2007).

### 2) Investigation of travel routes and site distribution pattern in the Bolaghi Valley

This operation was planned based on the results of our preliminary short visit. That is, the Bolaghi Valley is one of the potential archaeological area for studying transhumance and trade activities in both prehistoric and historic periods. To grasp the transhumance and trade routes, we must investigate and register all types of archaeological sites in the valley. The operation was executed by using high-resolution satellite imagery and an intensive field walking survey. Our investigation revealed the relationships between the travel routes within and to/from the Bolaghi Valley and the site distribution patterns of the valley. It offered us hints of dynamic transhumance, traffic and trade movements in the Bolaghi Valley in various periods. The detailed recording of the so-called *Dokhtar Bor*, probably dated to the Achaemenid Period, provided another aspect of the historical importance of the Bolaghi Valley hitherto unknown.

## Staff, Period of Work and Main Activities of Each Season

**2005**

Period of Work: July 13 - August 10, 2005 (period of fieldwork: July 17 - August 4)

Iranian Staff: Director: Mohsen Zeidi, Other Participants: Mozaffar Zarrinkouh, Keyvan Isapour, Banafshe Mollazadeh

Japanese Staff: General Director: Kazutada Kataoka, Field Director: Akira Tsuneki, Other Participants: Kazuya Yamauchi, Shin'ichi Nishiyama, Katsuhiko Ohnuma, Ken-ichiro Hisada, Atsunori Hasegawa, Sanae Ito

Main Activities: Excavations at TB75 and TB130, Geological Surveys, Field Walking Surveys

**2006**

Period of Work: July 13 - August 9, 2006 (period of fieldwork: July 16 - August 3)

Iranian Staff: Director: Mohsen Zeidi, Other Participants: Roshanak Jahromi, Banafshe Mollazadeh, Majid Kouhi, Vahid Barani

Japanese Staff: General Director: Kazutada Kataoka, Field Director: Akira Tsuneki, Other Participants: Setsuo Furusato, Katsuhiko Ohnuma, Ken-ichiro Hisada, Itsuro Tomita, Mark Diab, Takuro Adachi, Hotaka Ito

Main Activities: Excavations at TB75, Geological Surveys

**2007**

Period of Work: February 7 – March 5, 2007 (period of fieldwork: February 12 – 27)

Iranian Staff: Mohsen Zeidi

Japanese Staff: Kazuya Yamauchi, Shin'ichi Nishiyama

Main Activities: Field Walking Surveys

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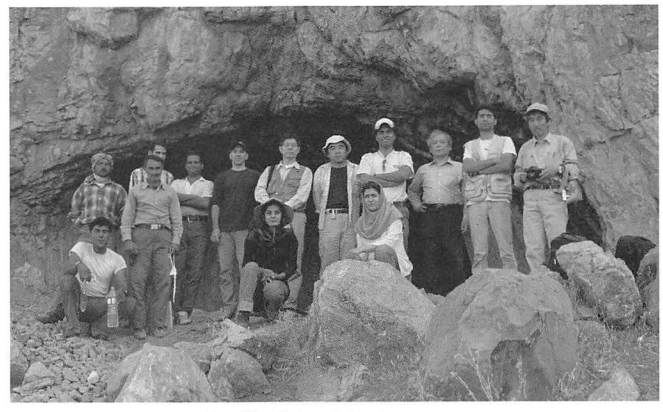
Staff of the 2005 season



Staff of the 2006 season

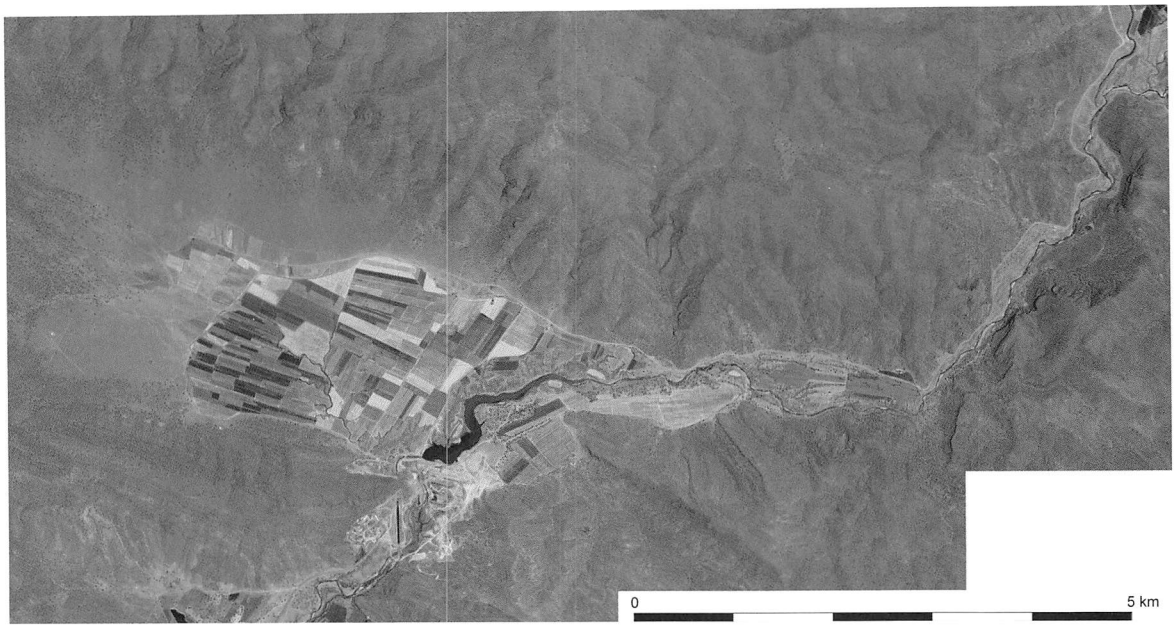



Plate 1.1 Satellite image of Tang-e Bolaghi.

Plate 1.2 The Sivand River flowing to the entrance of the Bolaghi Valley.

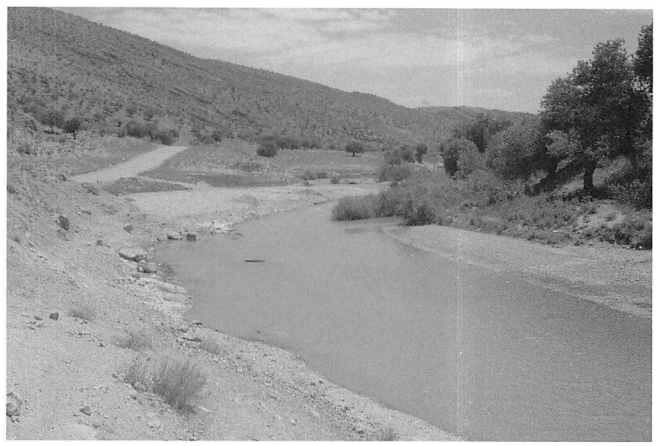


Plate 1.3 The northeastern narrow valley in Tang-e Bolaghi.

Plate 1.4 The central basin of the Bolaghi Valley.

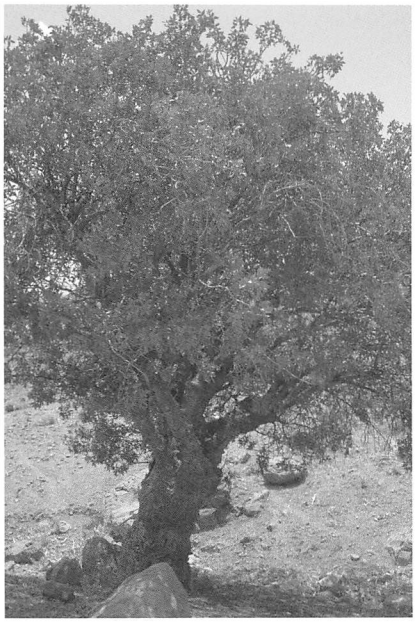


Plate 1.5 Wild pistachio tree near TB75.

Plate 1.6 Sap receptacles attached around the trunk of a pistachio tree.

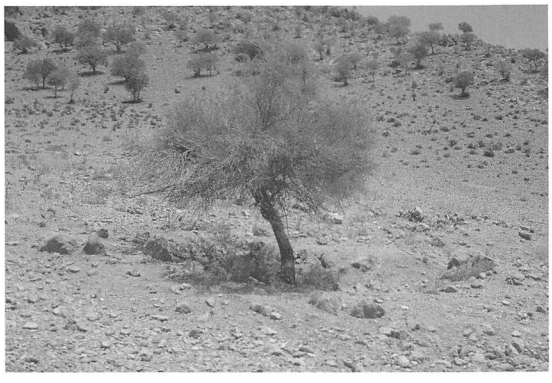


Plate 1.7 Wild almond tree near TB75.

Plate 1.8 Wild almond nuts.

Plate 1.9 TB107 (cairns).

Plate 1.10 TB107 (cairns).

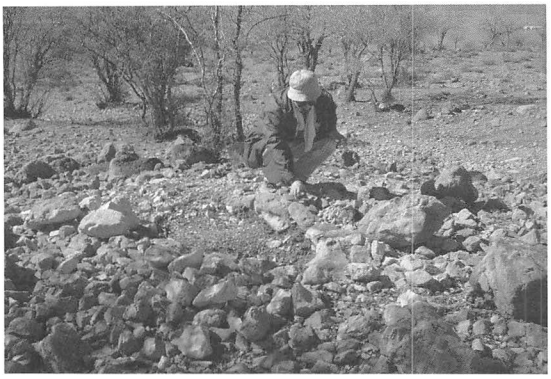


Plate 1.11 TB93/TB90 (cairns).

Plate 1.12 TB93/TB90 (collected potsherds).

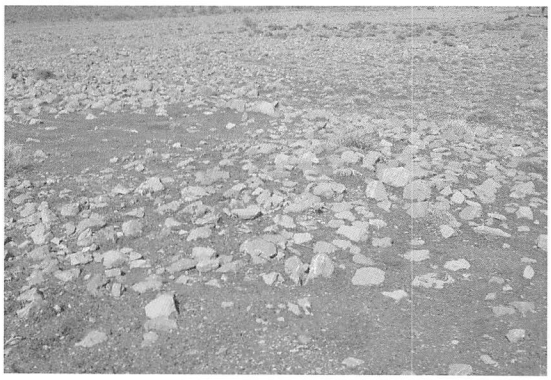


Plate 1.13 TB92 (building foundations).

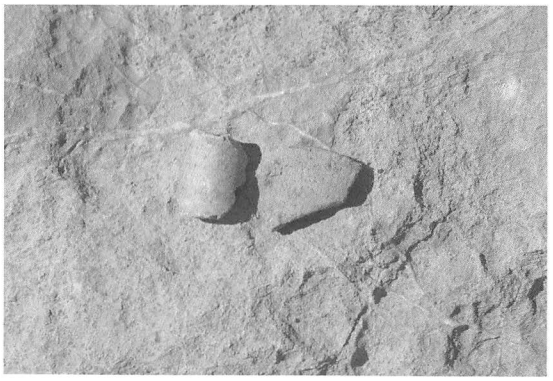


Plate 1.14 TB92 (collected potsherds).

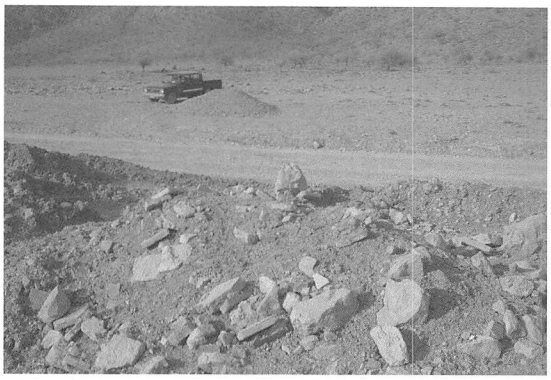


Plate 1.15 TB91 (scatter of Achaemenid bricks).

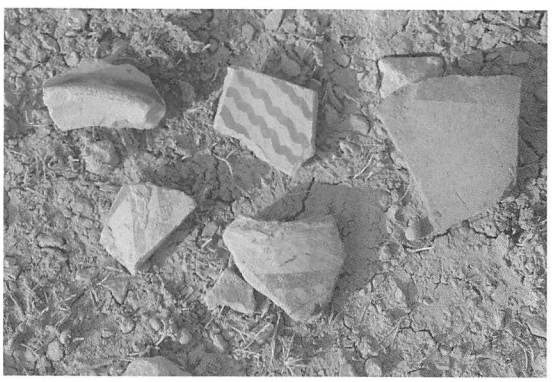


Plate 1.16 TB91 (Bakun A type potsherds).

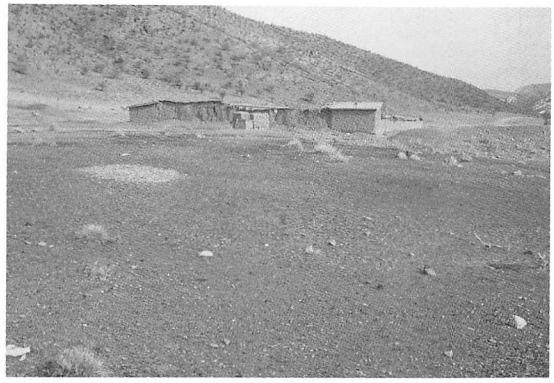


Plate 1.17 TB84 (low tappeh).

Plate 1.18 Iron slag scattered on TB84.

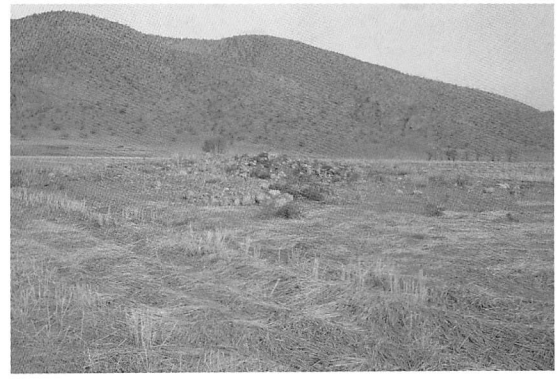


Plate 1.19 and Plate 1.20 Low tappeh near TB84.

Plate 1.21 General view of Tang-e Bolaghi.

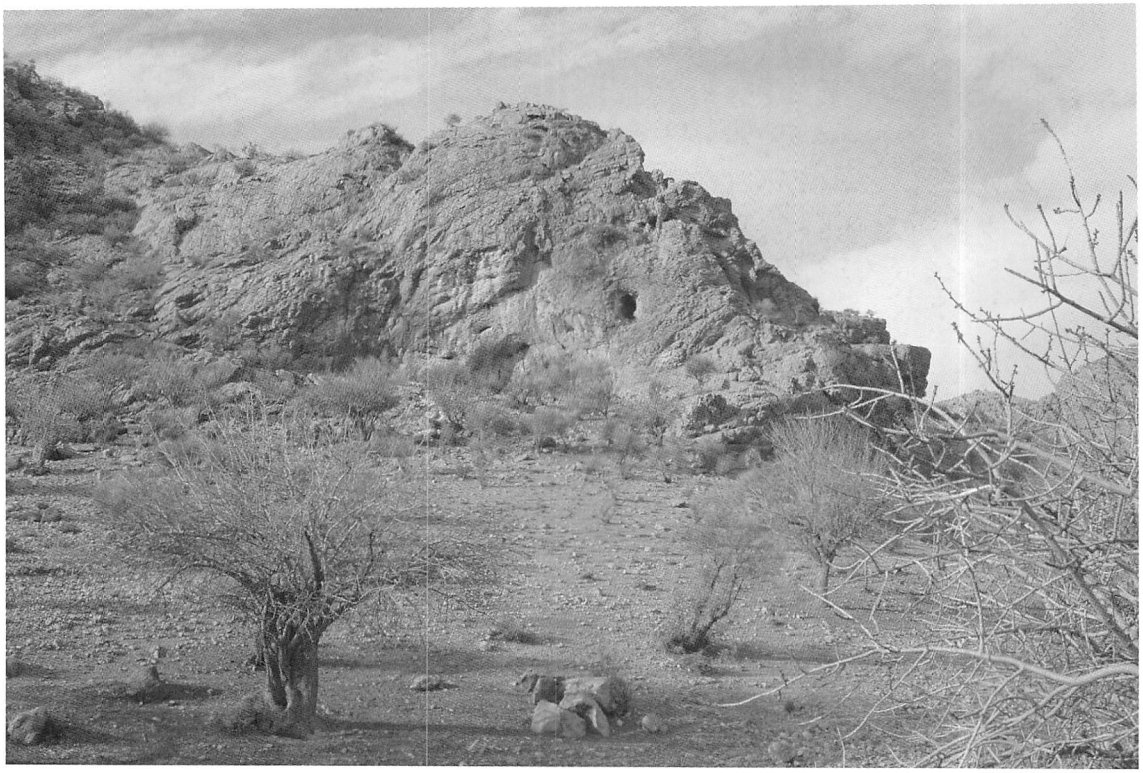


Plate 1.22 General view of a shelter TB130.

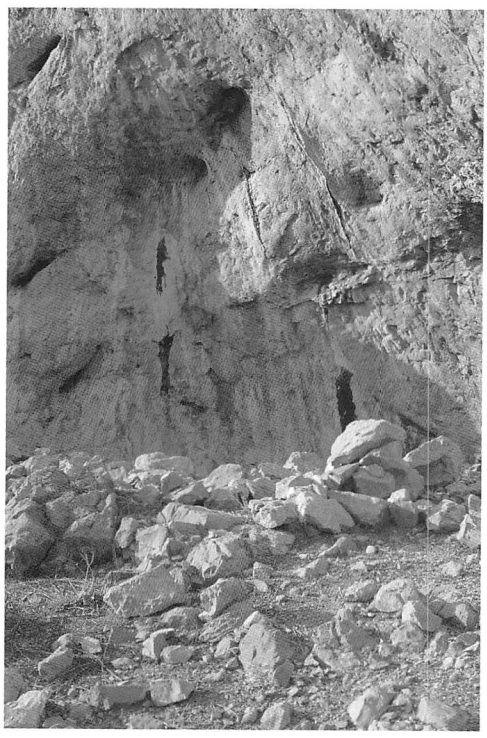


Plate 1.23 TB130 (shelter).

Plate 1.24 Lithic artifacts collected on the terrace of TB130.

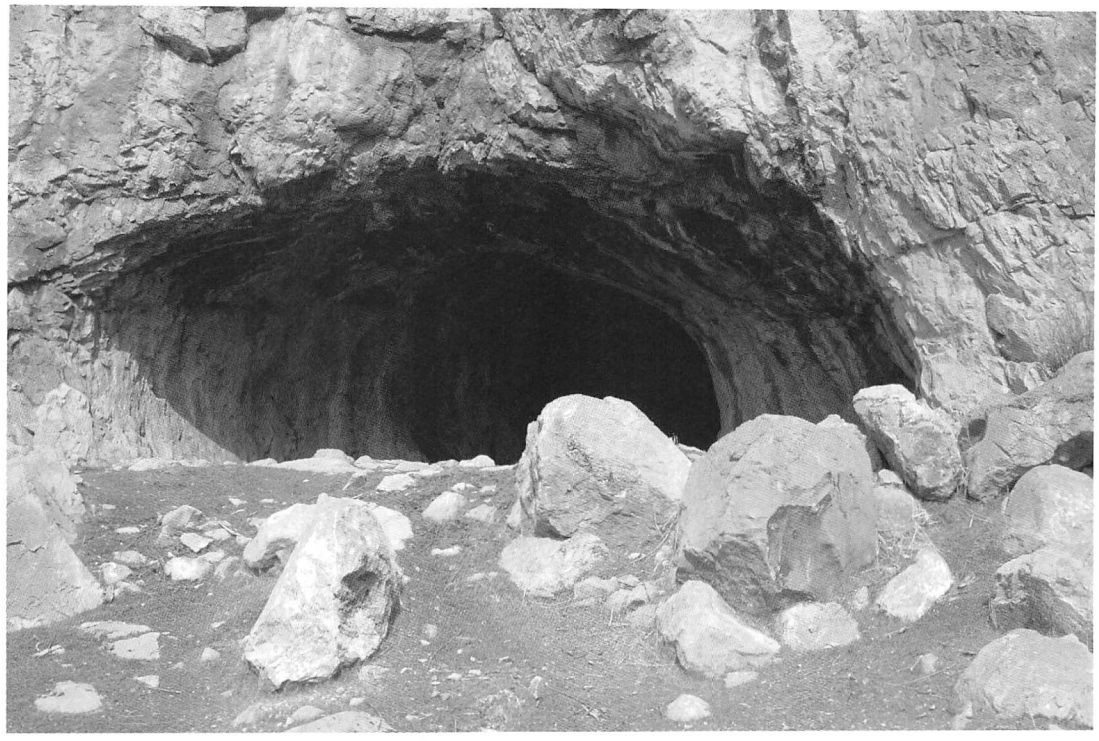


Plate 1.25 TB75 (cave).

Plate 1.26 Terrace of TB75.

Plate 1.27 Collected potsherds on the terrace of TB75.

Plate 1.28 Distant view of TB75.

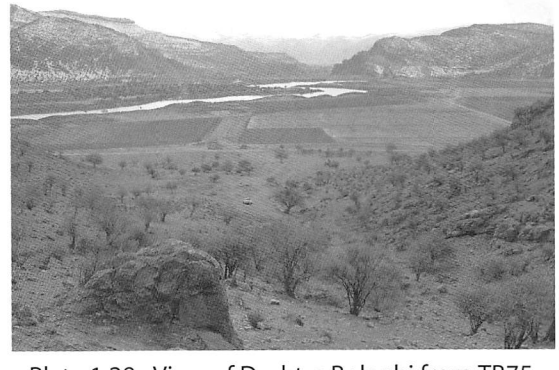
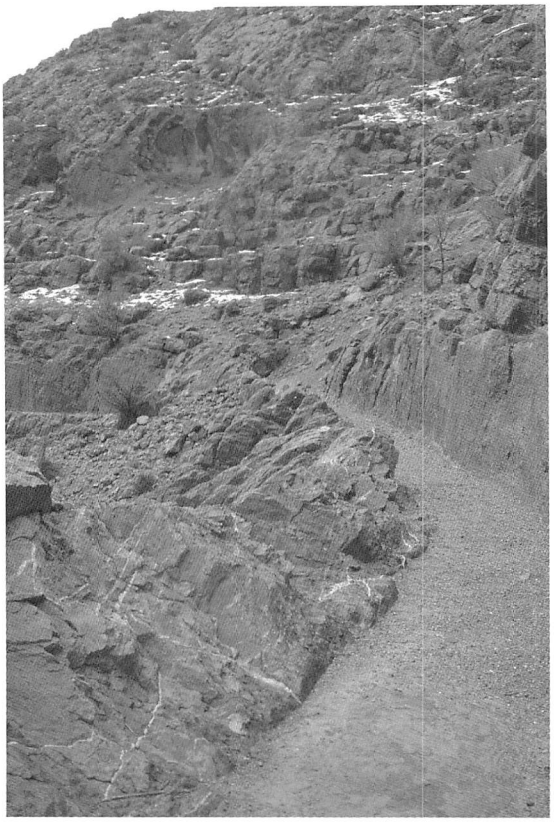


Plate 1.29 View of Dasht-e Bolaghi from TB75.



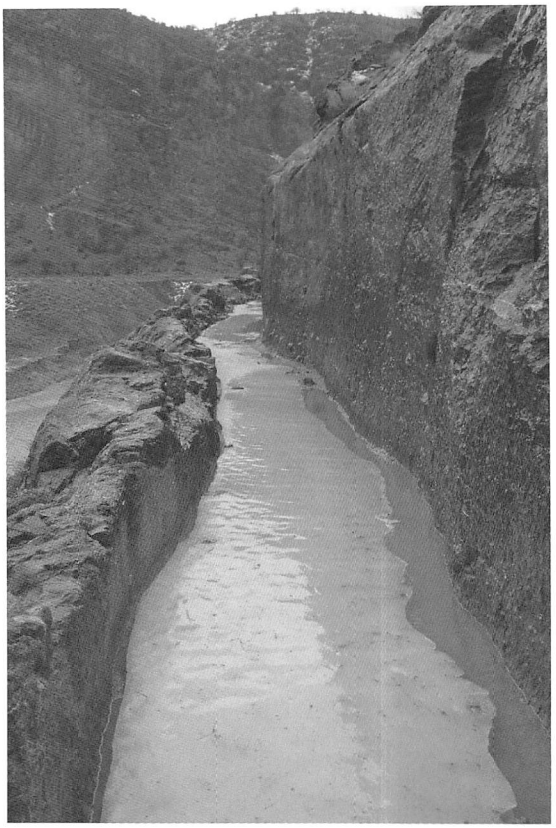


Plate 1.30 and Plate 1.31 The *Dokhtar Bor* in Tang-e Bolaghi.

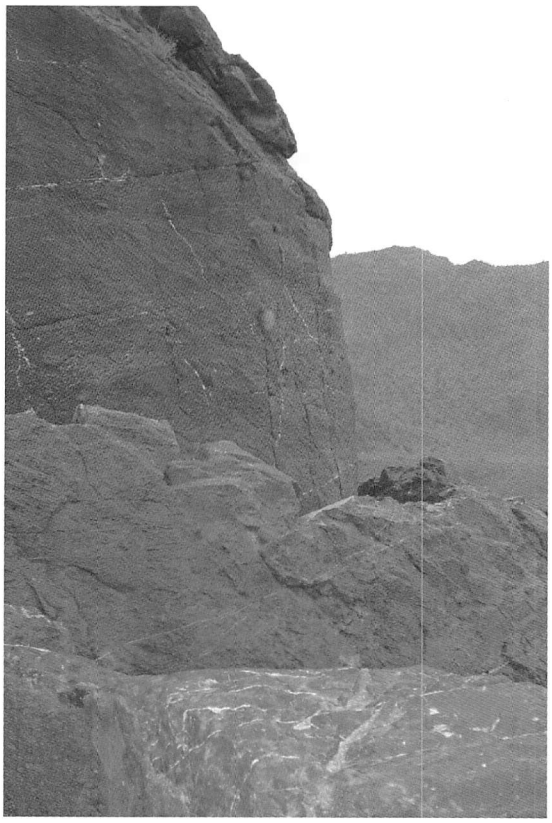


Plate 1.32 Rock cut of the *Dokhtar Bor*.

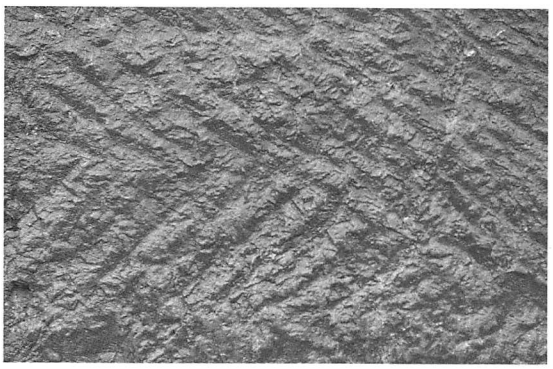


Plate 1.33 Traces of cutting chisel.

# CHAPTER 2

## GEOLOGY OF THE BOLAGHI AREA

# 2. GEOLOGY OF THE BOLAGHI AREA

Ken-ichiro HISADA, Hotaka ITO and Ayako KUNII

## Introduction

We examined the stratigraphy of limestone in the Bolaghi Valley and Basin (= Bolaghi area) in 2006 and 2007. The Bolaghi area belongs geographically to the Zagros Mountains which are located in the middle between the Alps and the Himalayas. This geological situation indicates the possibility that this study can provide important data about Cenozoic orogenic belts such as the Alps and the Himalayas. In this report, we present the summary of tectonic significance and the stratigraphy of the Bolaghi area.

## Tectonic Setting of the Zagros Mountains

The geology of the Bolaghi area can not be discussed without consideration of the Zagros Suture. Sutures mark zones along which oceanic lithosphere has been totally subducted (Dewey, 1987). He wrote about Suture in the following manner; *the simplest kind of orogenic suture is a high-strain zone, containing mangled ophiolite remnants and, occasionally, blueschist mélanges, that separates two continental terrains with dissimilar precollisional strain histories (Indus Suture-Zagros Crush Zone). The irregularity of colliding continental margins is shown in the Alpine System by sutures passing laterally into remnant oceanic tracts (Zagros Crush Zone-Eastern Mediterranean) and into subduction zones consuming large oceanic tracts (Indus Suture-Andaman Subduction Zone).*

The Bolaghi area is included in the Alpine System and is represented by the Zagros Suture. The Zagros Suture can be regarded as one of the most significant sutures in the world. The geological significance of the Zagros Suture has been intensively examined for last forty years. Before considering the recent interpretation (Dewey, 1987) about the Zagros Suture, there seem to be two representative works; Stöcklin (1968), and Sengör (1984, 1985). The Iranian-Japanese Research Group (1981) also studied the area adjacent to the Zagros

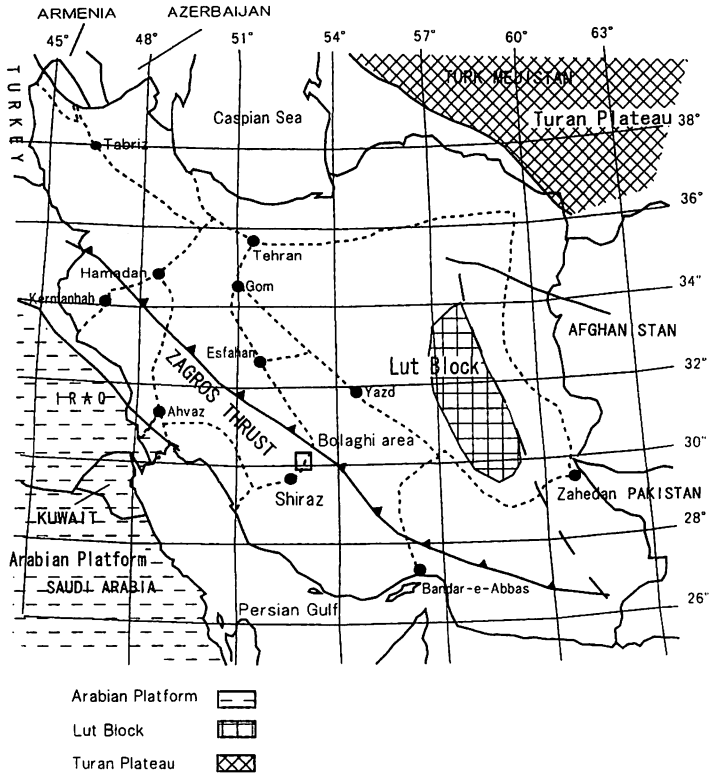



Fig.2.1 Geologic outline of Iran.

Suture and envisaged the horsts and grabens structure has been developed since the Infracambrian time. The development of this structure is caused by the movement of the Zagros thrust (Fig.2.1).

1) Stöcklin (1968)

*The main Zagros thrust has a remarkably straight alignment and is considered to be a surface expression of deep slip in the formerly coherent Arabian-Iranian platform.* (omission) *Just northeast of the thrust line an extensive metamorphic complex is exposed, part of which is Precambrian. Similar Precambrian basement rocks reappear farther northeast in Central and North Iran. The main Zagros thrust is thus a deep reverse fault, splitting a once-coherent platform into an Arabian and an Iranian fraction.*

2) Sengör (1984, 1985)

*The Alpides are the products of the convergence and final collision with Eurasia of independent pieces of the dispersed Gondwana-Land, such as Afro-Arabia and India. Likewise, the Cimmerides seem to have been generated by the collision, with Eurasia also, of two groups of continental objects.* (omission) *This Cimmerian Continent (Sengör, 1979) further disintegrated as it moved across the Tethyan domain - but without disrupting its east-west continuity.*

In summary, the Zagros Suture is defined as a zone including ophiolite remnants (Neo-Tethys ocean crust) and is a product of the final collision between the Gondwana-Land derived Cimmerian continent (i.e. Lut Block) and the Afro-Arabia (i.e. Arabian Platform) (Fig.2.1). The Zagros thrust can be regarded as the compressional expression of the northeast edge of the Zagros Suture on the ground (Fig.2.1).

## Stratigraphy of the Bolaghi Area

According to the geological map of Iran shown by Stöcklin (1968), the probable Cretaceous is distributed in the Bolaghi area (Fig.2.2). The Bolaghi area is topographically divided into eastern and western parts; Tang-e Bolaghi (Bolaghi Valley) and Dasht-e Bolaghi (Bolaghi Basin). The Sivand River flows into the Dasht-e Morghab (Morghab Plain) and joins some wadis before it enters into the Bolaghi Valley. The Bolaghi Valley directs southwesterly and then turns westward. Finally the Sivand River turns southward. The Bolaghi Basin spreads on the western side of the Sivand River. From a geological point of view, it is appropriate to divide the Bolaghi area into the Bolaghi Basin and the Bolaghi Valley.

Limestone extensively underlies the Bolaghi area (Fig.2.2). The limestone generally consists of dark gray micrite (06073103) (Pl.2.1-5, 6), and sometimes yields fossils such as pelecypod, coral and so on. In this report, we adopted the following words, massive and bedded to discriminate limestone. Bedded limestone consists of limestone beds and thin intercalated muddy parts (Pl.2.1-1, 2, 3). Discrimination of bedded limestone is dependent on the thickness ratio of an limestone bed and muddy limestone intercalation or calcareous mudstone (= marl) bed. Massive limestone sometimes forms nearly vertical cliffs as is the case in the Bolaghi Valley (Pl.2.1-4). Massive limestone often changes into bedded limestone, which often presents a slumped folded appearance.

The following presents the stratigraphy in the Bolaghi area in descending order. This sequence is typically seen along the Bolaghi Valley (Fig.2.2).

| | |
|---|---|
| Bedded limestone 6 | >50 m |
| Massive limestone 3 | 20 m |
| Bedded limestone 5 | 100 m |
| Bedded limestone 4 | 30 m |
| Bedded limestone 3 | 20 m |
| Massive limestone 2 | 120 m |
| Bedded limestone 2 | 100 m |
| Massive limestone 1 | 80 m |
| Bedded limestone 1 | >100 m |

## Injection Structure of Limestone

A large-scale injection structure was observed along the wadi where TB75 is located at its entrance. The injection structure is confirmed as a mound shape, 30 m high and 30 m long (Pl.2.1-7, 8). The bedded limestone gently dips downstream with a nearly same angle as the wadi gradient. The injected part is in step-like contact with the surrounding bedded limestone, and is characterized by a lens-shape fracture. The size of a lens ranges from 10 cm to 50 cm, whose longest axis is oriented in the same direction. The arrangement of the longest axis is nearly parallel to the contact surface of the wall rock of the bedded limestone.

According to the description of the Glossary of Geology (Bates and Jackson, 1980), the injection is a phenomenon that *the forcing, under abnormal pressure, of sedimentary material (downward, upward, or laterally) into preexisting deposit or rock, either along some plane of weakness or into crack or fissure.* The injection is closely related to the fluidization under which abnormal pressure is caused by earthquake and other trigger. As mentioned before, the bedded limestone is dated as probable Cretaceous, and the injection probably occurred in the Cretaceous and immediately later. It is inferred that the tectonic

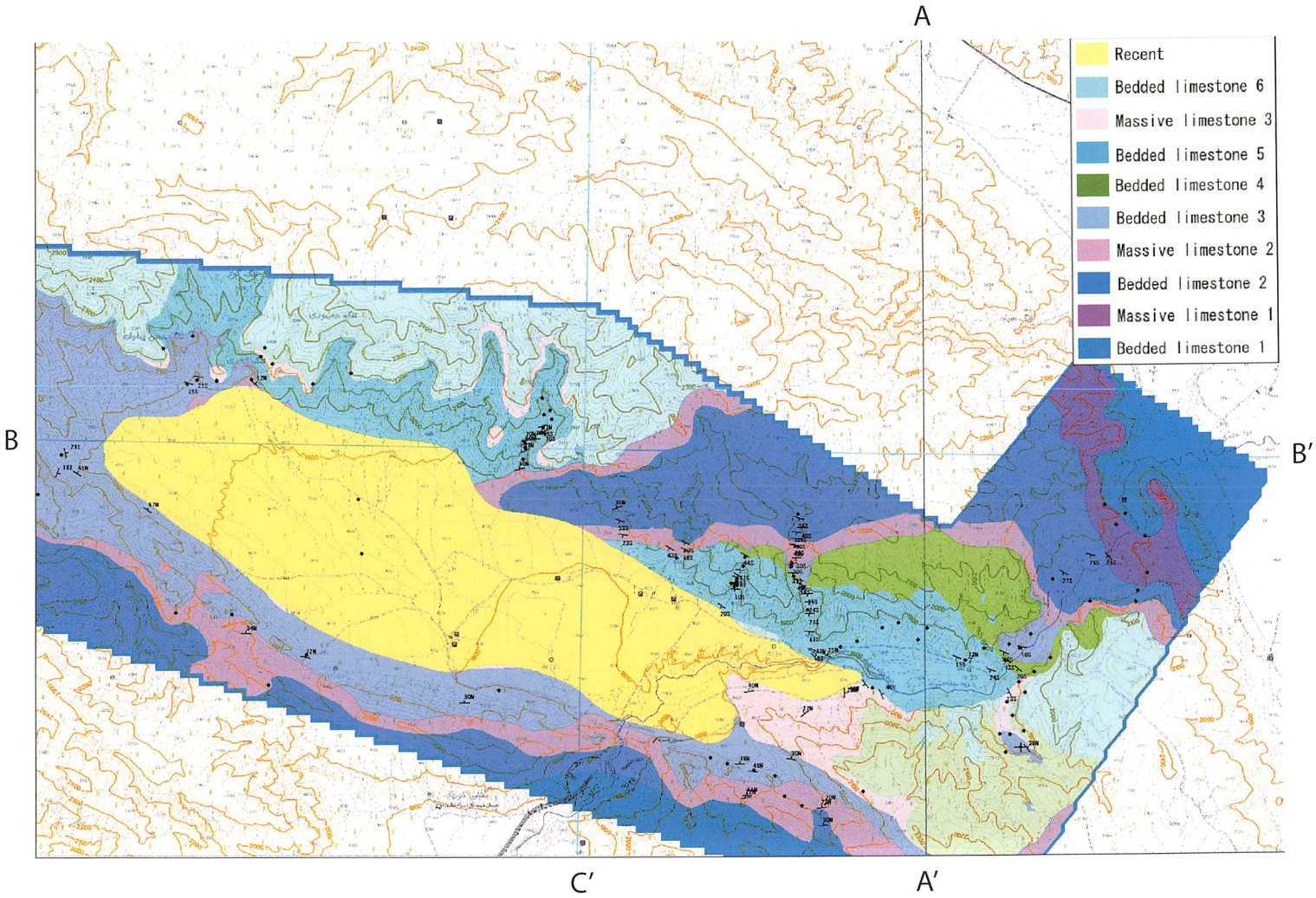



Fig.2.2 Geologic map of the Bolaghi area.
A-A′ is 53°07′30″ E and B-B′ is 30°10′34″ N. The distance of A′–C′ is 4.7km.
Two topographic maps (1/25,000, joint line; A-A′) are used; BALAQI KUCAK (west) and MADAR SOLEYMAN (east).

movement is of the pre-stage Alpine orogen (Stöcklin, 1968).

## Comparison of Chemical Composition

The chemical composition of massive, injected and alternated parts collected in the Bolaghi Basin were analyzed by fluorescent X-ray (Table 2.1). The massive part (06080110) is accompanied by siliceous nodules. The bedded part consists of two kinds; argillaceous (06073103 and 06072901) and non-argillaceous beds (06072902 and 06072903). The injected part (06073102) was collected from the lens-shape one. The injected part is characterized by relatively rich in $SiO_2$, $Al_2O_3$, $Fe_2O_3$ and $K_2O$, and poor in CaO, compared to the massive and bedded parts. The injected is opposite to the massive in terms of these chemical compositions. The original materials of $SiO_2$, $Al_2O_3$, $Fe_2O_3$ and $K_2O$ remain an unsolved problem, but it is likely that they were clay minerals. The injected part limestone is distinctive from the others. Thus, the abundance order of inferred clay minerals is the injected, bedded and massive.

## Geological Structure and its Relationship to Topography

The geological structure in the Bolaghi area is represented by an elongated basin feature. The long axis trends from WNW to ESE (Figs.2.2, 2.3). The eastern and western edges of the basin are characterized by a gentle dip, 13°W and 18°E, respectively. The main syncline axis is traceable in the median part of the Bolaghi area. Though the geological structure on the southern side of the Tang-e Bolaghi and Dasht-e Bolaghi is relatively similar to each other, the geological structure in the north is different between them. The beds to the north of the Bolaghi Valley dip moderately to the south but those of the Bolaghi Basin dip more gently. This dip difference is supposed to be the result in the topographical difference between the Bolaghi Basin and the Bolaghi Valley. That is, the wider open syncline may have formed the Bolaghi Basin. In this report, we name folded structure in the Bolaghi area

Table 2.1 Chemical composition of limestone.

| | specimen | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|
| | | massive | injected | bedded | | | |
| | | | | argillaceous | | non-argillaceous | |
| | | 06080110 | 06073102 | 06073103 | 06072901 | 06072902 | 06072903 |
| chemical composition (%) | $SiO_2$ | 0.37 | 2.21 | 0.95 | 0.98 | 1.16 | 1.56 |
| | $TiO_2$ | 0.01 | 0.04 | 0.02 | 0.02 | 0.02 | 0.02 |
| | $Al_2O_3$ | 0.10 | 0.86 | 0.42 | 0.41 | 0.54 | 0.59 |
| | $Fe_2O_3$ | 0.17 | 0.34 | 0.18 | 0.16 | 0.18 | 0.17 |
| | MnO | 0.03 | 0.01 | 0.08 | 0.01 | 0.01 | 0.01 |
| | MgO | 0.53 | 0.41 | 0.53 | 0.60 | 0.66 | 0.62 |
| | CaO | 54.93 | 53.26 | 54.15 | 54.04 | 53.84 | 53.46 |
| | $Na_2O$ | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 |
| | $K_2O$ | 0.02 | 0.18 | 0.07 | 0.09 | 0.11 | 0.13 |
| | $P_2O_5$ | 0.02 | 0.04 | 0.01 | 0.02 | 0.02 | 0.03 |
| | $SO_3$ | 0.02 | 0.03 | 0.03 | 0.05 | 0.06 | 0.08 |
| | Cl | 0.003 | 0.004 | 0.005 | 0.006 | 0.006 | 0.005 |
| | ig. loss | 43.65 | 42.40 | 43.31 | 43.39 | 43.20 | 43.06 |
| ppm | Cr | 5 | 15 | 5 | 11 | 8 | 9 |
| | Pb | 7 | 11 | 8 | 11 | 5 | 8 |

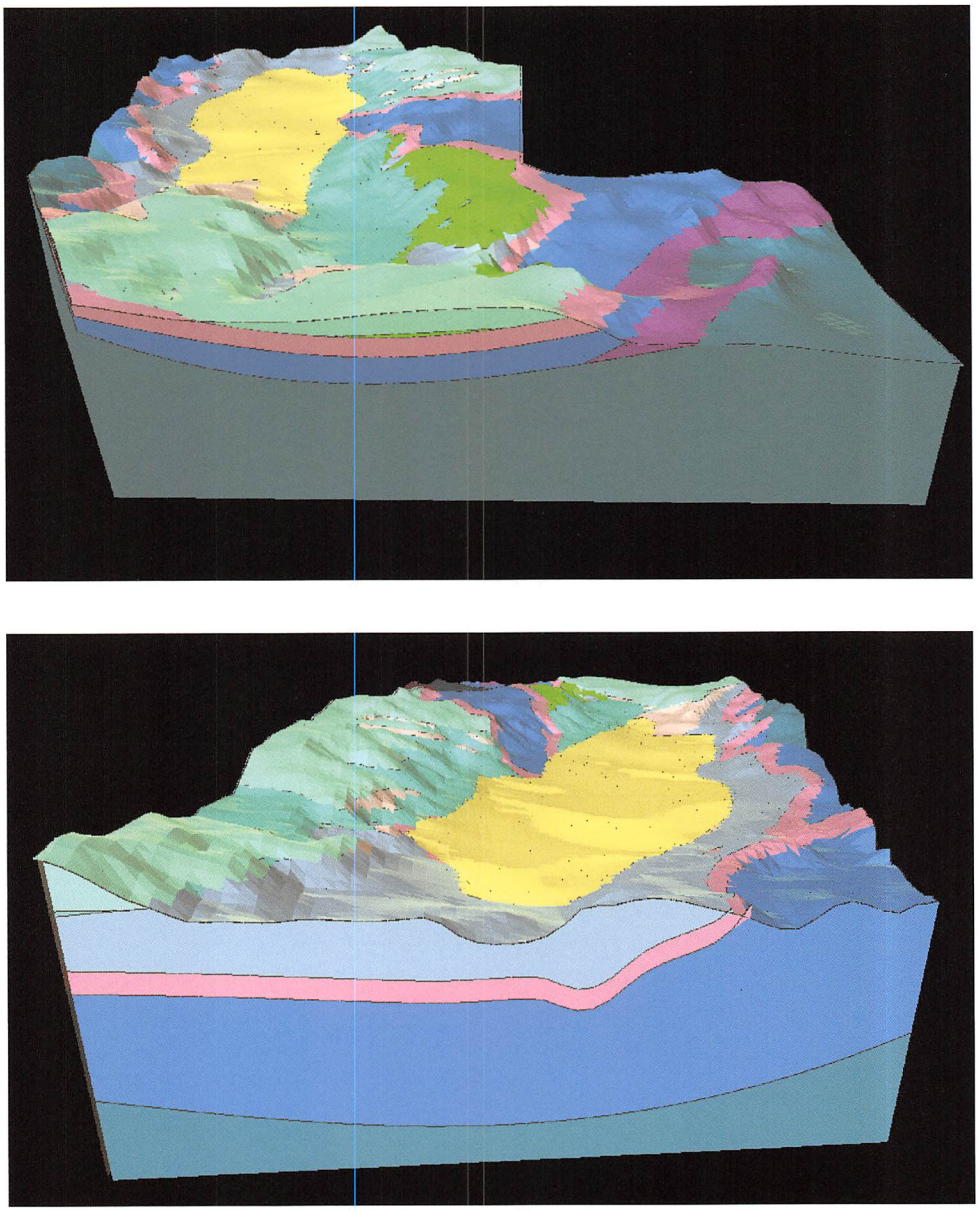


Fig.2.3 Block diagram of the Bolaghi area.
Upper and lower are a view from east and west, respectively.

the Bolaghi syncline.

We can observe the folded structure parallel to the Zagros thrust running from NW to SE in the Zagros thrust zone (Stöcklin, 1968). On the basis of satellite photographs, we can read the outline of the geologic structures (Fig.2.4). The folded structures are developed in the extensive area ranging from Pasargadae to Persepolis. The fold axis trends from NW to SE, and its wavelength ranges from a few kilometers to several kilometers. The anticline and syncline seem to correspond to the mountains/hills and the basin, respectively. Roughly speaking, the gentle dipping beds and the steep or overturned beds characterize folded structures on the southern and the northern sides, respectively. In the satellite photographs, we can distinguish "white strata" from the Mesozoic limestone. These strata were partly overturned in the southern wing of the syncline west of the Bolaghi Basin, though its detailed lithology is unidentified. The folded structure around Persepolis can be called the undulatory one rather than anticline, because the dipping direction is not constant in some places.

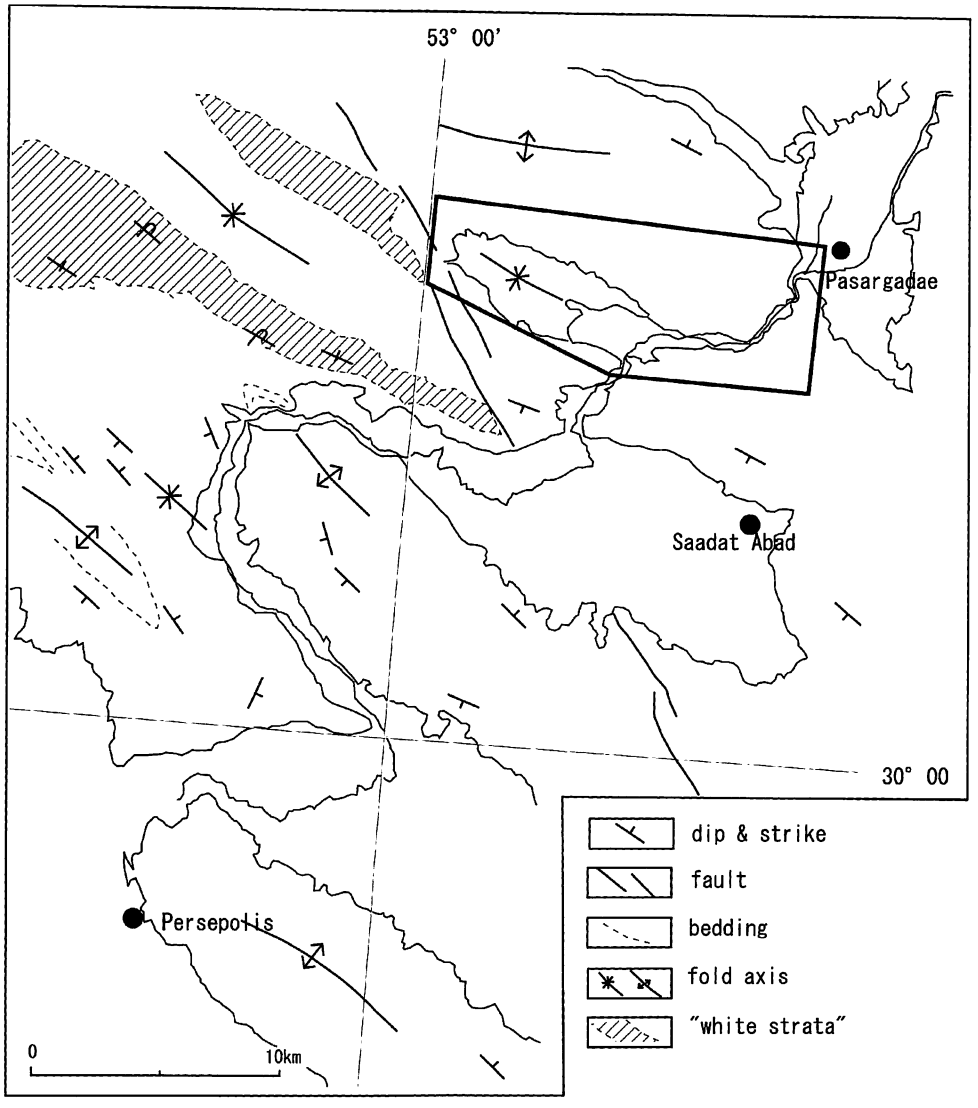



Fig.2.4 Geologic outline of the Pasargadae-Persepolis area.

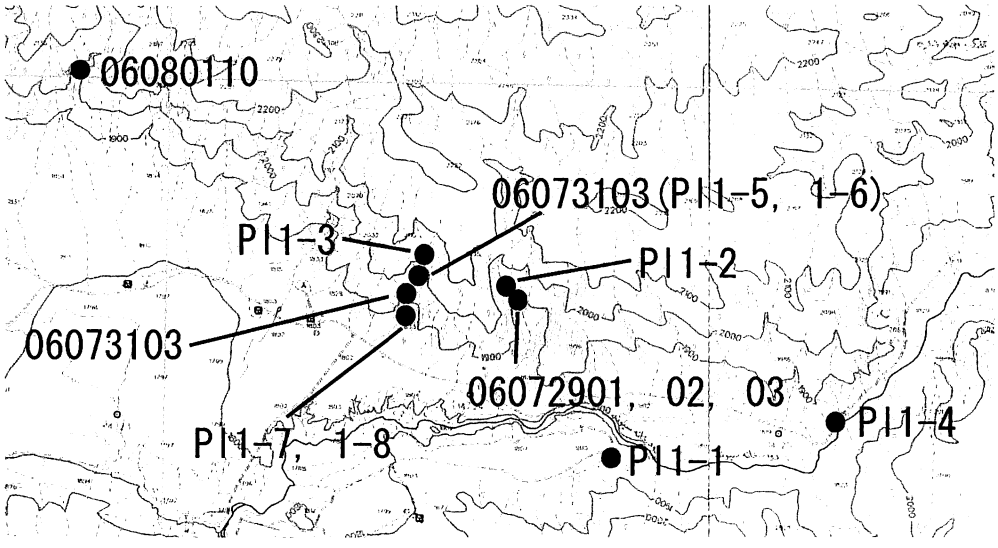



Fig.2.5 Location map of rock sampling points and photograph points.

## Concluding Remarks

Limestone from the probable Cretaceous is distributed in the Bolaghi area. The folded structure can be regarded as a product caused by tectonic movement of the pre-stage Alpine orogen. These tectonics may be due to collisional tectonics between the Gondwana-Land derived Cimmerian continent (i.e. Lut Block) and the Afro-Arabia (i.e. Arabian Platform).

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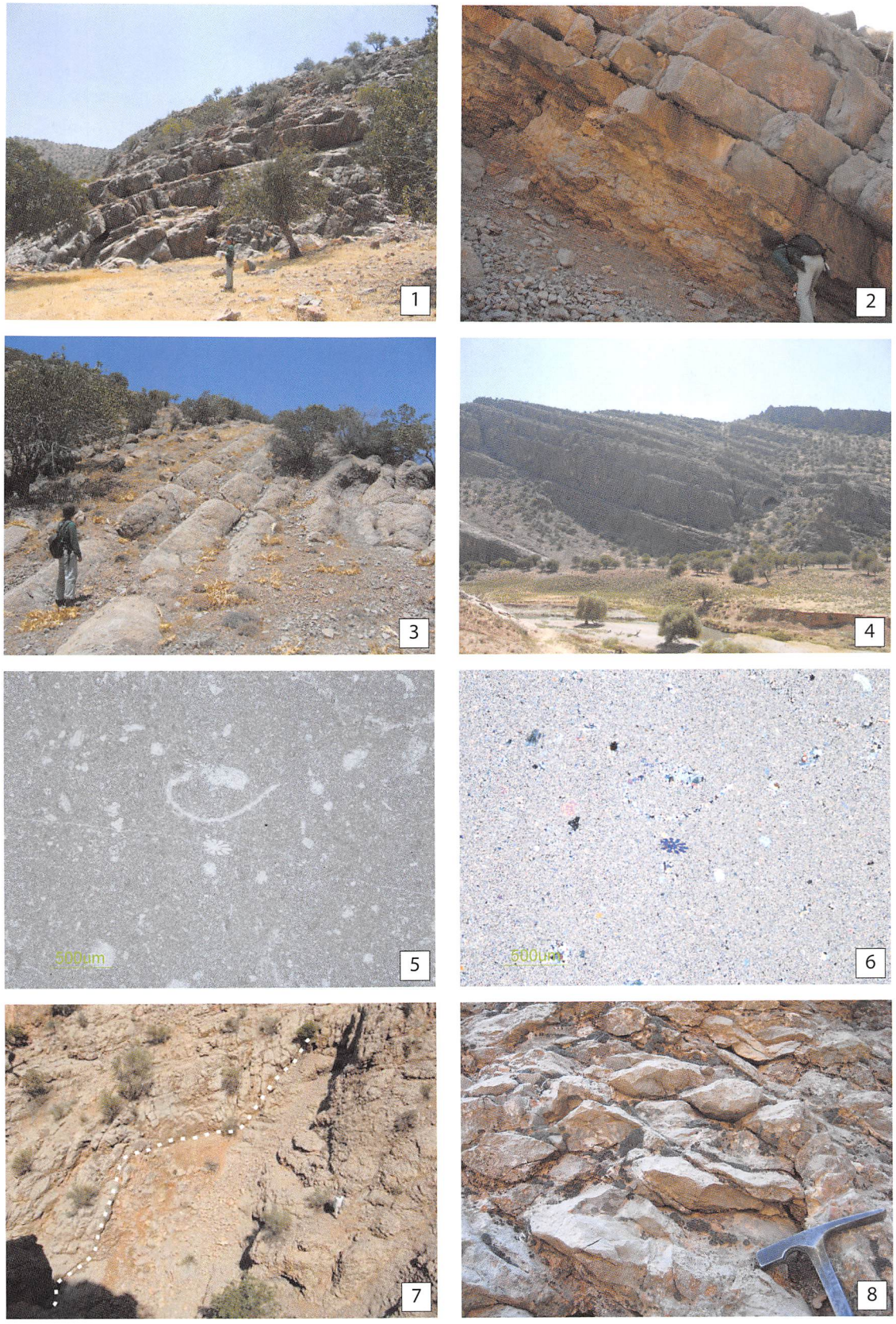


Plate.2.1

1, 2 & 3; Bedded limestone (photograph points are shown in Fig.2.5)
4; Massive limestone. Note limestone caves at upper left and right center. 5 & 6; Photomicrographs of dark gray micrite (06073103) 7 & 8; Injection structure. The scales are standing people at center right for 7 and hammer head for 8. Note that the white dotted line is a contact between injected and bedded limestones and that the lens shape fracture system is developed in the injected limestone.

# CHAPTER 3

## GEOLOGICAL PROSPECT FOR SOURCE ROCKS OF PREHISTORIC RAW MATERIALS IN THE BOLAGHI AND ARSANJAN AREAS

# 3. GEOLOGICAL PROSPECT FOR SOURCE ROCKS OF PREHISTORIC RAW MATERIALS IN THE BOLAGHI AND ARSANJAN AREAS

Ken-ichiro HISADA, Hotaka ITO and Yoshihito KAMATA

## Introduction

Flint, shale, chert, agate, obsidian and others had been used as raw material for artifacts (Ohnuma, 2002). Among these rocks and minerals, flint can be a problematic term. The well-known textbook, "Sedimentary Rocks" (Pettijohn, 1975) pointed out as cited below; *Chert and flint are the most common chemical siliceous sediments. Much current confusion concerns the origin of these terms, their exact meaning, and the differences, if any, between them.* (omission) *Flint (Feuerstein) is a term widely used both as a synonym for chert and as a variety of chert. Tarr (1938) states that it is identical with chert, and the term, therefore, should be dropped or reserved for artifacts to which it is most often applied. Although the term antedates the term chert, usage favors the latter as the proper designation of the materials to which both the terms have been applied.*

In this report, we follow Tarr's suggestion, and we don't apply flint as rock nomenclature. Thus, the usage of flint is reserved for artifacts. This confusion derived from the usage of chert and flint seems to be caused by its monotonous composition and texture. Flint is defined as the rock material used for artifacts herein, and flint corresponds to the siliceous rocks which has enough silica content to be used for artifacts, though it has a variety of origins. Pettijohn (1975) described three main categories as the origin of nonclastic sediments; primary precipitates, secondary or diagenetic segregations and metasomatites, and certain organic accumulation for chert. These categories are succeeded to the recent classification of chert. The origin of chert is classified into three major categories based on field observation (Blatt, 1992); 1. as nodules and silt-size grains in cratonic carbonate rocks, 2. as pure, bedded chert adjacent to tectonically active plate margins, and 3. in association with hypersaline lacustrine deposits. In summary, bedded radiolarian chert and siliceous nodule, instead of chert, are appropriate descriptive terms.

We tried to examine source rocks of Proto-Neolithic raw materials which can probably utilized for artifacts from exposed rocks on the ground and from river floor pebbles in the

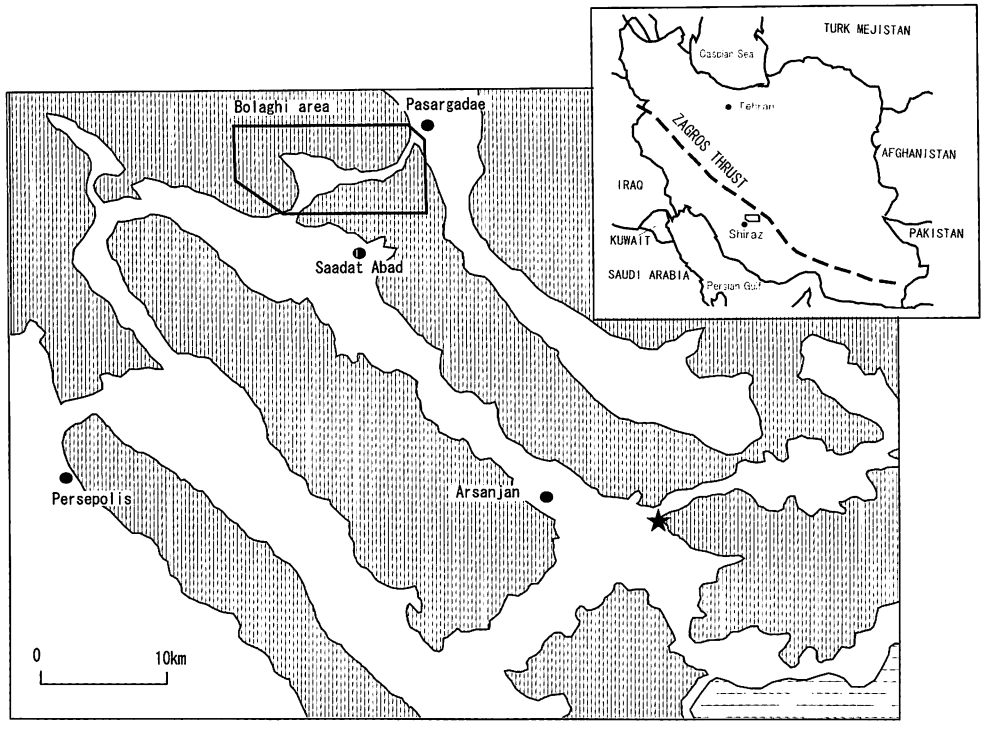


Fig.3.1 Location map of the Bolaghi area and Arsanjan. Star marks A5-3 (Qar-e Tang Sikan) (Ikeda et al. 1979)

Bolaghi Valley and Basin (= Bolaghi area) (Figs.3.1, 3.2). The former is siliceous nodule in bedded limestone, and the latter is radiolarian chert and jasper. Furthermore, we dealt with a dark red siliceous shale float collected from Locality A5-3 (Qar-e Tang Sikan) (Ikeda et al. 1979) which indicated constraints on the source rock available to be used for artifacts (Figs.3.1, 3.2).

## Candidate Rocks for Artifacts

### 1) Siliceous nodule in limestone

We found a stratigraphic sequence yielding abundant siliceous nodules. This horizon is included in bedded limestone 5, and ranges about 100 m thick (Fig.2.2 of Hisada et al. in this volume). The occurrence of siliceous nodules is well observed around the Bolaghi Basin . Three types of siliceous nodule occur there; layer type (=L type) (Pl.3.1-1), isolated irregular shape type (=IIS type) (Pl.3.1-2), and bed type (=B type) (Pl.3.1-3).

The L type is slightly oblique to the bedding plane of limestone in general. The L type ends abruptly and continues laterally for a few meters. Its thickness is usually less than 10 cm. The size of the IIS type is less than 30 cm. In rare cases, an almost spheroid shape is observed. The B type can be recognized as a rare case of L type. The B type occurs parallel to the bedding plane of limestone and its thickness is about 6 cm. According to our observation along the wadi eastward next to Darreh Rizeh (shown in the 1/25,000 topographic map BALAQIKUCAK), there is a certain tendency that the L type appears in the lower horizon of the siliceous nodule sequence, whereas the B type occurs in the upper horizon. IIS type is dominant in the lower to middle horizon. The B type siliceous nodule presents black color, "laminated", while the L type and the IIS type are gray. As a whole, a more silicified predominates the upsection. Thus, the B type siliceous nodule (Pl.3.1-3;

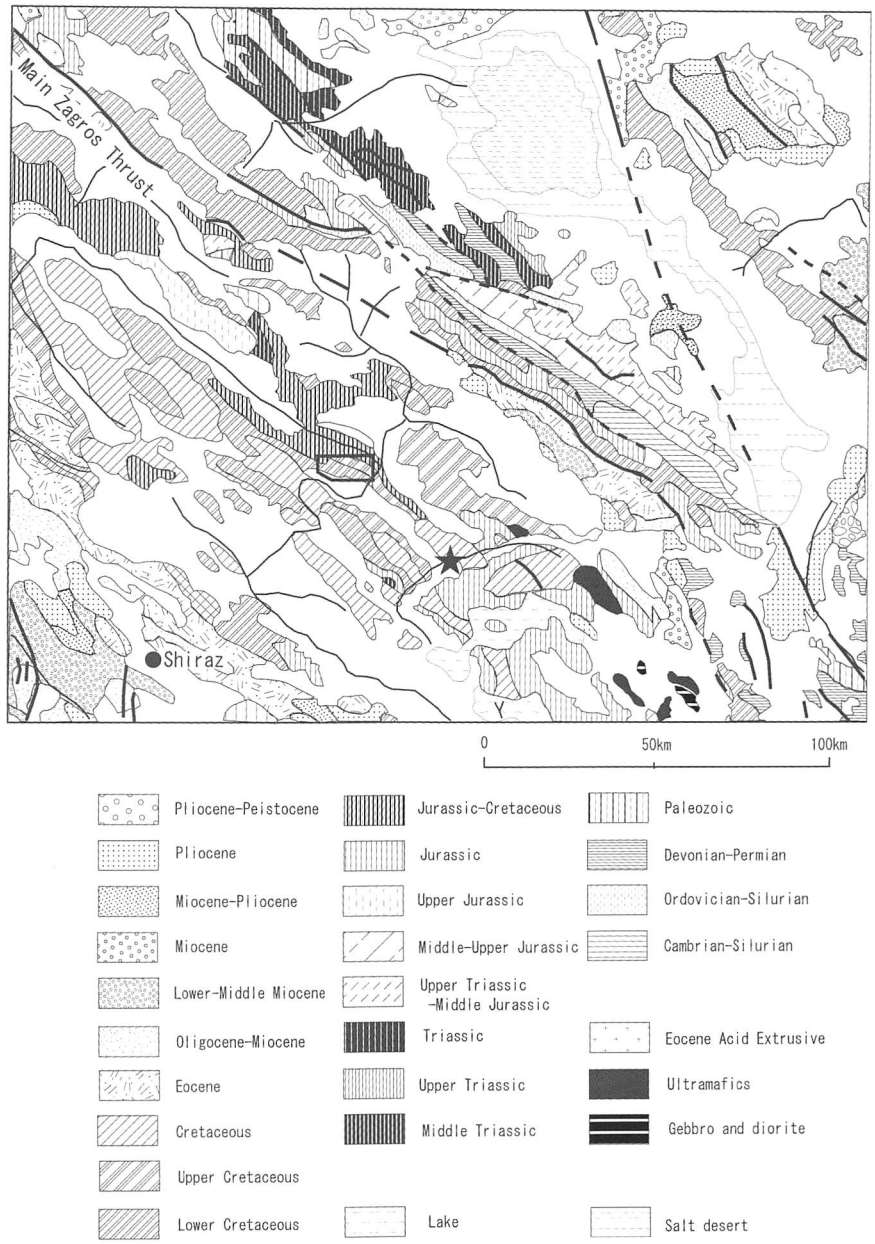


Fig.3.2 Geological map of the Shiraz district. (modified from the Geological Survey of Iran, 1986) Main Zagros Thust, Bolaghi area and Loc. A5-3 are indicated.

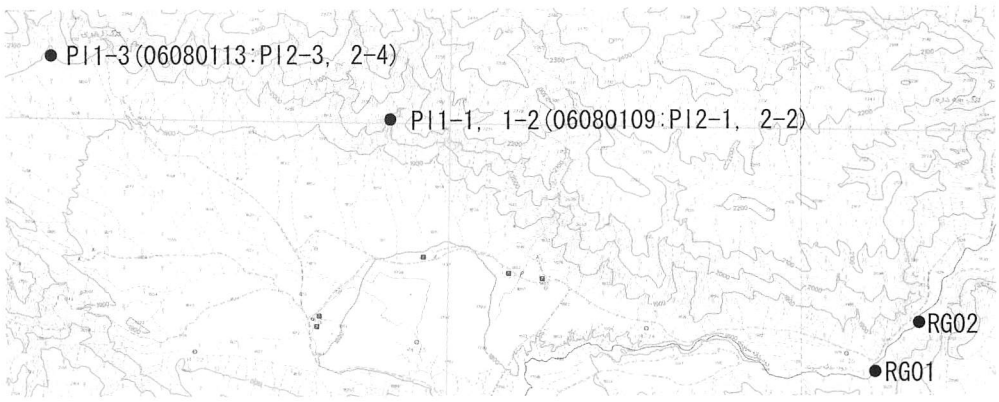


Fig.3.3 Location map of rock and river gravel sampling points. RG01, RG02; River gravel sampling points, GR03; outside this map.

Table 3.1 Chemical analysis of chert and siliceous nodules.

| Constituent | A | B 06080113 | C 06080109 | D RG02Yellow | E RG02Red |
|---|---|---|---|---|---|
| $SiO_2$ | 93.54 | 92.79 | 90.34 | 92.43 | 95.03 |
| $TiO_2$ | - | 0.01 | 0.01 | 0.00 | 0.06 |
| $Al_2O_3$ | 2.26 | 0.29 | 0.28 | 0.19 | 1.39 |
| $Fe_2O_3$ | 0.48 | 0.11 | 0.14 | 5.14 | 0.92 |
| Feo | - | - | - | - | - |
| MnO | 0.79 | 0.00 | 0.01 | 0.11 | 0.00 |
| MgO | 0.23 | 0.00 | 0.01 | 0.14 | 0.09 |
| CaO | 0.66 | 3.30 | 4.83 | 0.14 | 0.20 |
| $Na_2O$ | 0.37 | 0.00 | 0.00 | 0.00 | 0.14 |
| $K_2O$ | 0.51 | 0.04 | 0.01 | 0.00 | 0.29 |
| $H_2O+$ | 0.72 | - | - | - | - |
| $H_2O-$ | 0.21 | - | - | - | - |
| $P_2O_5$ | - | 0.03 | 0.01 | 0.01 | 0.02 |
| $CO_2$ | - | - | - | - | - |
| $SO_3$ | - | 0.05 | 0.00 | 0.00 | 0.00 |
| Cl | - | 0.012 | 0.013 | 0.000 | 0.000 |
| C | - | - | - | - | - |
| ig. loss | | 3.36 | 4.35 | 1.62 | 1.84 |
| Total | 99.86 | 99.992 | 100.003 | 99.78 | 99.98 |

A; Franciscan chert (from Pettijohn, 1975)
B & C; siliceous nodules
D & E; river gravels at RG02 (analyzed by Taiheiyo Consultant)

0608113 in Table 3.1) may be misunderstood as a chert bed. On the other hand, the siliceous nodule of the L type (Pl.3.1-1) and the IIS type (Pl.3.1-2; 06080109 in Table 3.1) in the lower horizon is less silicified.

The IIS type is characterized by microcrystalline quartz with scattered authigenic dolomite crystals (= rhomb shape) (Pl.3.2-1, 3.2-2). The length of the longest axis ranges from 100 to 300 μm. The B type is composed mainly of microcrystalline quartz and is "superimposed" by a repetition of impurities and calcite layers (Pl.3.2-3, 3.2-4). Each layer is a few millimeters thick. According to the fluorescent X-ray analysis, the former is less than the latter in terms of $SiO_2$ (2.45%) though the other composition is relatively similar in each. In comparison with Franciscan chert (A in Table 3.1) which represents the Cordillera in USA, both siliceous nodules are somewhat lesser in $SiO_2$.

For the IIS type, a complex replacement process happened in the limestone beds. The strongly silicified limestone was subjected to dolomitization to form the scattered dolomitic rhomb. As shown by the X-ray analysis (C in Table 3.1), Mg content is almost neglected. Therefore, these dolomitic rhomb had probably been replaced by a $CaCO_3$ solution, and seems to be a calcite pseudomorph. This process can be categorized into dedolomitization which means that dolomite may be replaced by calcite, usually by action of oxidizing meteoric waters (Adams et al., 1984).

For the B type, segregation seems to have happened to the limestone beds during the diagenetic stage. We need to study this further.

We found these siliceous nodules, but according to Ohnuma (2006, pers. comm.), the quality of these siliceous nodules is inadequate for making artifacts because of a lack of physical properties.

### 2) River gravel

We collected river gravel to obtain the prehistoric raw material. We preliminarily

counted the number mainly of yellowish, reddish, and brick color gravels at the three localities on the river bed of the Sivand River (RG01, 02 and 03 in Fig.3.3). RG01 and RG02 are located within the Bolaghi Valley (Tang-e Bolaghi) and RG03 is situated about 3 km upstream from the mouth of the Bolaghi Valley near Kordshoul village. The gravels at the former two sites were derived not only from upstream provenance but also the Bolaghi Valley, whereas the latter site gravel was provided only from the upstream provenance (Fig.3.2). This sampling was randomly and roughly carried out. After washing the gravel in water, we counted the gravel numbers of radiolarian chert, jasper and others (including volcanic rocks). Radiolarian chert includes numerous radiolarian ghosts and usually presents a brick color. In this study, the usage of jasper is limited to such cases where gravels presented milk-white yellowish and reddish colors. The others are composed of siliceous nodule, quartz vein rock and pore-filling quartz.

The lithological composition ratio among the radiolarian chert: yellowish jasper: others and the range of gravel diameter at three localities are as follows;

| | | |
|---|---|---|
| RG01 | 1:2:2 | 2 to 6 cm |
| RG02 | 1:1:1 | 2 to 6 cm |
| RG03 | 1:2:2 | 3 to 5 cm |

The abundance of other material including siliceous nodules is conspicuous, because beds which yield siliceous nodules are extensively distributed in the Bolaghi area as described before. On the other hand, the occurrence of radiolarian chert has not been recognized there so far. In general, it is well known that radiolarian chert is categorized as deep-sea sediment. Thus we exclude that the limestone of the Bolaghi Basin is accompanied by radiolarian chert. This means that radiolarian chert gravels were transported from an upstream provenance. The shape of the radiolarian chert at three localities is characterized by high angularity and ill sorting (Pl.3.1-4, 1-5, 1-6). This line of evidence may suggest that the transportation distance was not very far.

We examined the petrographical character of gravels of radiolarian chert and jasper under the microscope. The radiolarian chert (Pl.3.2-5, 3.2-6; RG02Red) consists of microcrystalline or cryptocrystalline quartz with numerous radiolarian tests, 80 to 200 μm in diameter. It is noteworthy that quartz veinlets are not necessarily as developed in the chert. It is suggested that radiolarian chert can be adequate for use as raw material for artifacts, because of less mechanical deformation. Jasper (Pl.3.2-7, 3.2-8; RG02Yellow) is also composed of microcrystalline quartz. Furthermore, chromian spinel crystal is observable. This may suggest that the original rocks was ultramafic to mafic rocks and then subjected to silicification. In this sense, jasper can be categorised into secondary or diagenetic segregations and metasomatites (Pettijohn, 1975).

The chemical composition is shown in Table 3.1. $SiO_2$ content of radiolarian chert is more than 95%, and may be called pure chert rather than Francisican chert. Jasper contains somewhat less $SiO_2$ than radiolarian chert, and is characteristically rich in $Fe_2O_3$ (5.14 %). Thus, jasper can be regarded as a ferruginous chert (Pettijohn, 1975).

## Depositional Ages of Dark Red Siliceous Shale

It is preliminarily concluded that there is no exposure of raw material suitable for prehistoric artifacts. Transportation of raw material by river flow and/or by ancient people can be suppposed. To confirm this idea, we studied the geological characters of more appropriate raw materials for artifacts. Thus we obtained a chipped stone assemblage abandoned by the ancient people at locality A5-3 (Qar-e Tang Sikan) (Ikeda et al. 1979) (star in Figs.3.1, 3.2). Included in this is some dark red siliceous shale, which was undoubtedly

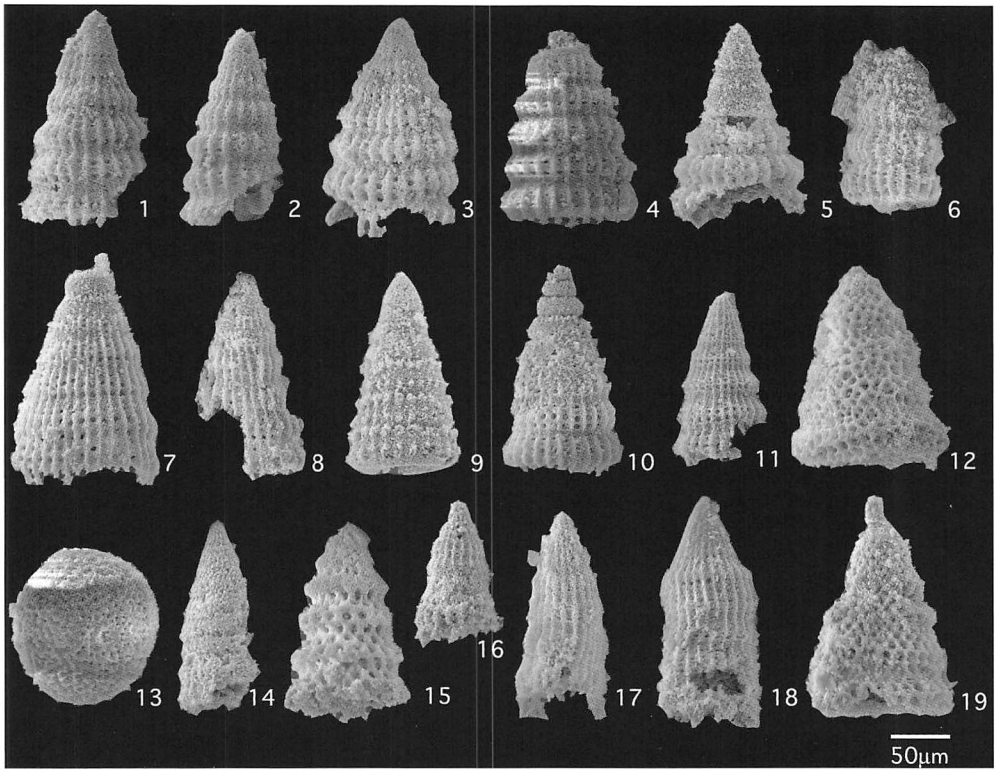


Fig.3.4 Radiolarians from dark red siliceous shale.
1-5: *Praecaneta minetica* DUMITRICA, 6-11: *Dictyomitra formosa* SQUINQBOL, 12,19: *Stichomitra* sp. , 13: Spumellaria gen. et sp. indet. , 14: Nassellaria gen. et sp. indet., 15: *Stichomitra* cf. *tosaensis* NAKASEKO & NISHIMURA, 16-18: *Archeodictyomitra* sp. Scale bar=50μm.

exotic, transported material.

Several pieces of dark red siliceous shale yielded an index fossil of radiolarians, a marine planktonic protozoan consisting of a tiny silica-test, by using the etching technique of dipping rock pieces into diluted hydrofluoric acid (HF) for 24 hours. Then following species were identified, although these radiolarian specimens are poorly preserved (Fig.3.4).

*Praecaneta minetica* DUMITRICA,
*Dictyomitra formosa* SQUINQBOL,
*Stichomitra* cf. *tosaensis* NAKASEKO & NISHIMURA,
*Archeodictyomitra* sp.
*Stichomitra* sp.
Spumellaria gen. et sp. indet.
Nassellaria gen. et sp. indet.

The occurrence of *P. minetica* was reported from the Early Cretaceous of the Mailolica Formation distributed in the Southern Alps and Umbria-Marche Apennines by Jud (1994) and Dumitrica et al. (1997). This species has a range from Berriasian to Barremian and is commonly found in the Hauterivian and Barremian. *D. formosa* is diagnostic species of the early Late Cretaceous (Cenomanian to Turonian) and occurs from all over the world (e.g., O'Dogherty, 1994). The range of *Stichomitra tosaensis* was the late Early to early Late Cretaceous of the Albian to Cenomanian.

Radiolarian fauna is monotonous and poorly preserved, however, occurrence of these radiolarians indicates that the siliceous red mudstone was deposited in the Early to early Late Cretaceous.

## Source Area for Siliceous Pebbles

In the Bolaghi area, raw material suitable for artifacts has not been found. Thus, it is more appropriate that raw materials must be transported from the surrounding areas by river flow and/or by ancient people. It is very characteristic that raw materials suitable to artifacts seem to be radiolarian chert and jasper.

The combination of radiolarian chert, jasper (= silicified ultramafic to mafic rocks) and red siliceous shale is expected in the ophiolite rock assemblage. The ophiolite is a fragment of fossil oceanic lithosphere which has been thrust over or obducted into continental margins at consuming plate boundaries and it is composed of oceanic crust and uppermost mantle; ultramafic, gabbroic, mafic sheeted dike, and mafic volcanic complexes associated with (1) an overlying section typically including ribbon chert, thin shale interbeds, and minor limestone, (2) podiform bodies of chromitite generally associated with dunite, and (3) sodic felsic intrusive and extrusive rocks (Dilek, 2003).

In the Zagros thrust zone (Stöcklin, 1968), two major occurrences of ophiolite-radiolarite are known; Kermanshah and Abadeh Tashk (to the east of Shiraz) (Fig.3.2). The details of both ophiolite-radiolarite are unsolved, but these seem to have been obducted to the Jurassic to Creatceous carbonate rocks. Because the oceanic sediments (dark red siliceous shale) is dated to the middle Cretaceous, the obduction of the oceanic crust must have occured after then.

## Probable Raw Material Procurement Zones

Earlier, we pointed out that the ophiolite rock assemblage could provide adequate raw material. Fortunately, the Bolaghi area is located not so far from the Abadeh Tashk ophiolite, approximately 60 km away. Also the Sivand River includes a part of this ophiolite rock assemblage as a drainage basin (Fig.3.2). Accordingly, the ancient people could get raw material easily.

Another ophiolite can also be a raw material procurement zone. The chert had been frequently used for lithic raw material and trade in the Zagros region (Biglai, 2004). Three types of radiolarian chert are known in the Kermanshah area (Biglai, 2004). First, the Harsin type is a typically homogenous reddish brown opaque material. Second, "Fine Opaque White Red or Brown Chert" has superior flaking qualities. Third, the grayish chert was exploited more during Neolithic and Chalcolithic periods for blade production. He also mentioned that Do-Ashkaft occupants obtained better quality raw material from sources in the Radiolarit Belt Zone or other unknown sources in the Kermanshah region prior to the occupation at Do-Ashkaft, and subsequently local sources of the Maiwaleh Zone were used. As indicated in this report, if the source rocks for raw material are more precisely determined, the significance of core size and shape will be understood.

## Concluding Remarks

The procurement zones for the prehistoric artifacts might be located not in the Bolaghi area, but in the Abadeh Tashk ophiolite, which is tens kilometers from there. They seem to have been transported as river pebbles and/or as trading material. In either case, the ophiolite could have provided the raw material for prehistoric artifacts.

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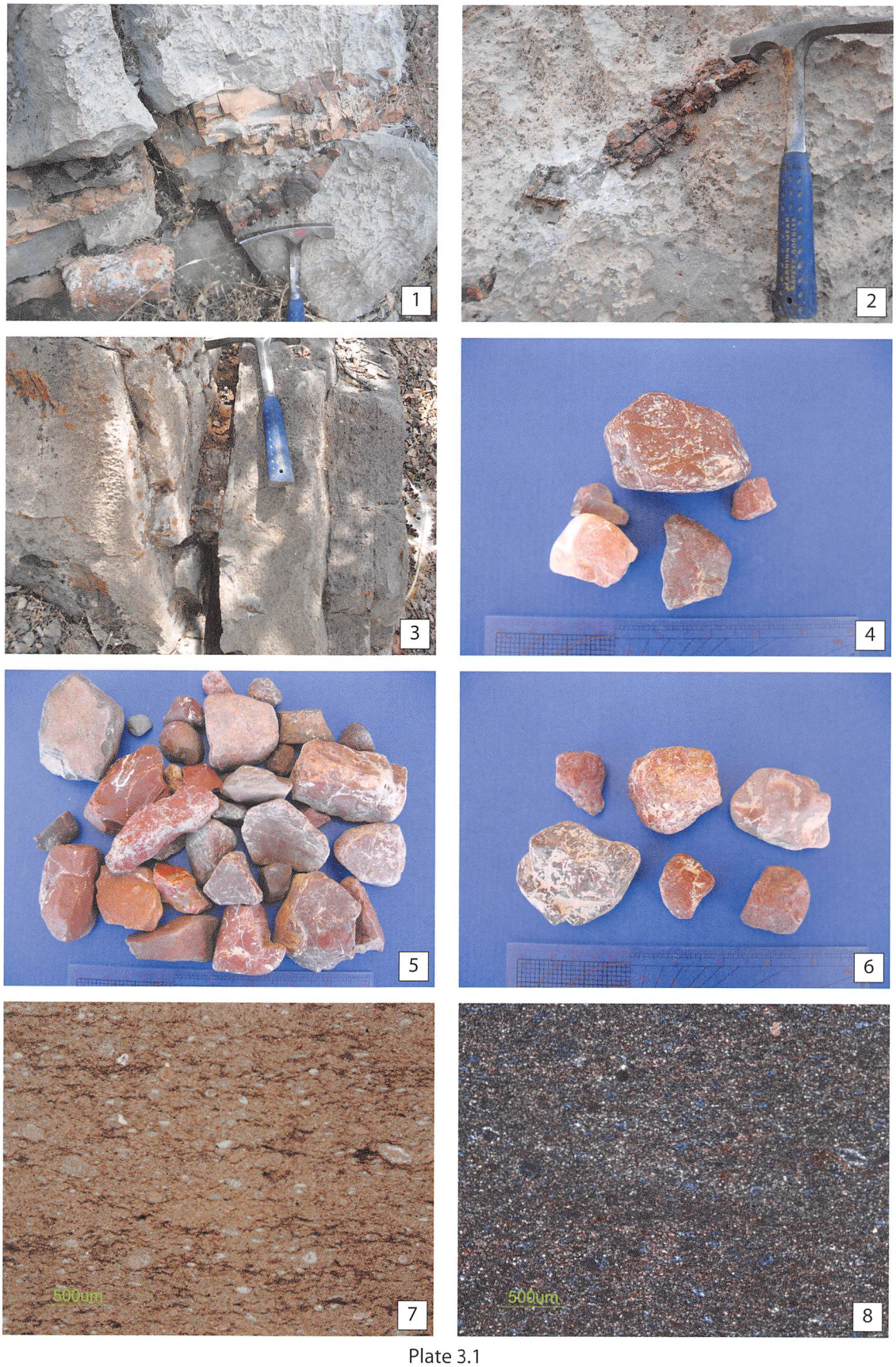



Plate 3.1

1; L type siliceous nodule 2; IIS type siliceous nodule 3; B type siliceous nodule 4; radiolarian chert gravel at RG01 5; radiolarian chert gravel at RG02 6; radiolarian chert gravel at RG03 7 & 8; Photomicrographs of dark red siliceous shale at locality A5-3 (Qar-e Tang Sikan) (7, open, 8, cross nicols)

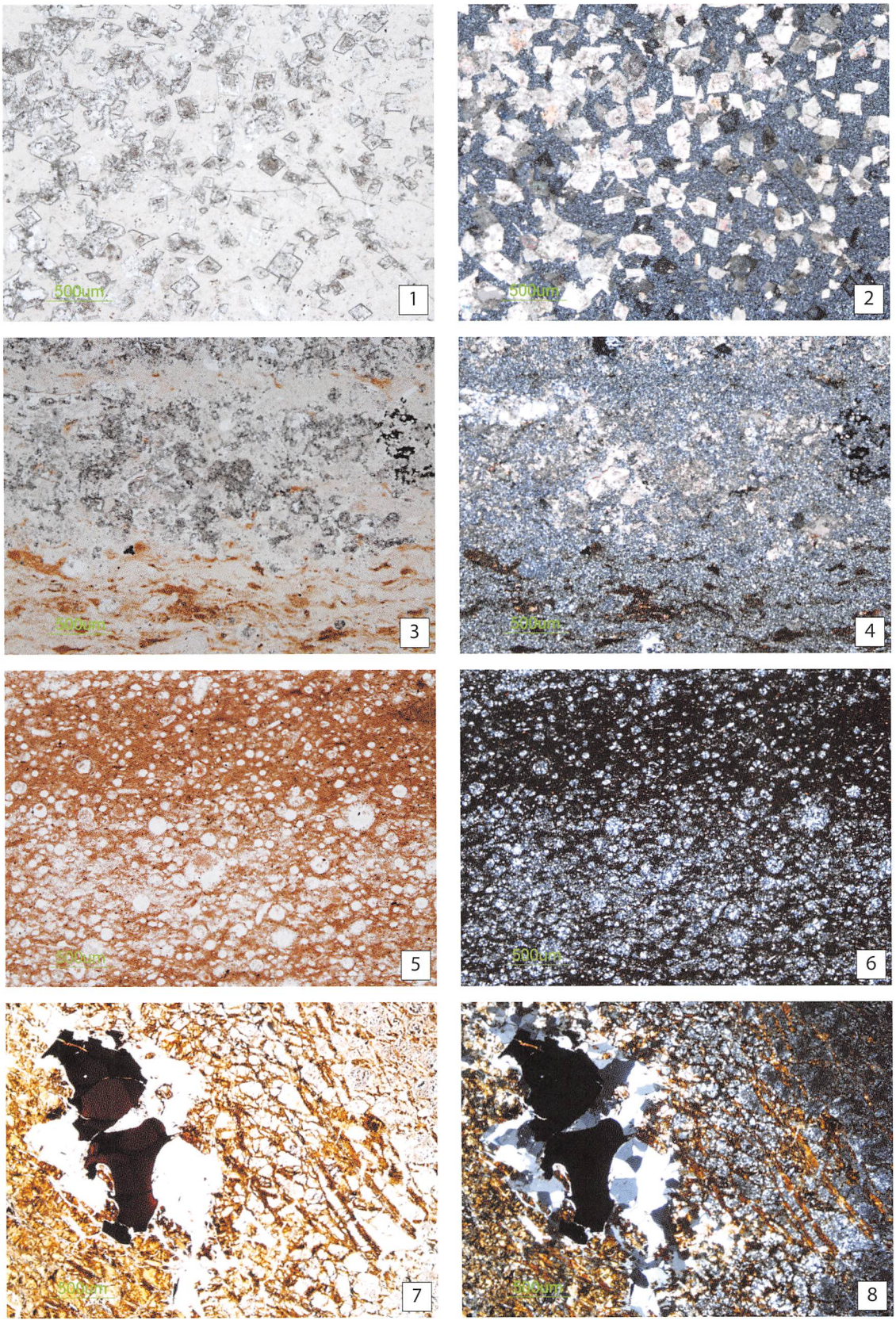



Plate 3.2

1 & 2; Photomicrographs of IIS type siliceous nodule (06080109) (1, open, 2, cross nicols) 3 & 4; Photomicrographs of B type siliceous nodule (06080113) (3, open, 4 cross nicols) 5 & 6; Photomicrographs of radiolarian chert river gravel at RG02 (5, open, 6, cross nicols) 7 & 8; Photomicrographs of jasper river gravel at RG02 (7, open, 8 cross nicols) Nore that large crystal is chromian spinel.

# CHAPTER 4

## EXCAVATIONS AT TB75 (HAJI BAHRAMI CAVE)

# 4. EXCAVATIONS AT TB75 (HAJI BAHRAMI CAVE)

Akira TSUNEKI and Mohsen ZEIDI

TB75 is a relatively large cave named Eshkaft-e Haji Bahrami (Haji Bahrami Cave) located on the southern slope of Kuh-e Bolaghi Bozorg and opens in a southwestern direction, facing the dam-site (Pl.4.1). It is the most conspicuous cave in the Bolaghi Valley, and comes into view immediately as one enters the valley from the south (Pl.4.2 and 4.3). From the cave location, the central part of the Bolaghi Valley is visible with a partial view to the south, through to the Kamin Plain (Pl.4.4). This strategic location commanding a fine view may have been one of the reasons why this cave was occupied, especially during the Achaemenid period, as we explain later.

The southern slope of Kuh-e Bolaghi produced many limestone caves, because the geological formations of the area consist of massive limestone and type 1 bedded limestone (see chapter 2 of this volume). Haji Bahrami Cave seems to result from dissolution of the huge limestone block surrounded by open cracks. A small *wadi*, named Tang-e Jili, flows from behind the limestone mountain, then around from the west to the front terrace. Another faint *wadi* also flows from behind the mountain and around to the east of the cave. The opening of the cave is at 1875 m and the height from the front *wadi* is over 30m (Fig.4.1). The terrace slope is steep. The inclination of the slope is about 20 degrees (Fig.4.2). The terrace slope is covered with many large-sized (over 1m in diameter) and middle-sized (around 50cm in diameter) limestone rocks, which have fallen down from the limestone mountain at the rear. These limestone rocks, especially huge-sized ones, were heavily weathered. There is no fertile land for agriculture near the cave. Only wild pistachio and almond trees are scattered on the sterile slopes near the cave.

The opening of the cave measures c. 9 m wide and 2.8 m high, and the depth to the back wall is 19 m (Fig.4.3). The cave opens to the southwest and the axis follows southwest - northeast. The height of the interior cave varies between 2.5m – 3m. At the back wall, the cave turns at a right angle to the northwest and continues, climbing upwards more than 10 m (Fig.4.4). This deep interior of the cave follows a southeast – northwest axis. Sunlight does not reach the deep interior and the area is pitch dark. There are large fallen limestone rocks scattered and piled up in the deep interior. The height of the deep interior cave is less than

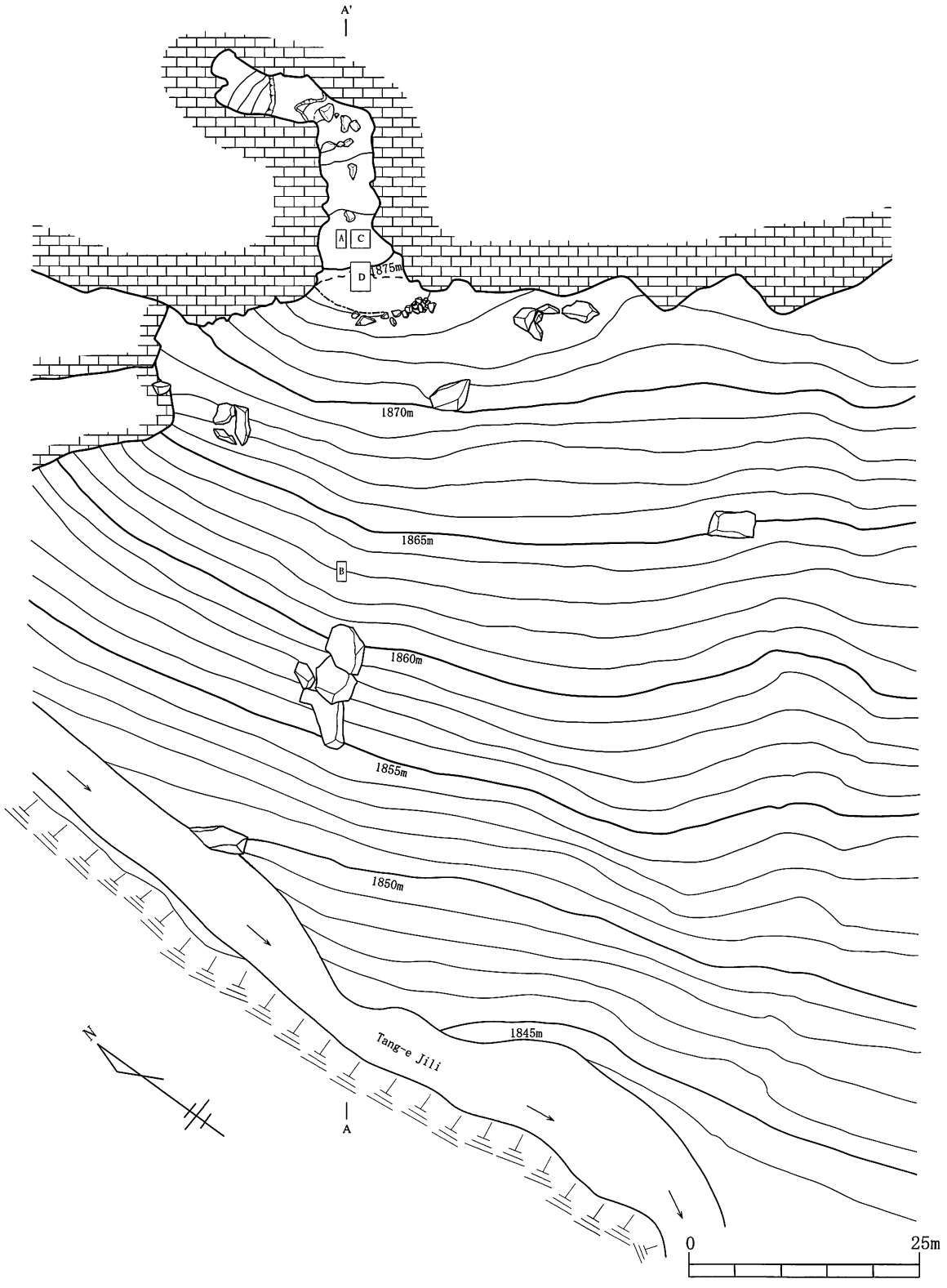



Fig.4.1 Morphological map of TB75.

2m, and human adults cannot move easily within it. It does not seem that this part of the cave was occupied or used by people.

The cave has been used as an animal refuge with dung deposits covering the front interior of the cave. We did not discover a large amount of archaeological artifacts in the cave. However, a few historic potsherds and lithic artifacts are scattered in front part of the

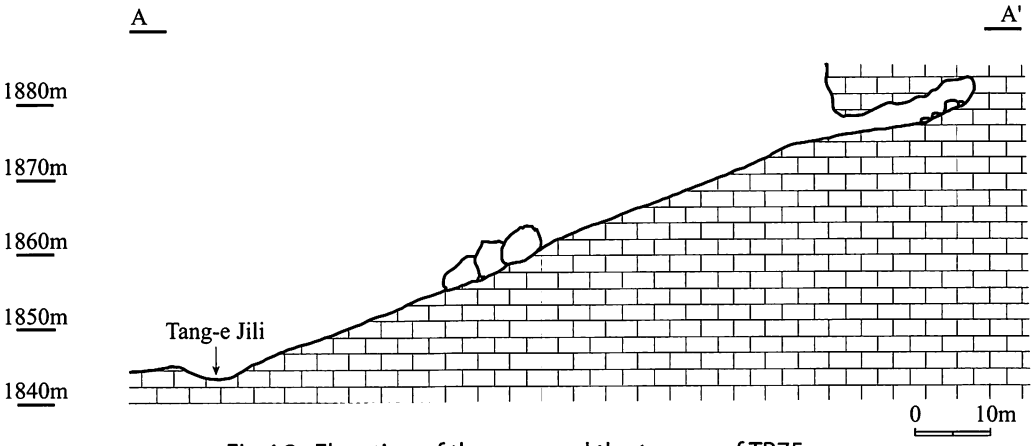



Fig.4.2 Elevation of the cave and the terrace of TB75.

cave and on the terrace slope. These objects encouraged us to carry out archaeological excavations in this part of the cave. We decided to dig inside the cave and on the terrace slope.

In the first field season (2005), two small trenches, measuring 2 x 1m each were dug inside the cave (Trench A) and in the middle of the terrace slope (Trench B) respectively. The location of Trench A is ca.2m inside from the line of the opening eaves (the rain-drip line) and ca.1.5m from the western wall of the cave. The trench was excavated to a maximum depth of 1.5m, but we did not reach bedrock at this depth. As we will see in detail later, the cultural deposits here can be divided into three cultural phases: Islamic, Achaemenid, and Proto-Neolithic. Trench B was sunk into the middle of the terrace slope, between the 1863m – 1862.5m counter line, and 36m southwest from Trench A. The cultural deposits from the surface to the mountain bedrock are about 1m thick in this part of the terrace slope. Though the cultural deposits of Trench B could be divided into three layers, all layers have similar characteristics and belong to the Proto-Neolithic phase.

In order to recover more archaeological material, especially organic remains such as charcoal, animal bones and plant remains, we excavated another two trenches in the frontal part of the cave during the second field season (the summer of 2006). Trench C, measuring 2 x 2 m, was sunk just east of Trench A. Trench D, measuring 2 x 3m, was sunk at the opening of the cave, 1.5m south of Trench C (Fig. 4.3). We reached virgin soil at around 2m deep in both trenches. Both trenches produced almost the same cultural phases, i.e. Islamic, Achaemenid, Proto-Neolithic and Epi-Paleolithic. In total, 12m$^2$ of cultural deposits were excavated inside the cave, and 2m$^2$ were excavated on the terrace slope.

## Trench A

Trench A was the first trial trench dug near the western wall of the cave (Pl.4.5, 4.6)). The trench was taken to a maximum depth of 1.5 m. We did not reach virgin soil at that depth, but had to halt the digging because of the danger of trench collapse. The cultural deposits in this trench were divided into many layers. However, compared to neighboring Trenches C and D, they could be summarized into four main cultural layers (Fig. 4.5).

Surface soil: This deposit contained much animal dung and ash that had been accumulated due to recent nomad activity. The average thickness of this layer is about 10cm. We found a few flint flakes and micro-blades in this layer.

Layer 1: This layer consisted of alternatively ash and soft soil. As the ash is the main structural material, the layer was generally very soft and dusty. The ash parts were a light

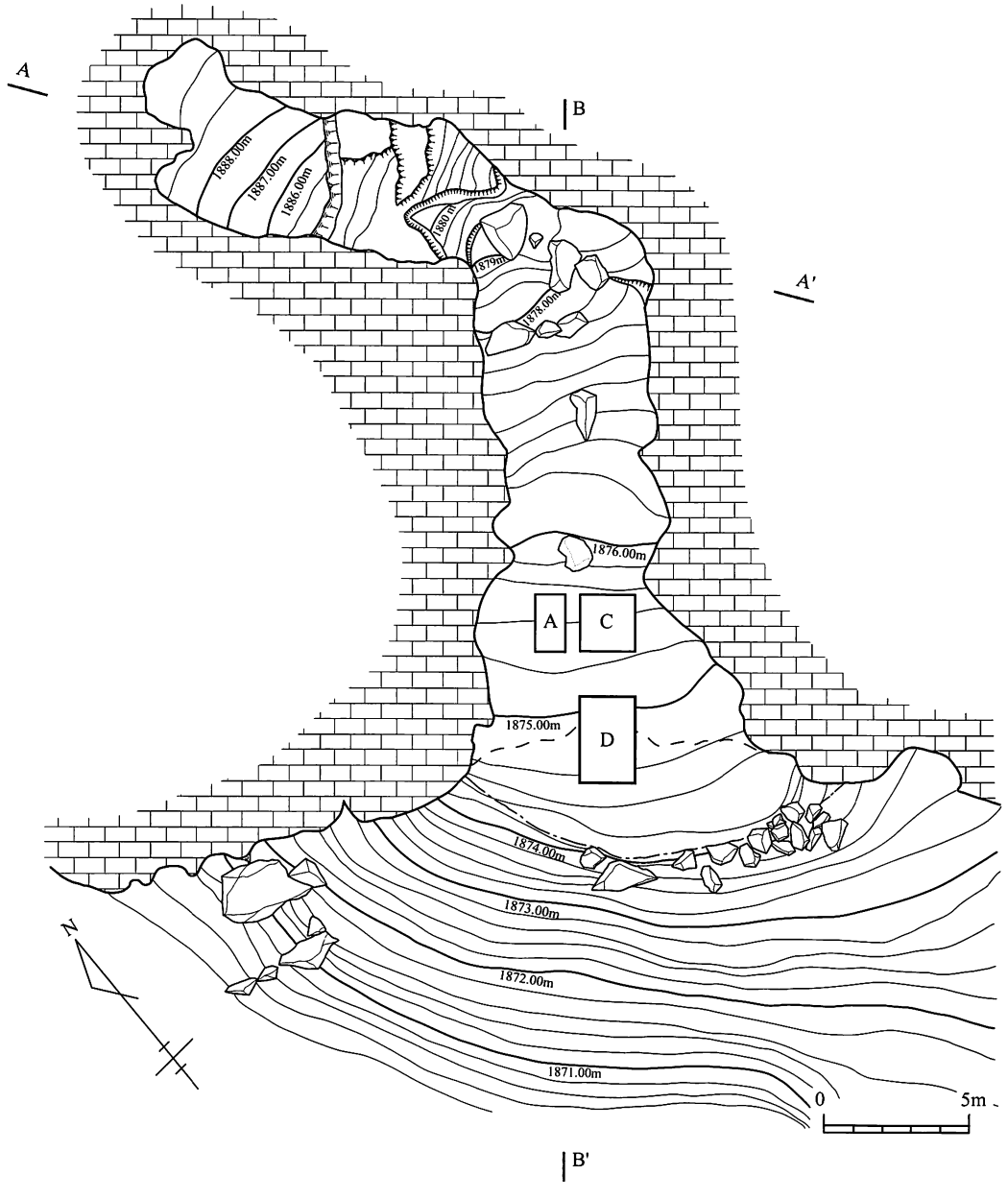



Fig.4.3 Cave of TB75.

grayish color. The soft soil parts were dark-brown in color and contained some pebbles, cobbles, charcoal and burnt soil. A small pit was discovered at the western part of the trench (Pl.4.7). The depth of this pit was about 30cm and filled with very soft light brown colored soil. It contained many pebbles and cobbles, some bones, potsherds and flint flakes. The average thickness of this layer is about 30cm. As we found a few pieces of Islamic glazed ware, this layer belongs to the early Islamic period.

Layer 2: This layer consisted of soft soil containing many pebbles, burnt clay and rubble (Pl.4.8). The soil was brown to dark brown in color. Lenticular ash deposits were also visible. A hearth was discovered in this layer. It was surrounded by cobbles and some pebbles and contained much charcoal and dark brown ashy soil. Some cobbles were burnt and had turned black. A deep pit had been dug down from this layer. This pit was located in the southern part of the trench and was not drawn in the section figure. The pit contained dark brown soft soil and a lot of fragments of typical Achaemenid large jars. The lower part of this layer revealed brownish orange soft soil mixed with much ash, charcoal, burnt soil

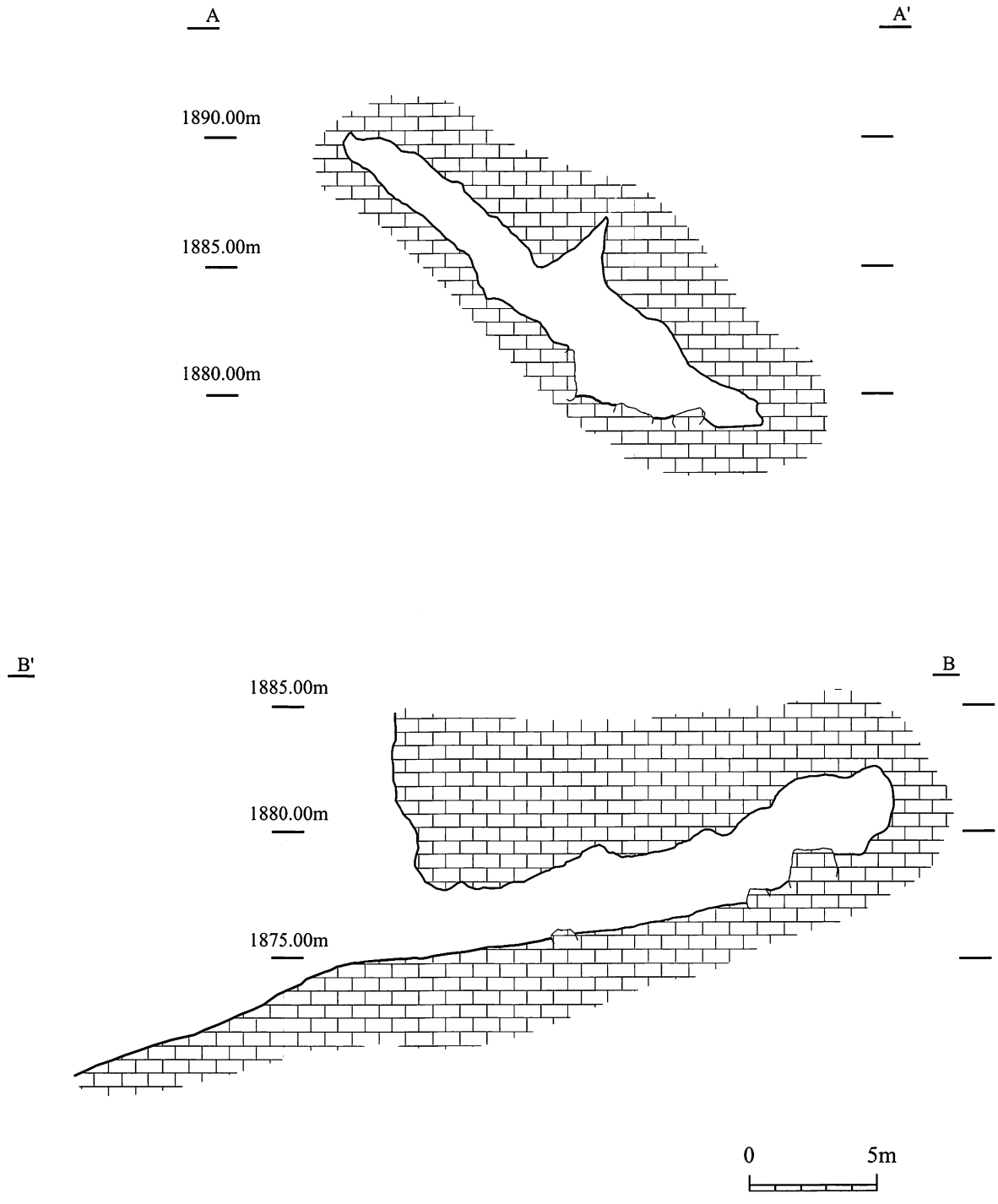



Fig.4.4 Elevations of the cave of TB75.

and some pebbles. We found many animal bones in this layer. Many chipped stones were also recovered after sieving. All of these elements indicate that this part belongs to the lower prehistoric deposits. However, four pieces of metal were discovered in this part. As was a potsherd containing plastic decoration which is also an element belonging to the Achaemenid era. Layer 2 shows various lithofacies and is about 20 – 30cm in thickness. Layer 2 probably belongs to the Achaemenid period.

Layer 3: Brownish orange soil layer mixed with many pebbles and some cobbles (Pl.4.9). We did not find any feature remains in this layer, except a pit dug down from the upper layer. This Achaemenid pit intruded into the southern part of layer, but other parts of

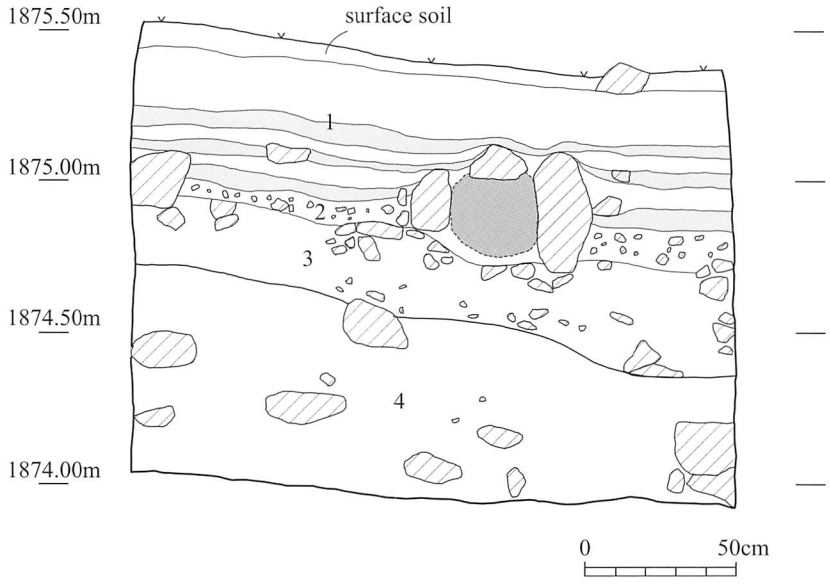



Fig.4.5 East wall section of Trench A.

Trench A
Surface soil: Much animal dung and ash.
1. Alternatively accumurated light gray ash and dark-brown soil.
2. Dark-brown soft soil containing many pebbles, burnt clay and rubble.
3. Brownish orange soft soil mixed with many pebbles and some cobbles.
4. Orange soil mixed with many pebbles and cobbles.

the layer remained undisturbed and produced many animal bones and chipped stones. The characteristics of the lithic artifacts tell us that this layer belongs to the Proto-Neolithic period.

Layer 4: Orange soil mixed with many pebbles and cobbles. We found many chipped stones and animal bones in this layer. All of the objects from this layer are prehistoric ones and no potsherds were recovered. Based on the characteristics of the lithic industry, this layer dates to the Proto-Neolithic period.

## Trench B

A 2 x 1 m trench, sunk on the middle of terrace slope, was dug 36m from and along the north-south axis of Trench A, between the 1863 m - 1862.5 m contour line (Fig.4.1, Pl.4.10). This trench was taken to a maximum depth of 1.35 m at the northern side and 0.95 m at the southern one until it reached the natural mountain soil. Therefore, the cultural deposits are about 1 m thick in this part of the terrace slope. The deposits could be divided into various layers (Fig.4.6). However, except recently accumulated surface soil, all of the layers show similar lithofacies, i.e. brown to red-brown colored soil with ash and limestone pebbles. The uppermost layer is 30 – 35cm thick, the second is 20 – 30 cm thick, and the lowest is c.50cm thick but is divided into two sub-layers, bordered by limestone pebbles. A stone spread, consisting of some limestone pebbles, was found in the second layer, but the trench is too small to identify the characteristics of this feature. No other structural remains were found.

A few potsherds (14 pieces), were discovered with a large number of chipped stones in the uppermost brown soil layer. These potsherds are historic and prehistoric varieties, but there are no diagnostic pieces for determining detailed chronology. It would be safer to say that this uppermost layer was a disturbed layer fallen from the cave and upper slope and

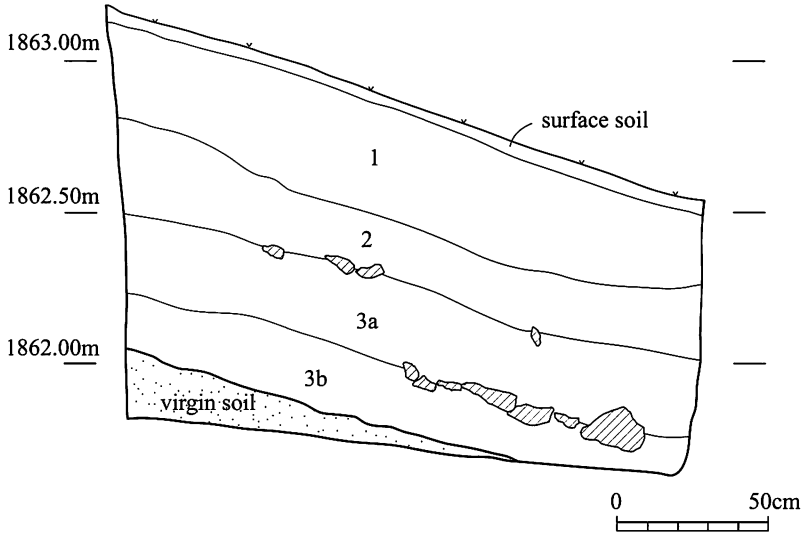



Fig.4.6 East wall section of Trench B.

Trench B
Surface soil: Modern debris consisting of grass.
1. Soft brown soil containing much whitish-gray colored ash.
2. Reddish-brown soil containing much ash. Probably and partly leveled for stone floor.
3a. Red-brown soil with many limestone pebbles.
3b. Red-brown soil with quite a few limestone pebbles.
Virgin soil: Yellow sandy soil.

accumulated on the middle terrace. The lower two layers did not produce potsherds. Instead, a great number of flint chipped stones (over 1500 pieces) were discovered. The lithic artifacts of these layers seem to belong to the same industry.

It is certain that the lithic artifacts recovered from each level of Trench B apparently have the same micro-blade industry affinities with those found from the layers 3 and 4 of Trench A. The most numerous tools are micro-blades, measuring 3 – 8 mm wide and less than 30 mm long (Pl.4.11). They are quite tiny blades, but most of them have faint retouch or nibbling on one side or both sides. This evidence indicates that these tiny micro-blades were made and used as the elements of some composite tools. Trenches A and B produced dozens of micro-blade cores in various stages, from pebbles through the initial stages to the final discarded ones. Single-platform conical shaped cores (Pl.4.12), regularly detached by pressure-flaking technique, were the most prevalent. Though various kinds of flint were used as micro-blade cores, green-colored flint had been chosen as the primary material. In addition to cores, micro-blade core rejuvenation flakes, such as core tablets and bottom flakes, were frequently recovered, and it is quite certain that the micro-blades were produced in large scale numbers at the site. Though small in number, some geometric microliths such as lunates, were among the chipped stone tools. For the production of larger and heavier tools, such as end-scrapers, retouched flakes and thumbnail scrapers (Pl.4.13), flakes and blades were used instead of micro-blades. Pointed pieces, burins and notches (Pl.4.14) were also discovered, though the number of these tools is limited. Although minor typological and technological difference can be observed between each layer, the chipped stone industry at Trench B is fundamentally the same tradition. All of them seem to belong to the Proto-Neolithic period, and the details and chronological position of these lithic artifacts will be discussed in Chapter 6.

## Trench C

Trench C was a 2 x 2m square and approximately 2m inside from the line of the opening eaves, and about 1-2m from the eastern wall of the cave, and 50cm from the eastern wall of Trench A (Fig.4.3). The trench was dug down to a maximum 3.30m, and we reached undisturbed soil at c.2.3m from the surface. Though the cultural deposits were divided into many sub-layers, they can be categorized into the following six layers (Fig.4.7).

Surface soil: Ashy deposits with much animal dung, measuring less than 10cm.

Layer 1: The uppermost deposits, just below the surface soil, and consisting of a series of ash and brown soil layers (Pl.4.16). They are 40 – 50cm thick and produced some glazed

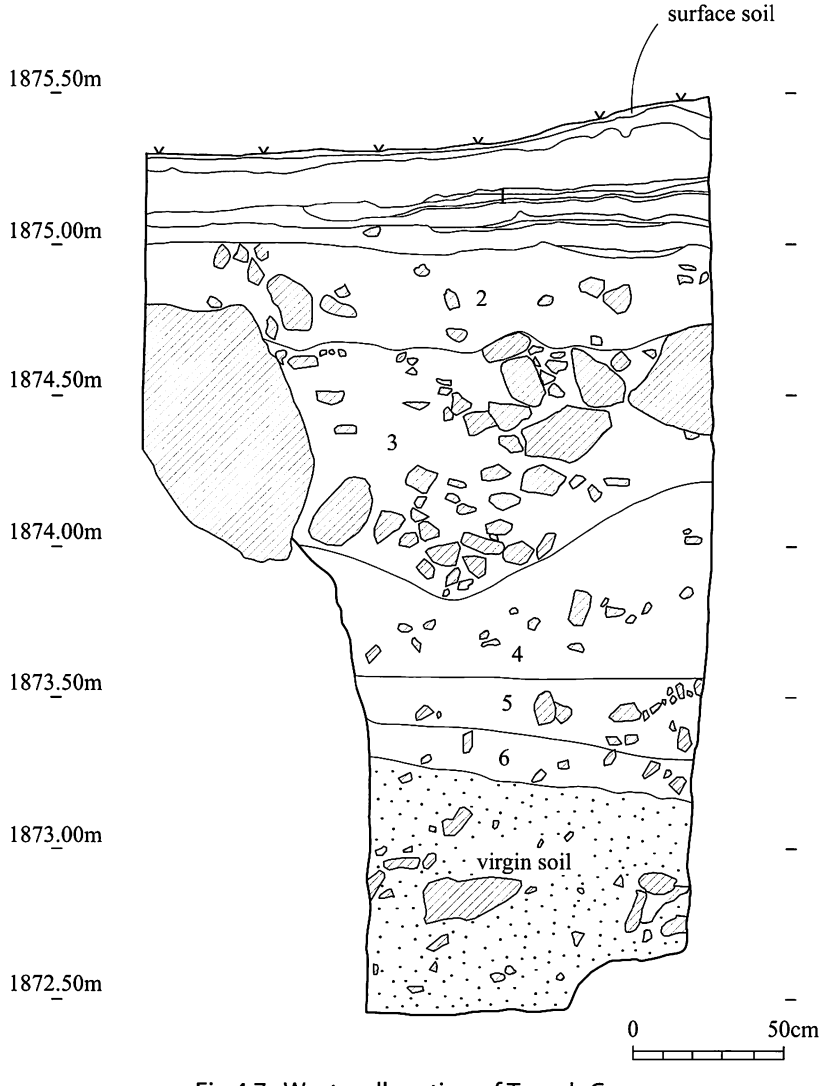



Fig.4.7 West wall section of Trench C.

Trench C
Surface soil: Ashy deposits with much animal dung.
1. Ash and brown soil layers.
2. Grayish brown soil with many angular limestone pebbles.
3. Yellowish orange soft soil mixed with many small pieces of charcoal, and various sizes of angular limestone pebbles.
4. Orange soil, mixed with a small amount of charcoal and many angular limestone pebbles.
5. Yellowish orange soil and some patches of compact soil with many angular limestone pebbles.
6. Brownish orange compact soil mixed with various sized angular limestone pebbles.

ware sherds, most likely belonging to the Islamic period. One hearth-like structure was discovered in this layer (Pl.4.17). We recovered 30 potsherds, 6 lithic artifacts, 6 metal objects and many animal bones in this layer.

Layer 2: This layer consisted of many angular limestone pebbles and grayish brown soil, about 30-35cm in thickness. It produced some material dated to the Achaemenid period. 47 potsherds, three lithic artifacts, five metal objects and many animal bones were recovered from this layer. An iron trilobate arrowhead was among the special finds, indicating the presence of an Achaemenid army (Pl.4.18).

Layer 3: This was a layer of yellowish orange soft soil mixed with many small pieces of charcoal, and various sizes of angular limestone pebbles. The thickness was 60-80cm. Layer 3 produced many prehistoric materials and a few later potsherds. We recovered five pieces of Achaemenid potsherds from the upper part of this layer, and some hundreds of lithic artifacts, and many animal bones.

Layer 4: The layer consisted of a soft orange soil, mixed with a small amount of charcoal and many angular limestone pebbles, being 40-75cm thick (Pl.4.19). From this layer, over one hundred lithic artifacts and many animal bones were recovered. No potsherds were found. Characteristics of the lithic artifacts indicate that the layer must date to the Proto-Neolithic period.

Layer 5: The fifth layer consisted of a yellowish orange soil and some patches of compact soil with many angular limestone pebbles. The thickness ranged from 10 - 40cm. The digging was obstructed by many large limestone rocks, which were collapsed from the cave roof. Therefore, the excavation square was quite limited in layers 5 and 6. We discovered a hearth at the southeastern corner of the trench. The hearth was fringed by some limestone pebbles, and was 95cm long, 75cm wide, and 20cm deep (Pl.4.20). We recovered only one lithic artifact and a few animal bones within the hearth. The inside hearth was filled with some very thin ash lenses about 10cm thick. The number of lithic artifacts in layer 5 is small, and animal bones are very few and small in size.

Layer 6: The lithofacies of this layer are very similar to those of layer 5. The layer consisted of brownish orange compact soil mixed with various sized angular limestone pebbles. We recovered only few lithic artifacts and very few and small animal bones, because of the limitation of the digging square. This layer gradually changed into virgin soil around 1873.2m above sea level.

Based on the characteristics of potsherds (upper two layers) and lithic artifacts, we can propose the period of each layer as the follows; Layer 1 is Islamic, layer 2 is Achaemenid, layers 3 and 4 are Proto-Neolithic. The number of lithic artifacts in layers 5 and 6 is quite limited, but they probably belong to the Epi-Paleolithic.

### Trench D

Trench D was set at the mouth of cave across the line of the opening eaves (the rain-drip line), because the mouth of the cave was intensively used by prehistoric people in general (Fig.4.3, Pl.4.15). This Trench D, measuring 2 by 3m, was parallel to and 1.5m apart from Trench C. The cultural deposits of Trench D are essentially same as those of Trench C, except the relative thinness of the Islamic layer. The altitude of the trench surface is about 1874.85 – 1875.10m and we reached sterile soil, probably virgin soil, at a level of 1873.20m. Therefore, the thickness of the cultural deposits is 1.9 - 1.7m and they can be divided into six layers based on soil characteristics and included artifacts (Fig. 4.8). On the west wall section of Trench D, we could observe the rain-drip line (Pl.4.21). The lithofacy of each layer of both sides is almost homogenous. However, the soil in the exterior part of the cave (left side

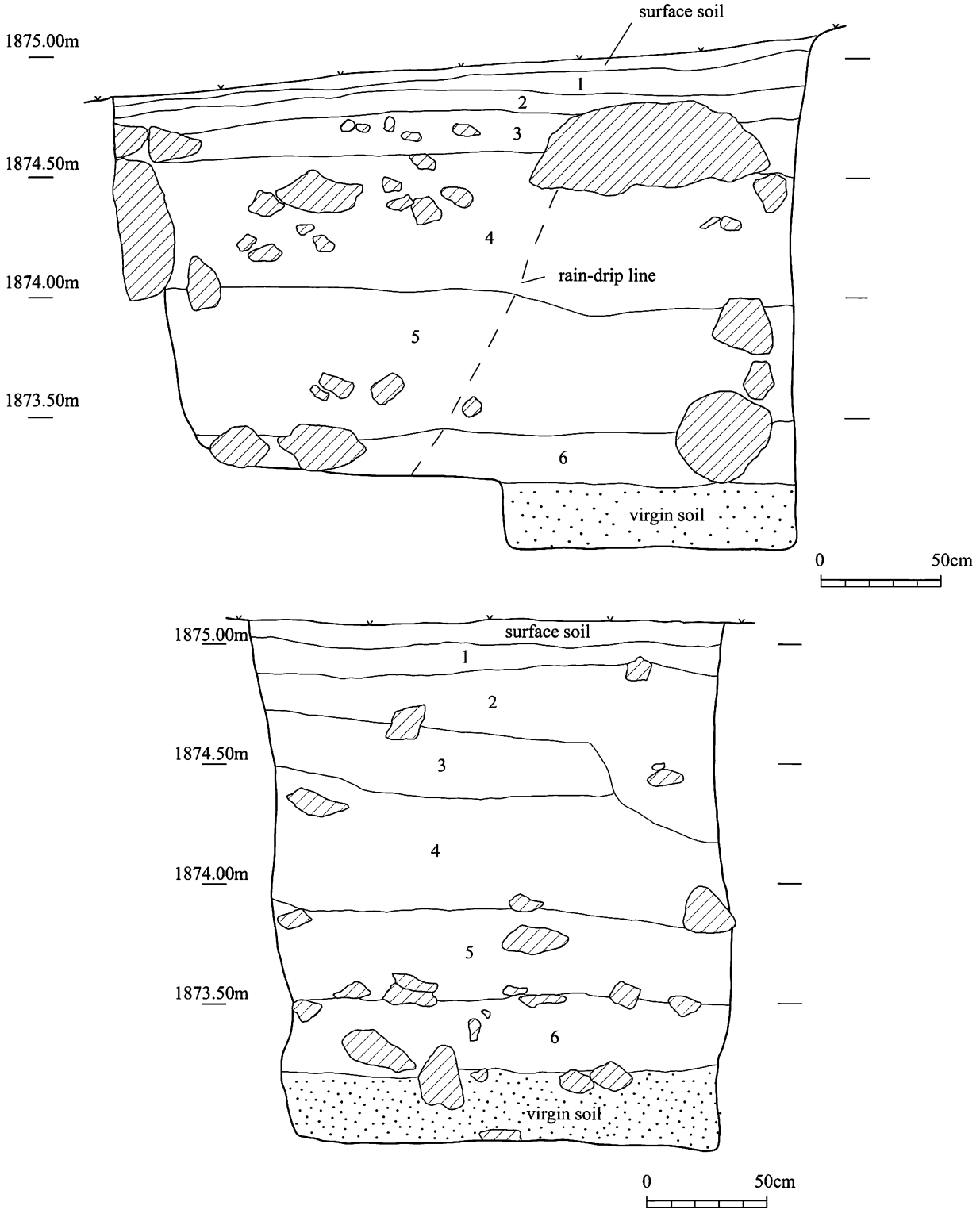



Fig.4.8 West and north wall sections of Trench D.

Trench D

Surface soil: Ashy deposits with much modern animal dung.

1. Brown ash soft layer containing much animal dung and small pebbles.
2. Gray and fine ash layer, containing many small pebbles, charcoal and Achaemenid potsherds.
3. Soft layer of yellowish-brown color and containing many limestone pebbles and some charcoal.
4. Yellowish orange soil with many angular limestone pebbles and some charcoal.
5. Orange soft soil, quite similar to but slightly darker than layer 4.
6. Orange-brown color soil with many angular limestone pebbles.

in this section) has a coarser and reddish colored lithofacy than that of the interior part (right side of this section).

Surface soil: Ashy deposits with much modern animal dung, measuring 5 – 15cm.

Layer 1: A 5 - 15cm thick brown ash layer existed below the modern surface layer. The ash layer is soft and contained much animal dung and small pebbles. Though there are very few diagnostic potsherds, this layer seems to have accumulated during the Islamic period.

Layer 2: This layer is gray and fine ash layer, containing many small pebbles, charcoal and Achaemenid potsherds. The thickness of this layer in the north section is about 15 - 30cm, but it is only 10cm in the southern part of the trench. This means that the habitation deposits of the layer became thicker toward the back of the cave. A small shallow pit was discovered at the northeastern corner of this trench (Fig.4.9, Pl.4.22). It is c. 80cm in diameter and 45cm deep at most. This pit was filled with the gray and fine ash of layer 2. A fragment of large ribbed pithos was found at the bottom of this pit, and dates to the Achaemenid period (Pl.4.23).

Layer 3: This layer consisted of yellowish-brown colored soil and many limestone pebbles. This is a relatively soft layer, and patches of some burnt soil and some charcoal

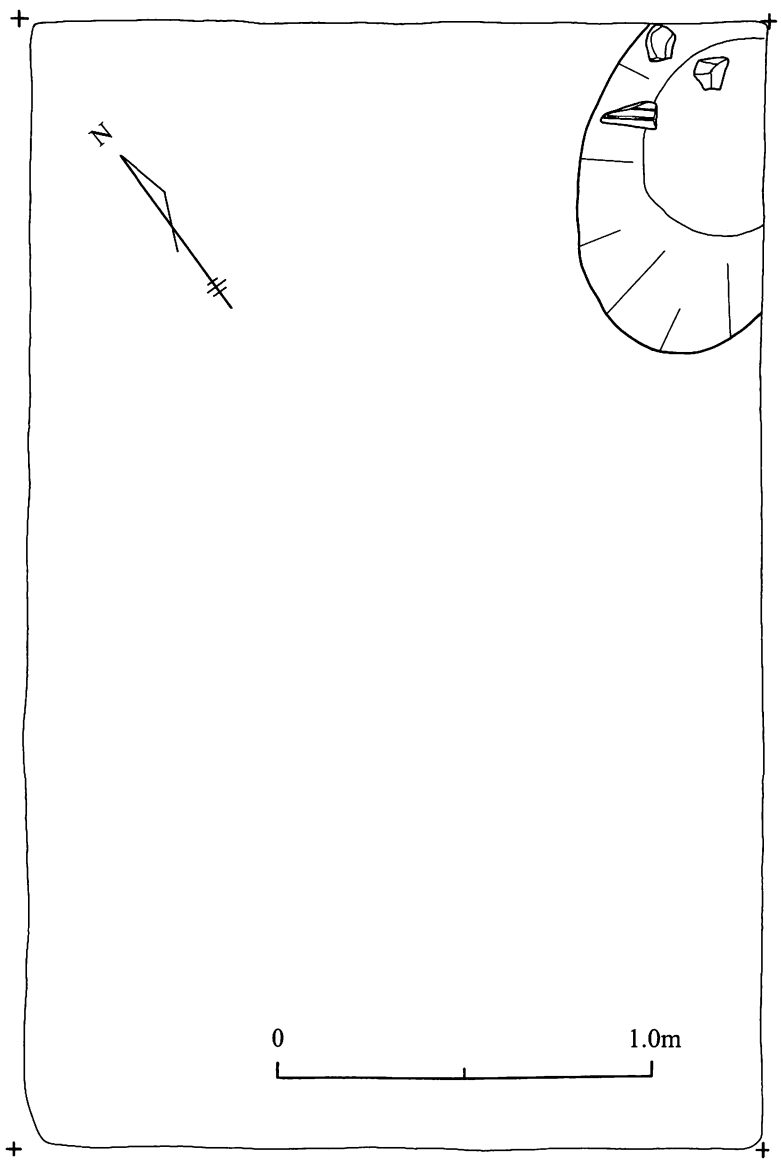



Fig.4.9 Shallow pit in layer 2, Trench D.

pieces were contained in it. It is 20 - 30cm thick. Though a few number of Achaemenid potsherds were obtained, this layer is mostly aceramic character. A large amount of lithic objects (1,006 pieces) began to appear from this layer. They consisted of many micro-blades (Pl.4.24), micro-blade cores (Pl.4.25), small scrapers, some burins, other retouched tools and much debitage from the micro-blade industry. Micro-blades were detached by pressure-flaking. The characteristics of the lithic industry indicate that they are very similar to those from Trench B, i.e. having a Proto-Neolithic affinity.

Layer 4: Orange colored soft soil continued from this layer to the virgin soil. Layer 4 is slightly yellowish orange soil with many angular limestone pebbles. Some charcoal fragments were observed in this layer. This is the thickest cultural deposit in Trench D, measuring about 50 - 80cm in thickness. Many stone artifacts (2,601 pieces) and animal bones came from this layer. No potsherds appeared at all. The characteristics of the lithic assemblage are similar to those of layer 3. However, the blades seemed to be detached not by pressure-flaking but by percussion, though the micro-blades were detached by pressure-flaking. Small scrapers, including side-scrapers, thumbnail-scrapers and round scrapers, are one of the main lithic categories. Small borers on blades (Pl.4.26 left) are among the lithic inventories. Besides the chipped stones, some ground stones, such as pierced disc (Fig.4.10.1, Pl.4.27), grinding slab (Fig.4.10.2, Pl.4.28) and grinding disc (Fig.4.10.3, Pl.4.29 right) were discovered in this layer.

Layer 5: It is an orange soft soil, quite similar to but slightly darker than layer 4. Charcoal, many lithic artifacts (530 pieces) and animal bones were included in this layer. Large limestone rocks were spread in the northern half of the trench, at the same level with the hearth discovered in Trench C (Fig.4.11, Pl.4.30). It is possible that this spread was a part of the working floor. A gazelle horn was discovered at the same level of this stone spread (Pl.4.31). The most remarkable features among the lithic assemblage are an increasing number of blades. On the other hand, the number of micro-blades decreased. A large single plat-formed blade core was discovered in this layer (Pl.4.32). Backed blades and micro-blades were the main types of lithic tools, with end-scrapers on blade (Pl.4.33) and small scrapers (Pl.4.34), including thumbnail and side-scrapers on flakes. Borers and burins were also among them. Besides the chipped stones, a few grinding stones were discovered. One was probably used as a hammer stone (Fig.4.12, Pl.4.29 left). Based on the characteristics of this lithic assemblage, we can assume that layer 5 belongs to the Epi-Paleolithic period, probably the late Zarzian tradition.

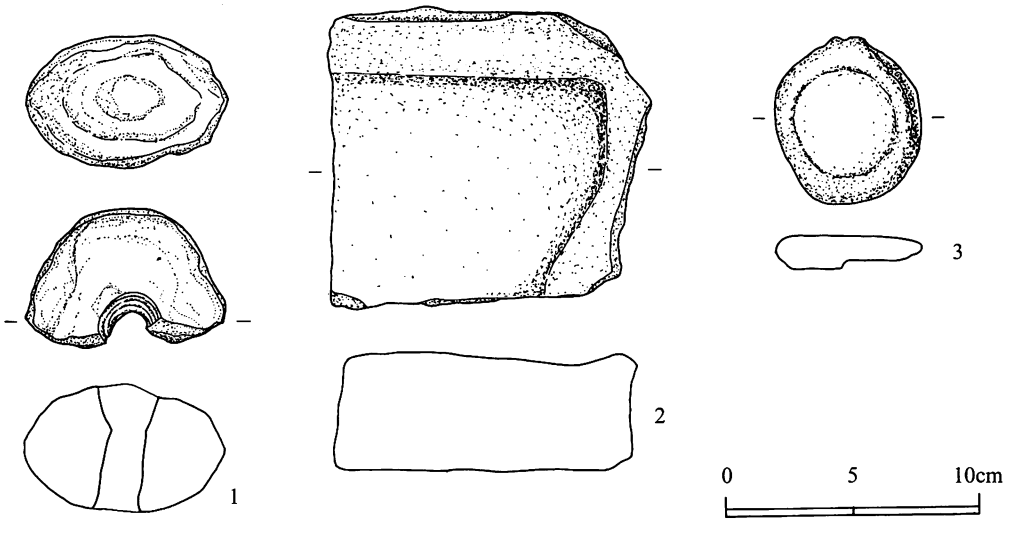



Fig.4.10; 1 Pierced disc; 2 Grinding slab; 3 Grinding disc from layer 4, Trench D.

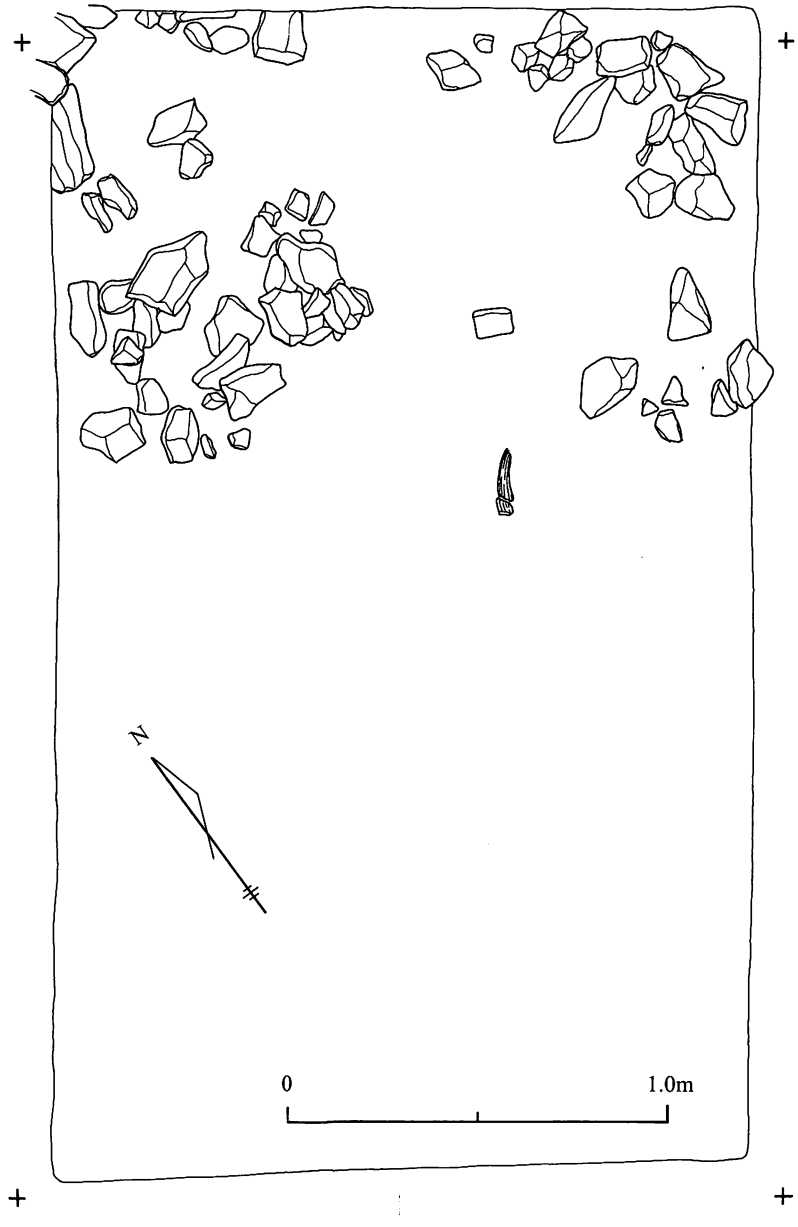



Fig.4.11 Spread of limestone rocks in layer 5, Trench D.

Layer 6: The soil of this layer was an orange-brown color, and many angular limestone pebbles were included. Pebbles are relatively larger than those in layer 5. The thickness of layer 6 is 15 - 35cm. Epi-Paleolithic type lithic artifacts, mostly similar to those in layer 5, came from this layer with a medium amount of animal bones. Among them, backed blades and bladelets (Pl.4.35) existed in large numbers.

Below layer 6, the similar orange-brown colored soil continued with more angular limestone pebbles. However, we did not encounter any lithic artifacts below 1873.20m. Though there is a possibility that earlier cultural deposits will be encountered after the hiatus of thick sterile layers, we judged that this orange-brown soil was naturally accumulated virgin soil.

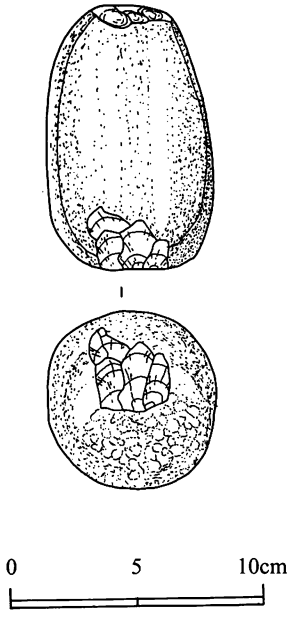



Fig.4.12 Hammer stone from layer 5, Trench D.

The chronological and technical problems of the lithic artifacts will be discussed in Chapter 6. At the moment, we summarize the dates of each layer as follows; Layer 1 is Islamic, layer 2 is Achaemenid, layers 3 and 4 are Proto-Neolithic, and layers 5 and 6 are Epi-Paleolithic.

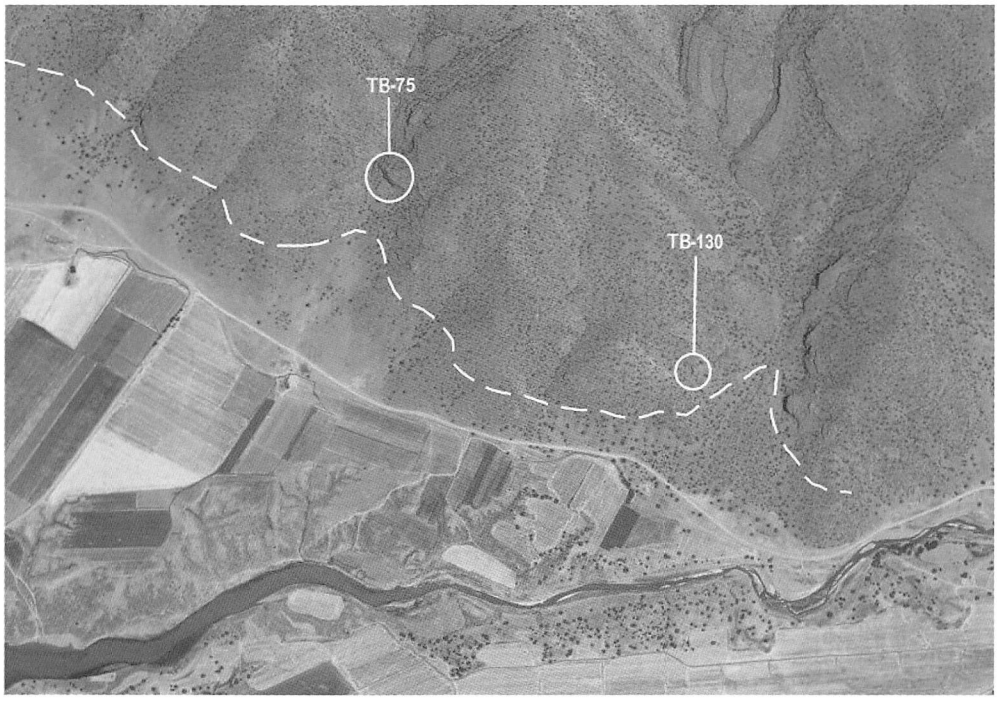



Plate 4.1 Satellite image of the area of TB75 and TB130.

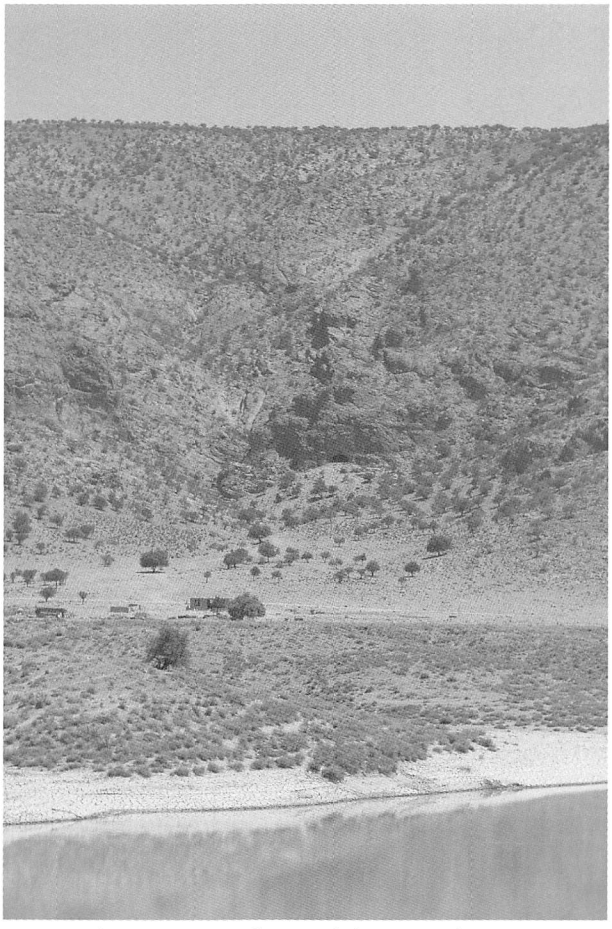


Plate 4.2 TB75 beyond the Sivand River.

Plate 4.3 Distant view of TB75.

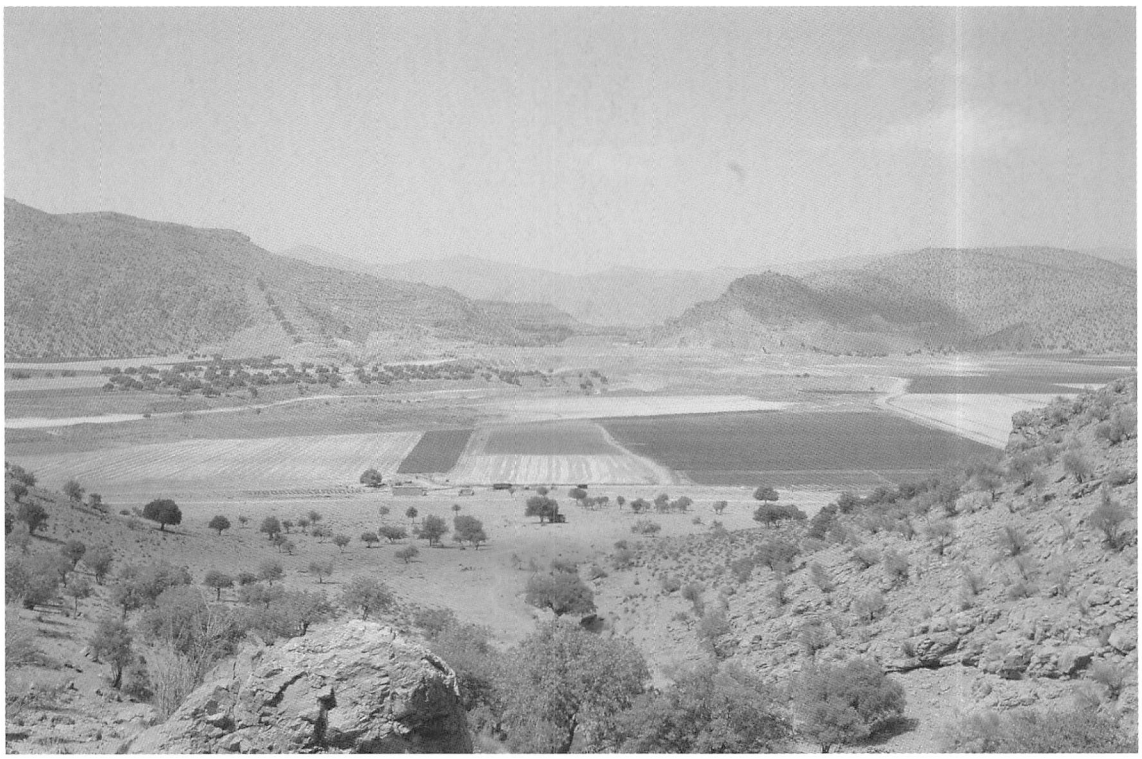


Plate 4.4 Outlook from TB75.

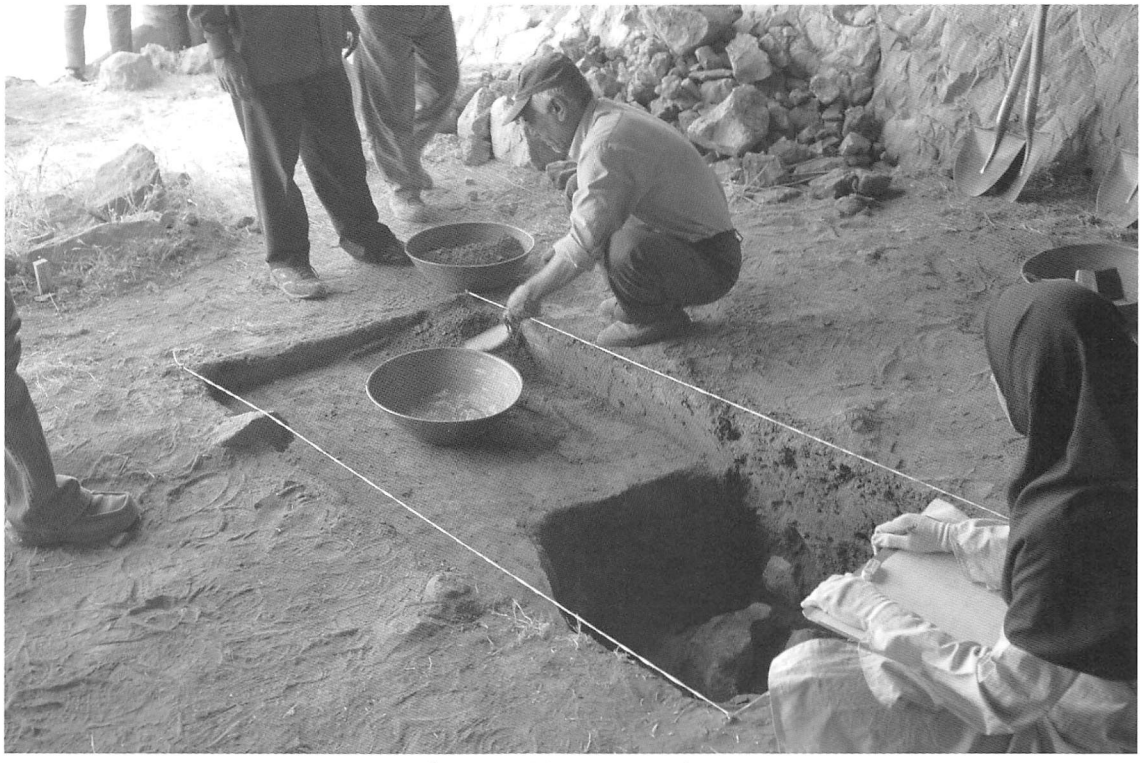


Plate 4.5 Digging Trench A.

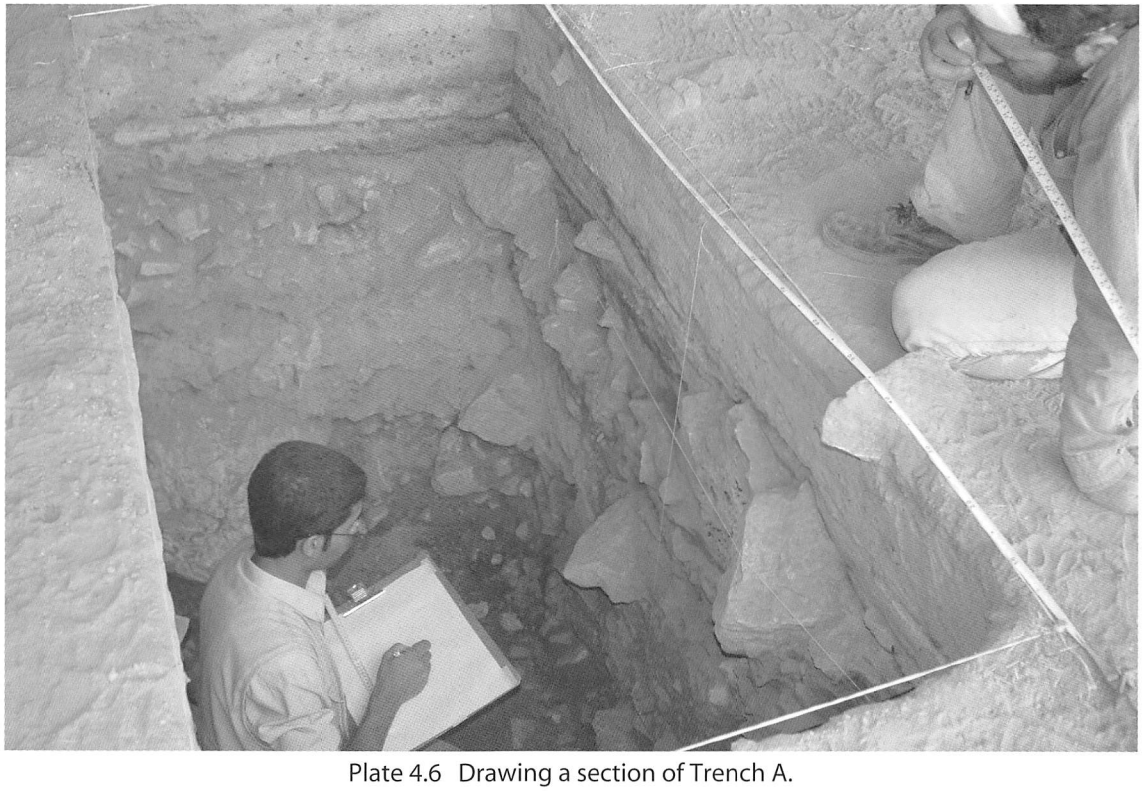


Plate 4.6 Drawing a section of Trench A.

Plate 4.7 Small pit in layer 1 of Trench A.

Plate 4.8 West wall of Trench A.

Plate 4.9 North wall of Trench A.

Plate 4.10 The cave and Trench B.

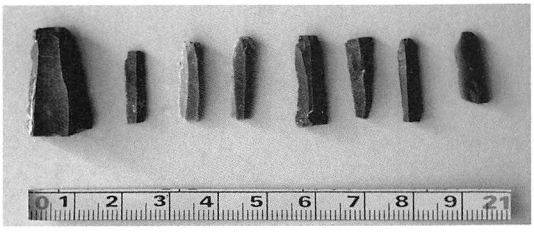


Plate 4.11 Blade and micro-blades from layers 2 and 3, Trench B.

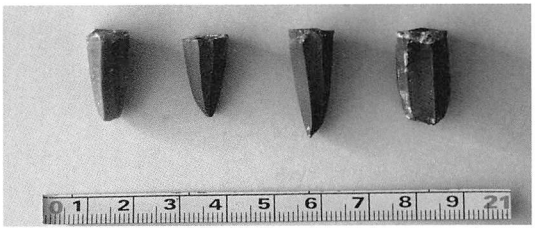


Plate 4.12 Micro-blade cores from layers 2 and 3, Trench B.

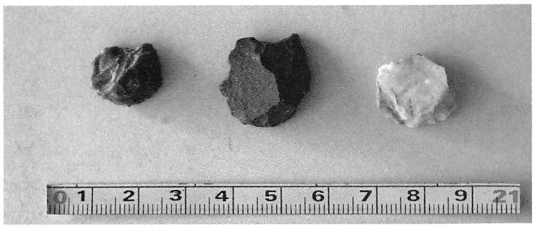


Plate 4.13 Small scrapers from Trench B.

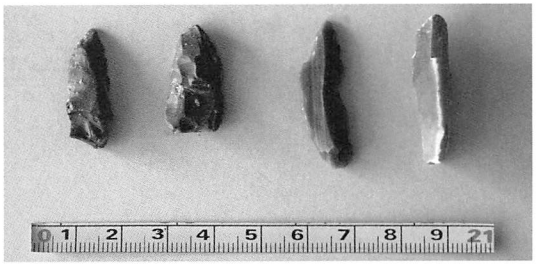


Plate 4.14 Two pointed pieces (layer 2, Trench B), notch (layer 3, Trench B) and burin (layer 4, Trench A) (from the left).

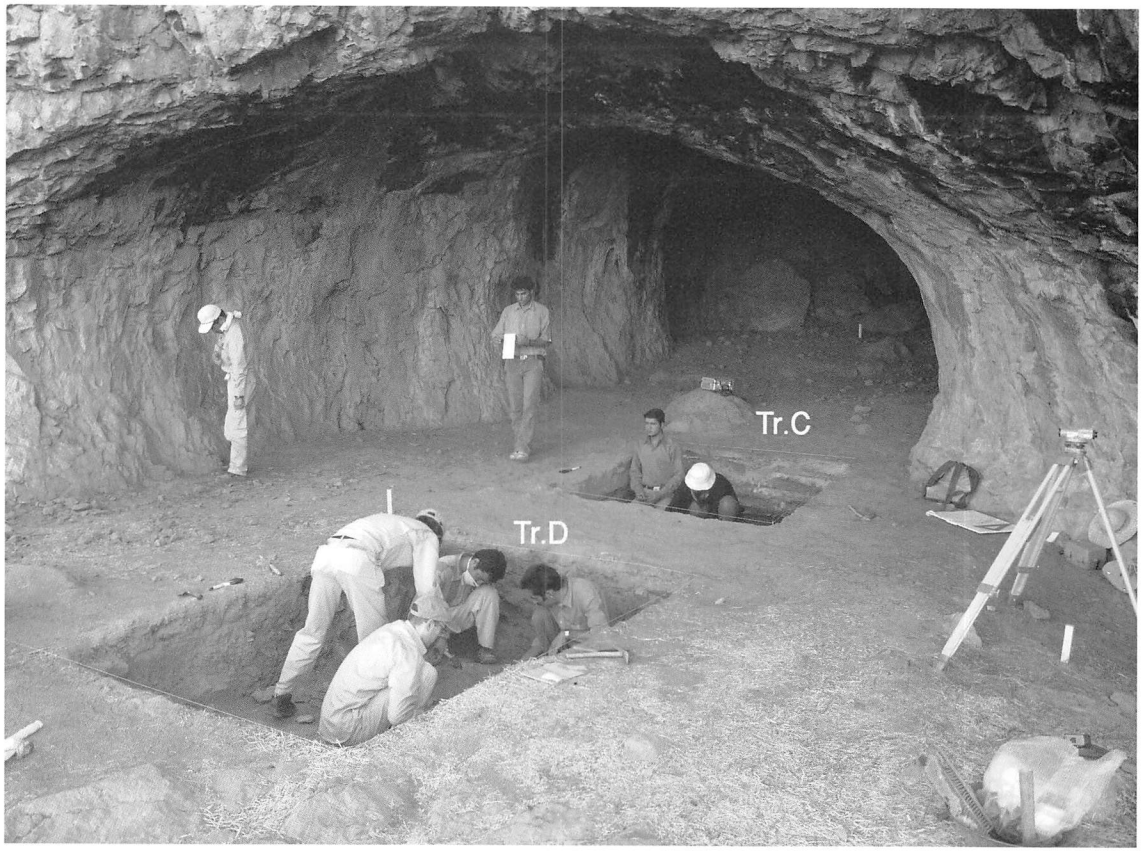



Plate 4.15 Digging Trenches C and D.

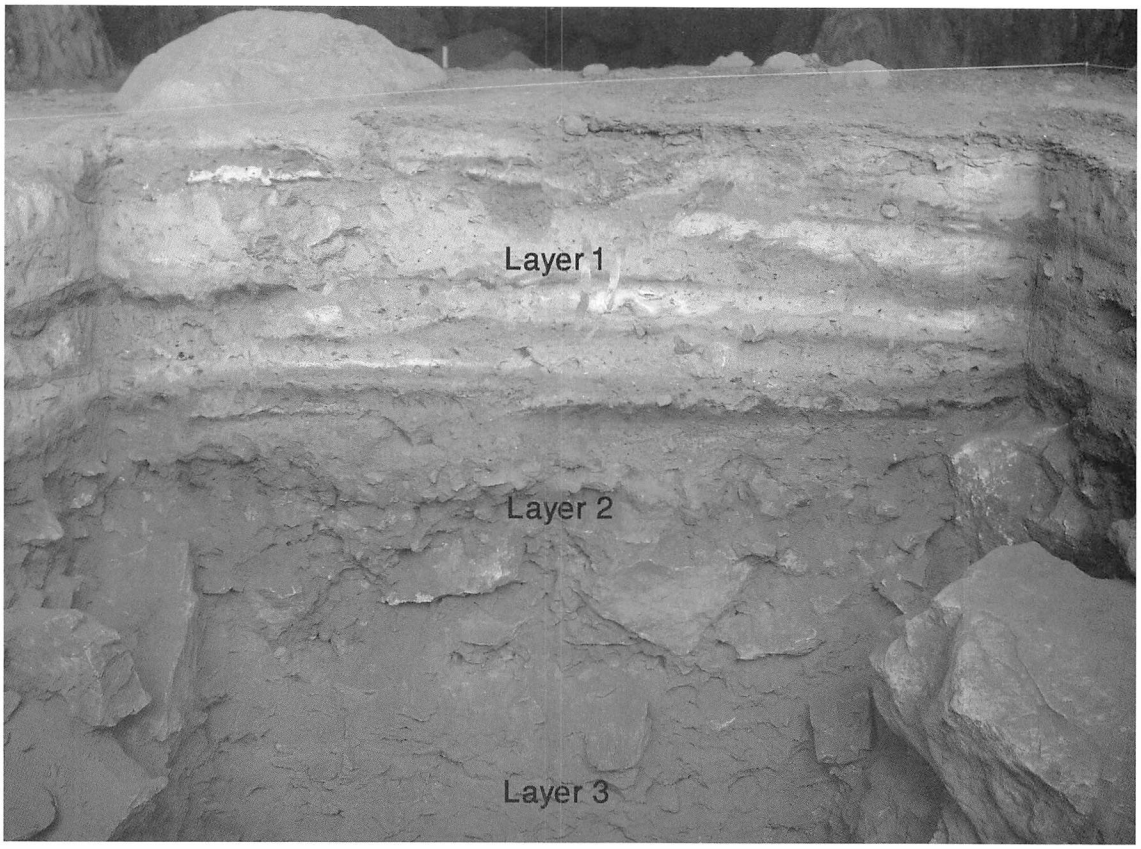



Plate 4.16 Upper layers of the deposits at Trench C.

Plate 4.17 Hearth discovered in layer 1, Trench C.

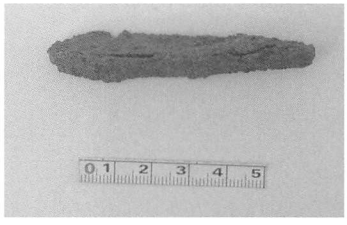



Plate 4.18 Iron trilobate arrowhead from layer 2, Trench C.

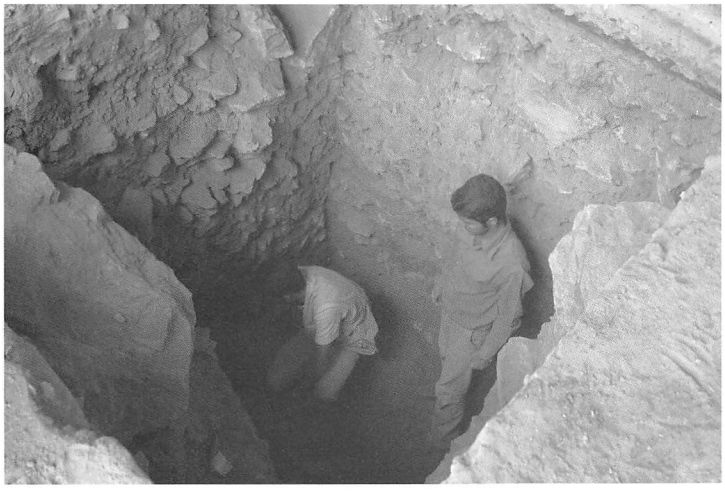


Plate 4.19
Lower layers of the deposits at Trench C.

Plate 4.20
Hearth in layer 5, Trench C.

Plate 4.21 West wall section of Trench D.

Plate 4.22
Shallow pit in layer 2, Trench D.

Plate 4.23
Achaemenid large jar fragments found in layer 2, Trench D.

Plate 4.24 Micro-blades from layer 3, Trench D.

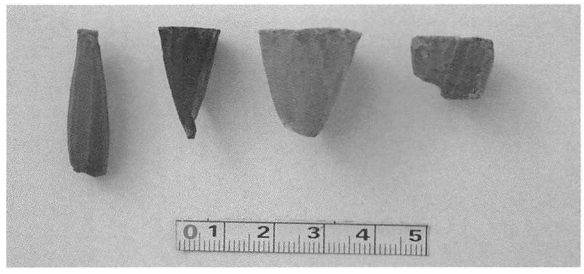


Plate 4.25 Micro-blade cores from layer 3, Trench D.

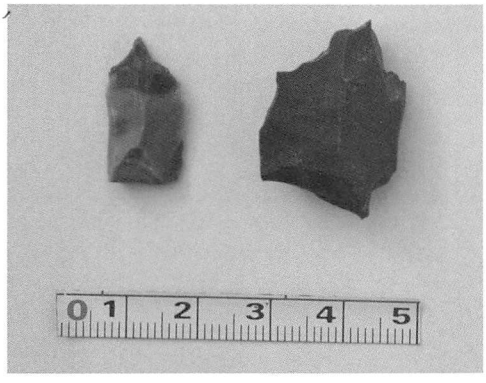


Plate 4.26 Borers from layer 4, Trench D.

Plate 4.27 Pierced disc from layer 4, Trench D.

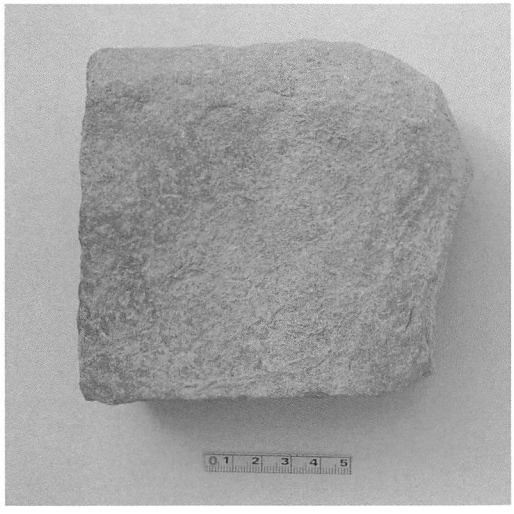


Plate 4.28 Grinding slab from layer 4, Trench D.

Plate 4.29 Grinding stones from layer 5 (left) and layer 4 (right), Trench D.

Plate 4.30 Spread of limestone rocks in layer 5, Trench D.

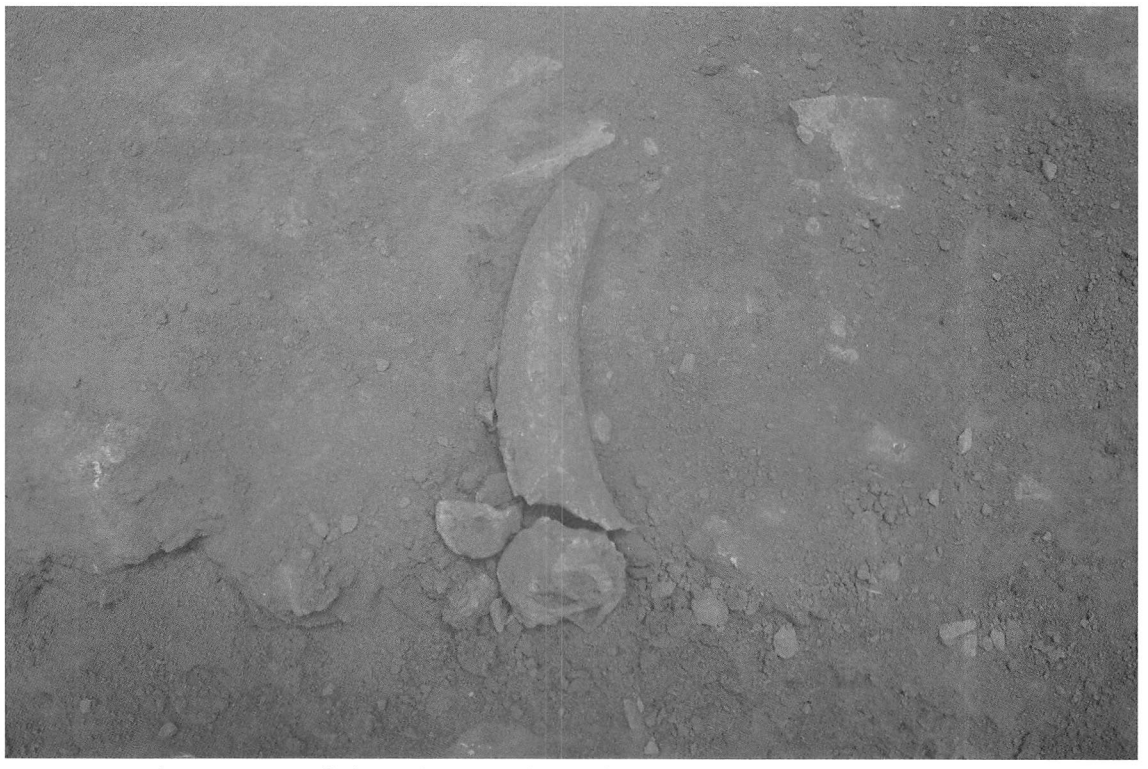


Plate 4.31 Gazelle horn discovered near the stone spread in layer 5, Trench D.

Plate 4.32 Single platformed blade core from layer 5, Trench D.

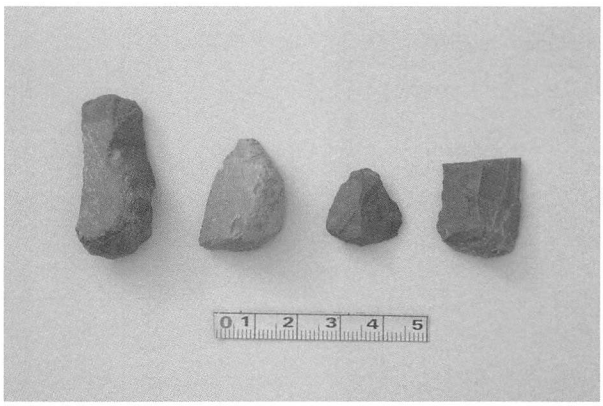


Plate 4.33 End-scrapers from layer 5, Trench D.

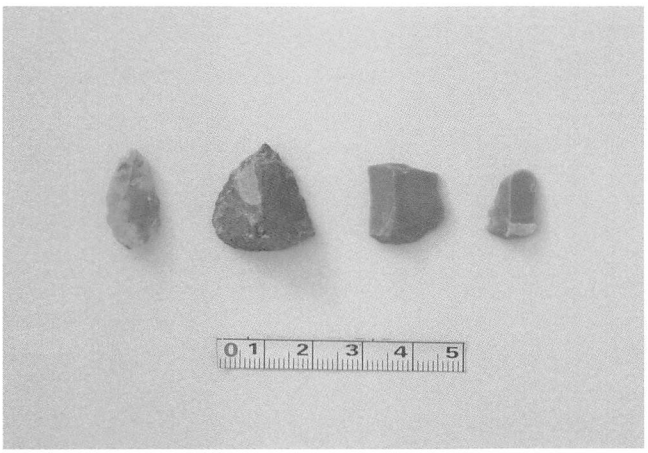


Plate 4.34
Small scrapers from layer 5, Trench D.

Plate 4.35
Backed blades and bladelets from layer 6, Trench D.

# CHAPTER 5

## EXCAVATIONS AT TB130

# 5. EXCAVATIONS AT TB130

Akira TSUNEKI and Mohsen ZEIDI

As mentioned above, the southern slope of Kuh-e Bolaghi Bozorg provided good geological conditions for forming limestone caves. TB130 is one such cave, located about 1.2 km east of TB75. However, TB130 is not so deep so we could call it a shelter rather than a cave (Pl.5.1, 5.2). The shelter is located in the middle of the slope at the western side of a small valley, and a small *wadi* flows from north to south (Pl.5.3). The shelter was formed in the massive limestone protruding to the east. The shelter opens to the southeast and a limited part of the Bolaghi Valley can be viewed from it. The outlook from TB130 is much less open than that of TB75. This is one of the reasons why there were no Achaemenid cultural deposits at TB130. However, the natural environment around TB130, with the exception of perspective, is quite similar to that of TB75. There are large limestone rocks lying about on the slopes in the small valley where TB130 is situated. There is no fertile land for agriculture near the cave other than the alluvium of the Sivand River in the Bolaghi Valley. Wild pistachio and almond trees are scattered on the sterile slopes (Pl.5.4, 5.5). Small sized chert pebbles could be collected both in the front *wadi* and the Sivand River (Pl.5.6).

The opening of TB130 is at 1848 m above sea level, and the height from the front *wadi* is about 30m (Fig.5.1, 5.2). The shelter is 9m wide by 6m long, and the height of the opening is about 9m (Fig.5.3). The interior of the shelter is c.50m$^2$, and the space was filled with recent ash and animal dung. The front terrace slope is steep, and the limestone bedrock is exposed here and there, especially near the shelter. So, the cultural deposits of the upper terrace are very thin and quite limited. On the other hand, relatively thick cultural deposits were observed in the middle and lower terraces, where we collected many chipped stones during our preliminary survey. The existence of these artifacts encouraged us to carry out further excavation because they pointed to the existence of Epi-Paleolithic / Neolithic cultural deposits.

Initially one 2 x 2m trench (Trench A) was sunk inside the shelter, and two 2 x 1m trenches (Trenches B and C) were sunk into the middle of the terrace slope along the north-south axis. Then, another 2 x 1m trench (Trench D) was sunk four meters east of Trench B. As this trench produced part of a prehistoric stone floor, we excavated another 2 x 1m trench (Trench E) adjoining it. Therefore, the excavated area covered 12 m$^2$ in all.

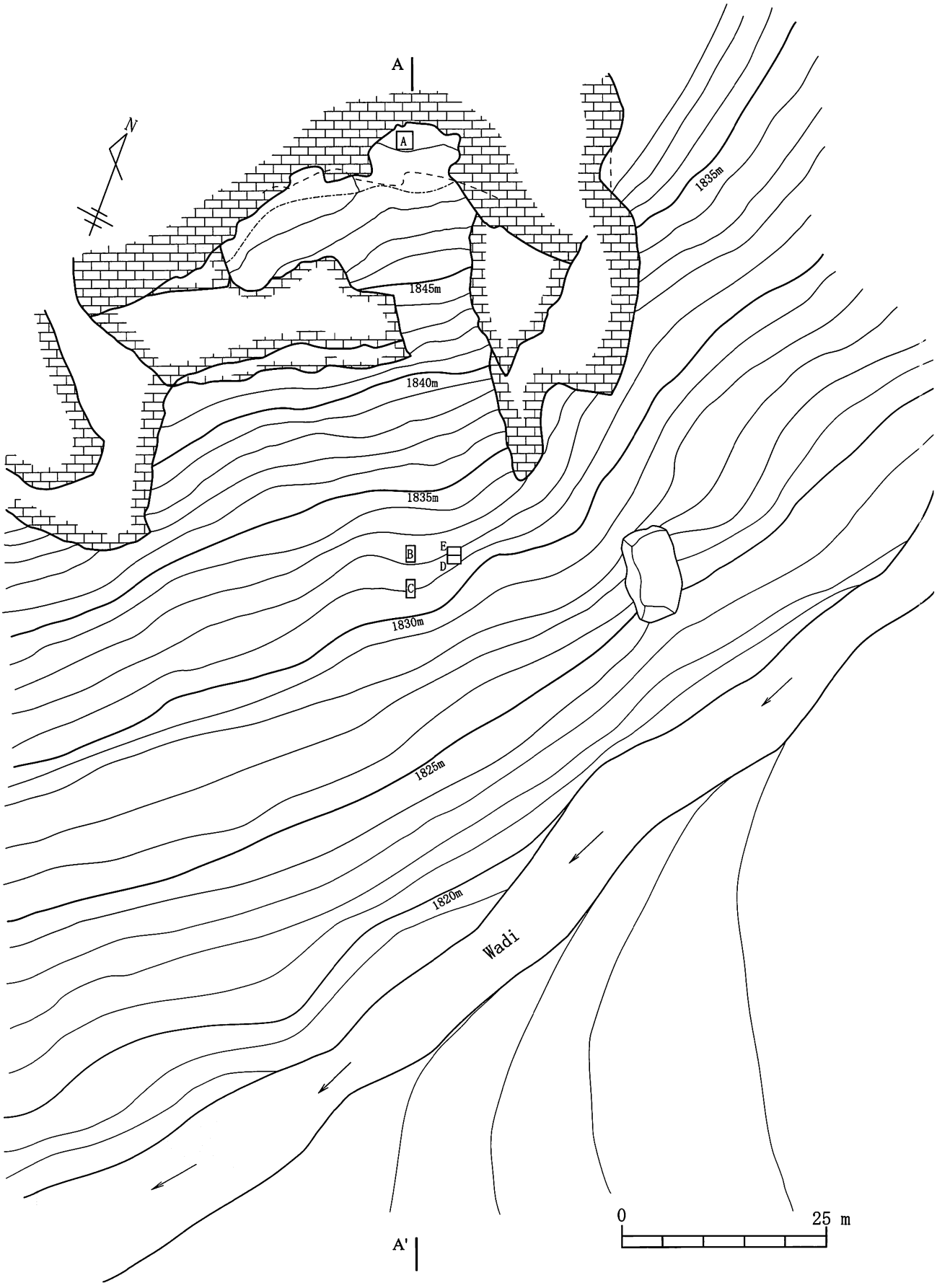



Fig.5.1 Morphological map of TB130.

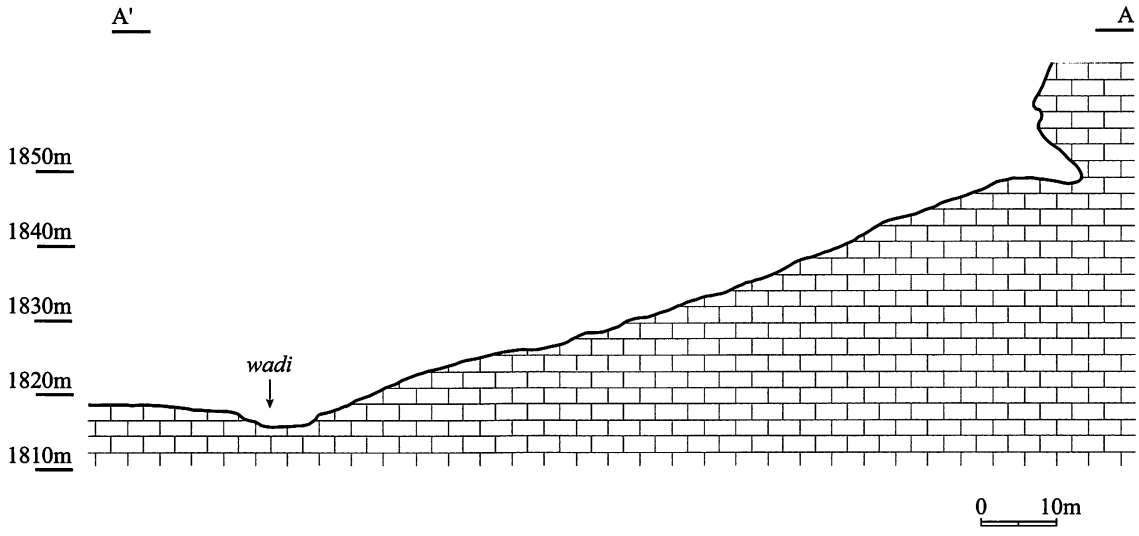



Fig.5.2 Elevation of the shelter and the terrace of TB130.

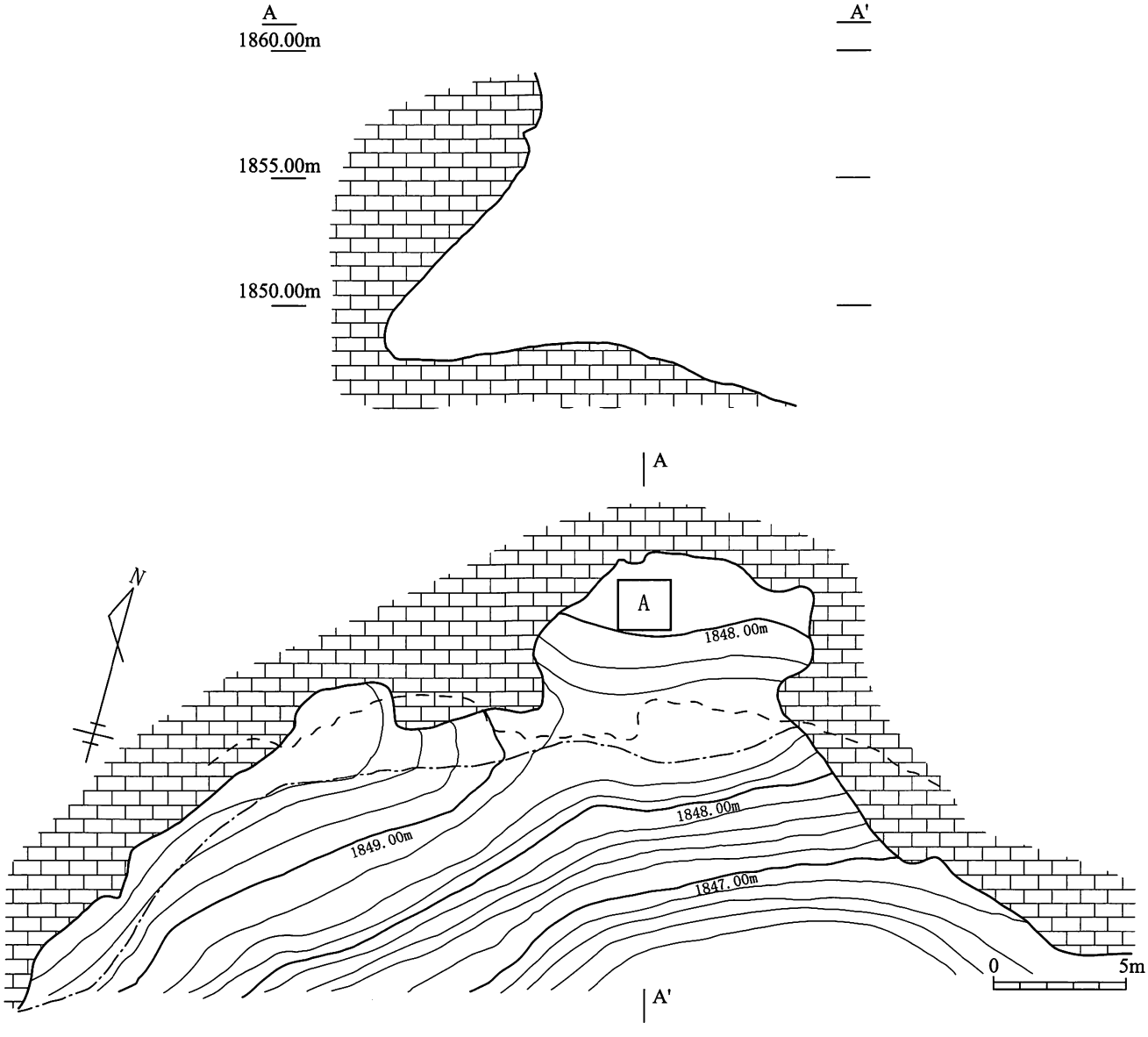



Fig.5.3 Shelter of TB130.

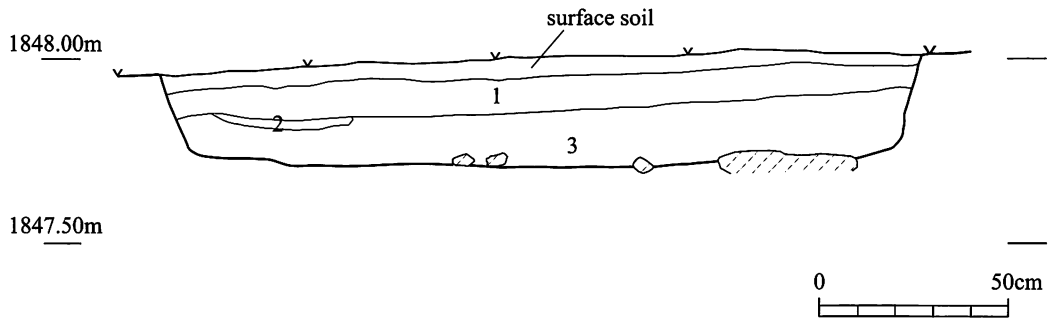



Fig.5.4 East wall section of Trench A.

Trench A
Surface soil. Black color soft soil, containing much animal dung.
1. Very soft white-gray ash.
2. Whitish ash.
3. Soft gray ash with small-sized limestone rocks.
Virgin soil. Orange terra-rossa clay soil with numerous rocks.

All of these trenches, except Trench A, have Proto-Neolithic cultural layers, which produced a considerable number of lithic artifacts and debitage. A rough stone floor was also discovered in Trench D-E. Therefore, it is quite probable that the Proto-Neolithic people used the terrace of TB130 as an workshop area for flint knapping.

## Trench A

A 2 x 2m trench was sunk deep inside the shelter (Pl.5.7). The location of the trench was less than 1m from the back wall of the shelter. Unfortunately, we reached virgin soil and bedrock at a depth of only 0.3m from the surface (Pl.5.8). The trench was filled with black soft soil, white-gray ash, animal dung and limestone pebbles (Fig.5.4). A few modern potsherds were the only artificial objects recovered from digging, and they seem to be very modern. We concluded that the shelter was used only by modern sheepherders, or that the prehistoric cultural deposits had completely eroded away from the shelter. We could not find any evidence that prehistoric people used this shelter.

## Trench B

A 2 x 1 m trench was sunk into the middle of the terrace slope at 1832.7 – 1832.1m. We reached sterile orange brown soil with large limestone rocks, which was finally identified as virgin soil, at a depth of 60 - 70cm from the surface (Fig.5.5, Pl.5.9). Therefore, the thickness of the cultural deposits of this trench was about 60 – 70cm. The deposits between the surface and the virgin soil could be divided into four layers. All of the layers were accumulated slantingly along the surface slope, and we could not identify any structures or leveling activities by the ancient people. The lithofacies of each layer is as follows;

Surface soil: Brown color grassy soil with a few pebbles and roots. It is c.5cm thick.
Layer 1: Gray-brown soil with small limestone pebbles. It is 10 – 15cm thick.
Layer 2: Whitish limestone pebble layer, partly visible in the western part of the trench. It is less than 10cm.
Layer 3: Soft gray soil with many limestone pebbles. It is 20 – 30cm thick.
Layer 4: Light brown soil with many limestone pebbles. It is 15 – 20cm thick.
Virgin soil: Orange brown soil with large limestone rocks

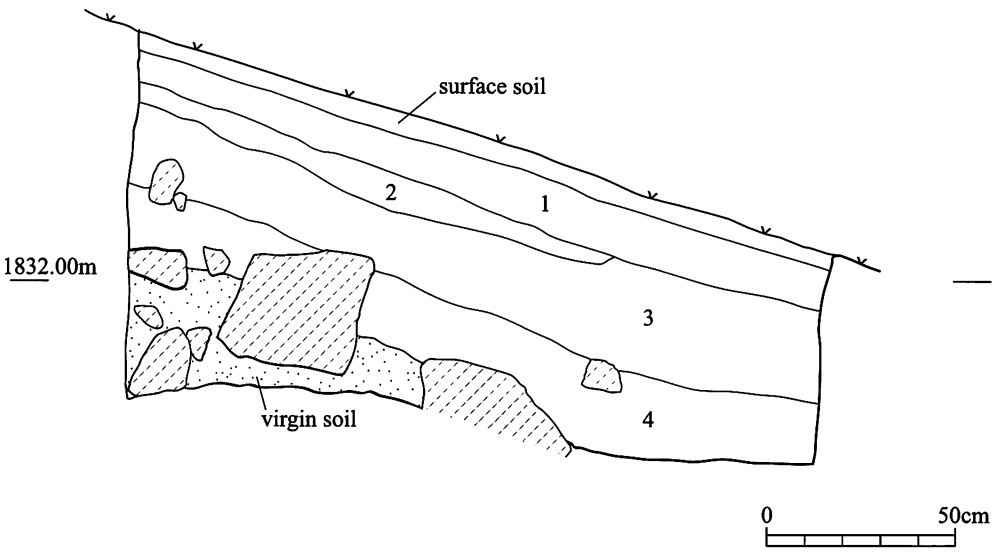



Fig.5.5 East wall section of Trench B.

Trench B
Surface soil. Brown color grassy soil with a few pebbles and roots.
1. Gray-brown soil with small limestone pebbles.
2. Whitish limestone pebble layer.
3. Soft gray soil with many limestone pebbles.
4. Light brown soil with many limestone pebbles.
Virgin soil. Orange brown soil with large limestone rocks.

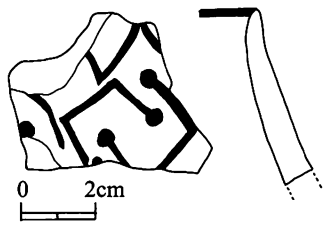



Fig.5.6 Mushki type potsherd discovered in Trench B.

571 chipped stones and 14 potsherds were recovered from the three cultural layers of this trench. Five animal bone fragments comprised the other categorical finds. As for lithic artifacts, micro-blades (Pl.5.10) were the most numerous, and some small scrapers (Pl.5.11 two pieces right in the second row) and retouched or backed blades are considered to be rather popular tools. A few lunates were also found among the tools. Single platform conical micro-blade cores were found in considerable numbers, and core trimming pieces were also numerous. However, the differences between layers are small, and all layers produced similar categories of lithic artifacts.

Compared to the number of chipped stones, the number of potsherds, i.e. fourteen, is quite small and limited. Most of the potsherds came from the surface soil and layer 1. In this sense, we must say that layer 1 was a mixed layer. Although most of potsherds are not diagnostic for their chronological position, at least four of the fourteen potsherds seem to have Neolithic affinities. Others are more recent. It is mysterious that one typical Mushki painted potsherd was discovered among the limestone rocks in layer 4 (Fig.5.6, Pl.5.12). However, it cannot be cotemporaneous with the lithic artifacts, because the latter dates much earlier than the former. Almost all of the lithic artifacts from Trench B seem to date to the Proto-Neolithic period, and they do not belong to the Pottery Neolithic period. Therefore, it must be said that this Mushki potsherd is not in situ, but intrusive from the surface or layer 1. In other cases, most of the terrace deposits were re-accumulated.

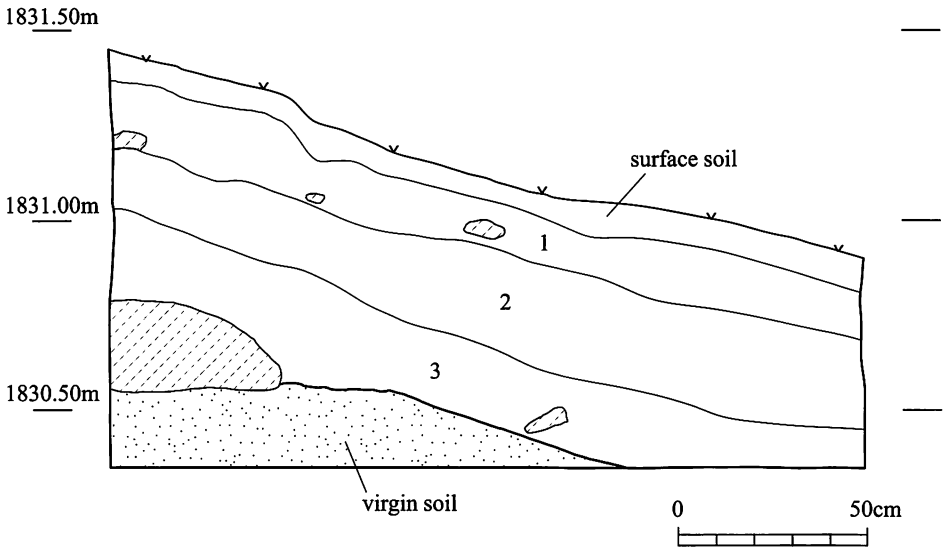



Fig.5.7 East wall section of Trench C.

Trench C
Surface soil. Brown color grassy soil with a few pebbles and roots.
1. Gray-brown soil with many pebbles and a few cobbles.
2. Soft gray soil with very many limestone pebbles.
3. Light brown soil with many limestone pebbles.
Virgin soil. Orange brown soil with large limestone rocks.

## Trench C

A 2 x 1 m trench sunk into the terrace two meters south of Trench B, at 1831 – 1831.5m. The characteristics and the inclination of the cultural deposits are quite similar to those of Trench B. The total thickness between the surface and virgin soil measures 60 – 70cm. Each cultural layer of Trench C is summarized as follows (Fig.5.7) ;

Surface soil: Brown color grassy soil with a few pebbles and roots. It is c. 10cm thick.

Layer 1: Gray-brown soil with many pebbles and a few cobbles. It is 15 – 20cm thick.

Layer 2: Soft gray soil with many limestone pebbles. It is 15 – 25cm thick.

Layer 3: Light brown soil with many limestone pebbles. It is 20 – 30cm thick.

Virgin soil: Orange brown soil with large limestone rocks.

578 chipped stones and 22 small potsherds were obtained from the excavation. Characteristics and composition of the lithic artifacts were very similar to those of Trench B. As for pottery, the existence of the historic potsherds indicates that they were intrusive.

## Trench D - E

Trench D was also dug in the middle of the terrace slope. It is a 2 x 1 m trench located 4m east of Trench B (Pl.5.13). Therefore, the altitude of this trench is almost the same as that of Trench B. The uppermost surface level of this trench is at 1832.6m. As mentioned above, this trench produced part of a stone floor. We laid out another 2 x 1 m trench (Trench E), next to it and these two trenches formed one 2 x 2 m trench as a result.

We dug down about 50cm from the surface and encountered a stone floor, paved with many angular limestone pebbles (Fig.5.8, Pl.5.14). The slope was artificially leveled at first, and then angular limestone pebbles were spread very roughly. The floor level is at 1831.6 –

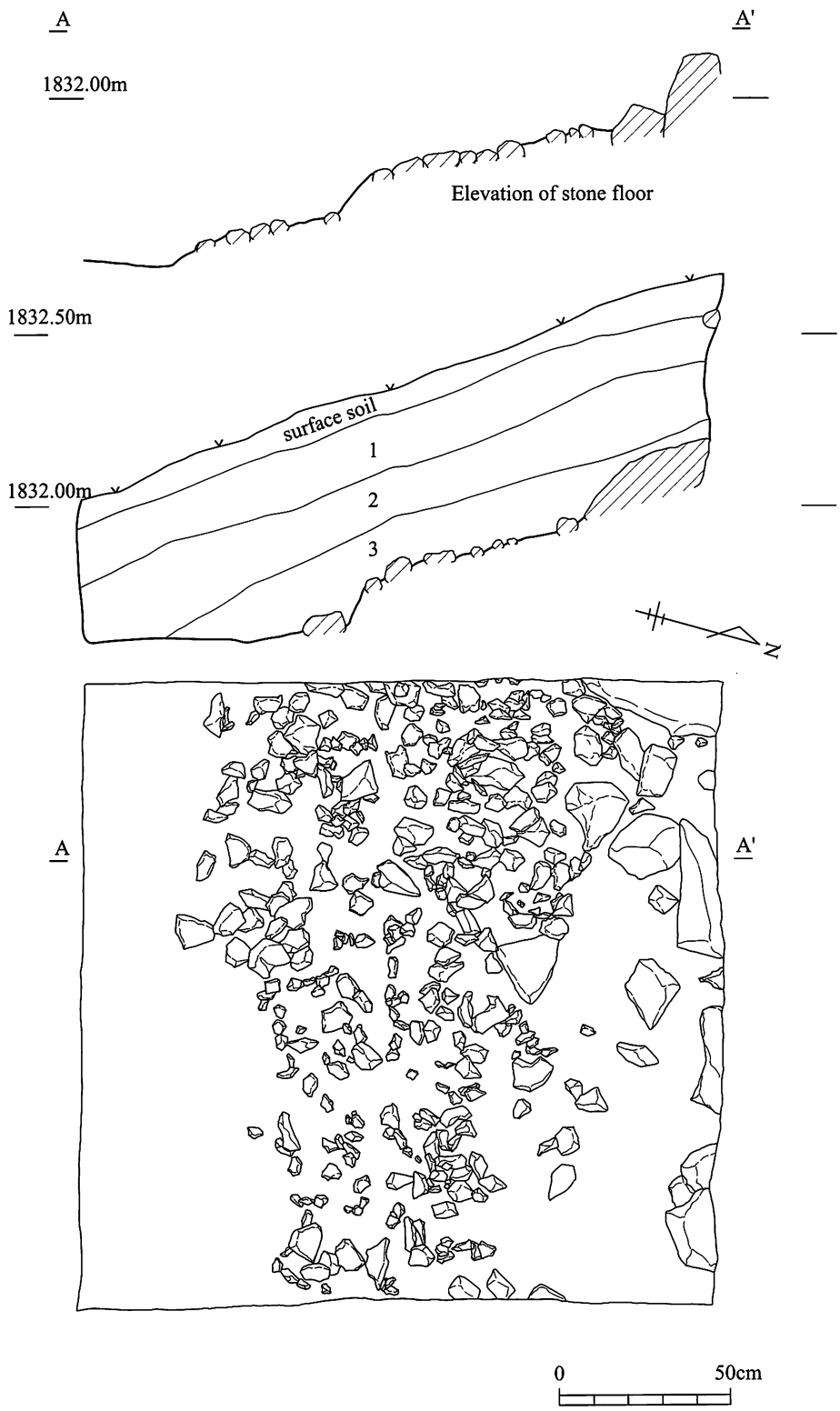



Fig.5.8 Stone floor discovered in Trench D – E and west wall section.

Trench D-E

Surface soil: Brown color grassy soil.

1. Gray-brown soft soil with limestone pebbles.
2. Soft gray ashy soil with limestone pebbles.
3. Reddish gray soil with many limestone pebbles.

1831.9m. The northern edge of the floor seemed to be fringed with a row of large limestone, along the line of the same contour. The extent of the floor is not fixed, because the floor extended out of the trench in two directions. Based on its present condition, the floor seems to have a long and narrow shape, being 1.2 – 1.5m wide. The floor surface is rough and hardened, and it was probably used for working purposes, such as butchering or cooking, rather than for habitation.

As we stopped digging at the level of the stone floor, the exposed cultural deposits are relatively thin, measuring 50 – 60cm. However, we distinguished three cultural layers from the surface soil and the stone floor. The lithofacies of each layer are as follows (Fig.5.8);

Surface soil: Brown color grassy soil. It is 5 - 10cm thick.

Layer 1: Gray-brown soft soil with limestone pebbles. It is c.15cm thick.

Layer 2: Soft gray ashy soil with limestone pebbles. It is 15 – 20cm thick.

Layer 3: Reddish gray soil with many limestone pebbles. It is c.15cm thick.

The characteristics of layers 1 and 2 are similar to those of Trenches B and C. The color of layer 3, the soil accumulated on the stone floor, was slightly different from that of Trenches B and C, but the lithofacies are not so different. We can say safely that the above-mentioned stone floor was formed before the accumulation of layer 3.

All three layers produced a large number of and quite similar chipped stones, consisting mainly of micro-blades, small scrapers (Pl.5.11), retouched / backed blades, and a few geometric microliths (Pl.5.15), notches and burins (Pl.5.16 left and right). A considerable number of micro-blade cores (Pl.5.17) were also discovered. Trench D-E did not produce potsherds. Therefore, all cultural deposits of Trench D-E seem to belong to the aceramic, Proto-Neolithic period.

The chipped stone assemblages discovered from these three trenches on the terrace of TB130 essentially belong to the same lithic industry, or so-called micro-blade industry. Compared with the number of lithic artifacts, the number of potsherds recovered is extremely small. Almost all of the potsherds discovered in Trenches B and C came from the surface and upper layers. On the basis of the relative dating of lithic material, this pottery, even the Mushki specimen from Trench B, must date to a period later than all of the lithic artifacts. As with the material from Trench B of TB75, it seems likely that the upper layers at Trenches B and C of TB130 that contain a mixture of pottery and lithic material have been re-deposited from higher up the slope. It is possible that the lithic artifacts from the layers without pottery could also have been re-deposited. However, there is consistency in the lithic assemblages from the aceramic levels in each trench. This suggests that the lithic material from these lower layers may represent a coherent chipped stone assemblage. Of course, Trenches A, C and D inside the cave at TB75 produced the pure aceramic layers, and there is no doubt about their purity.

The details of each lithic assemblage will be discussed in Chapter 6.

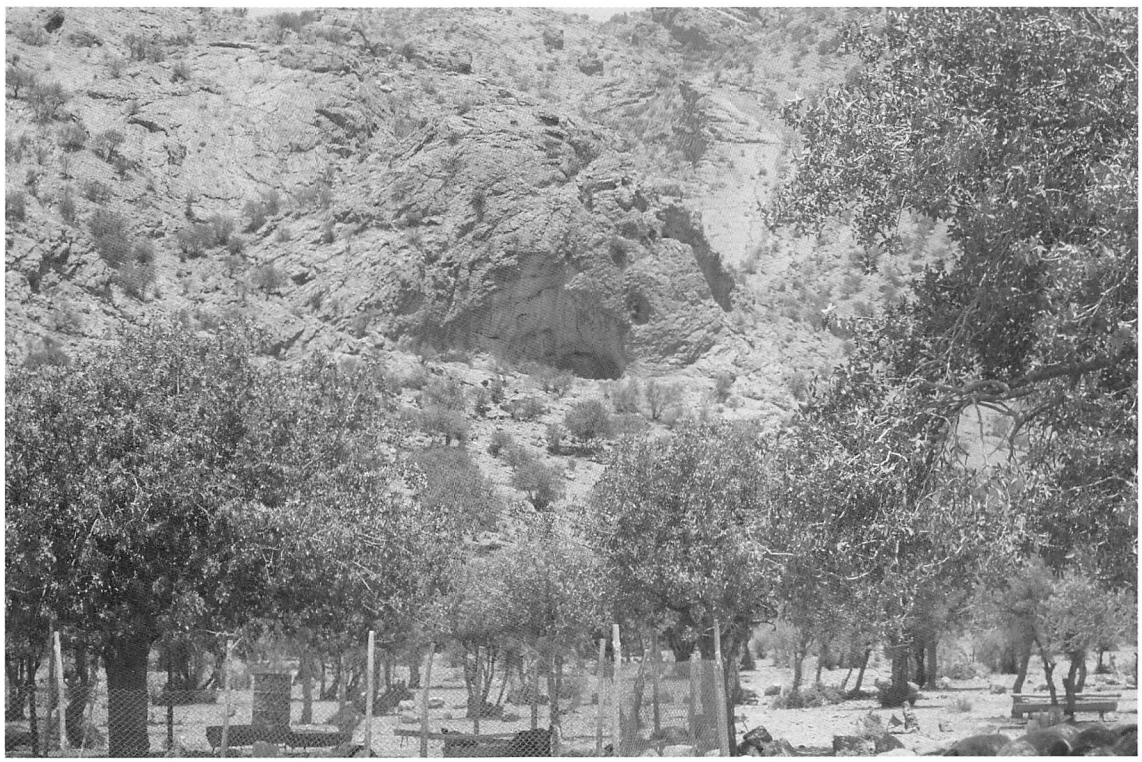


Plate 5.1 Distant view of TB130.

Plate 5.2 Shelter of TB130.

Plate 5.3 *Wadi* flows in front of TB130.

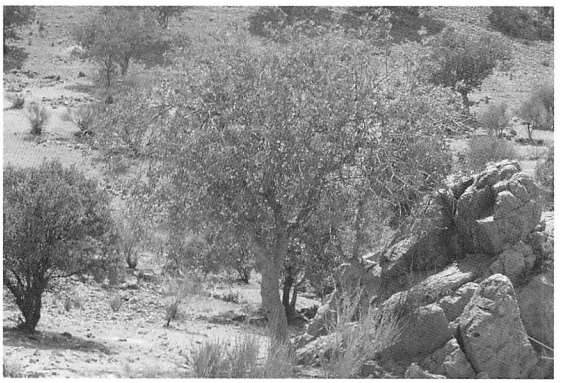


Plate 5.4 Wild pistachio tree on the terrace.

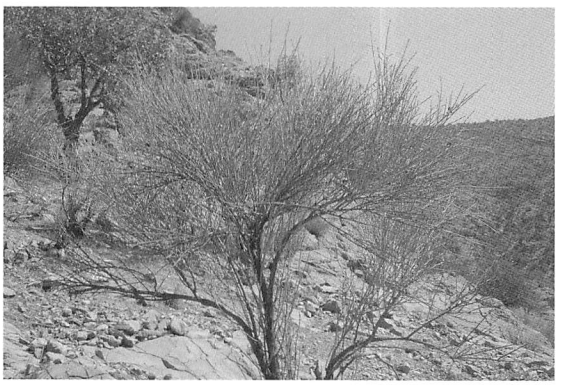


Plate 5.5 Wild almond tree on the terrace.

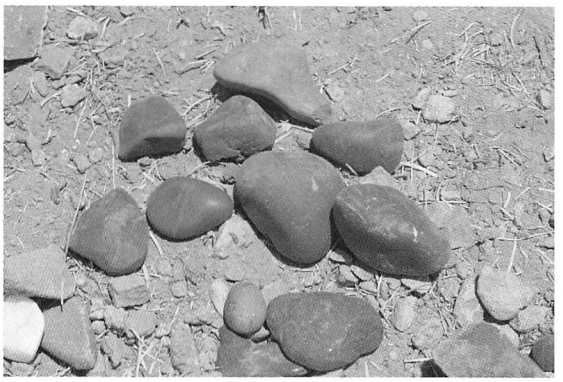


Plate 5.6 Small chert pebbles along the front *wadi*.

Plate 5.7 Digging inside the shelter, Trench A.

Plate 5.8 Trench A.

Plate 5.9 North wall section of Trench B.

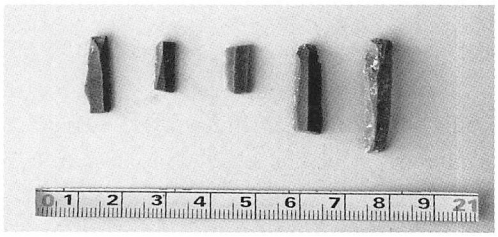


Plate 5.10 Micro-blades from Trench B.

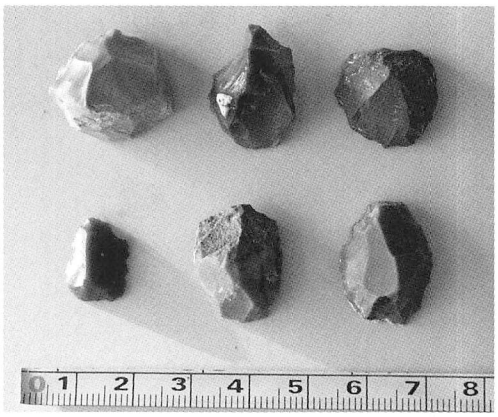


Plate 5.11 Small scrapers from various trenches.

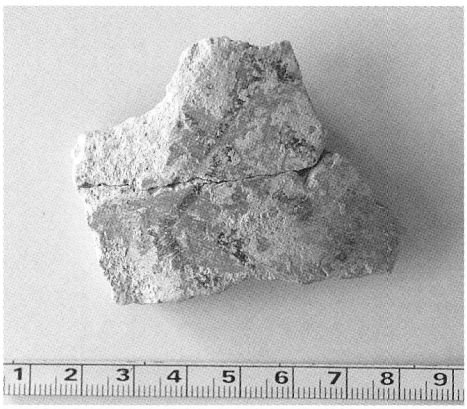


Plate 5.12
Mushki type painted potsherd from Trench B.

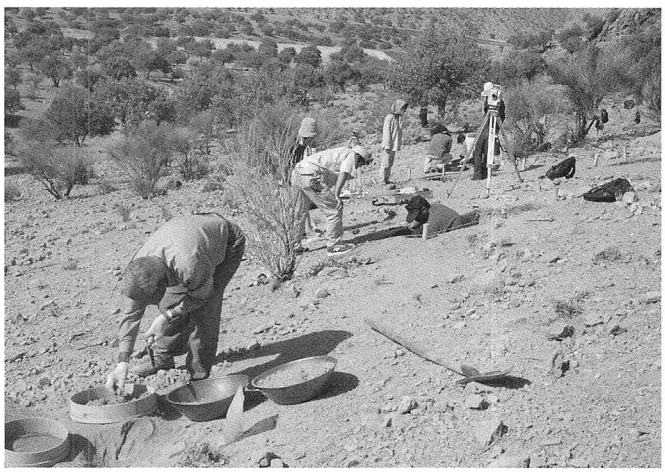


Plate 5.13
Digging Trench D-E on the terrace.

Plate 5.14 Stone floor discovered in Trench D – E.

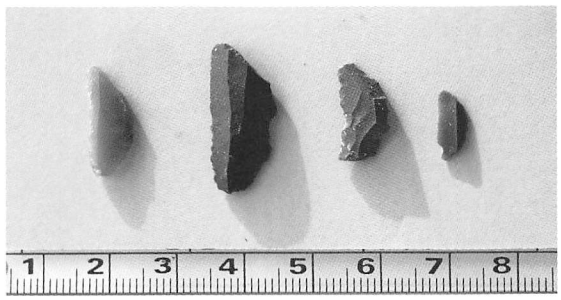


Plate 5.15 Geometric microliths from Trench D – E.

Plate 5.16 Notch, small scraper and burin from Trench D – E (from the left).

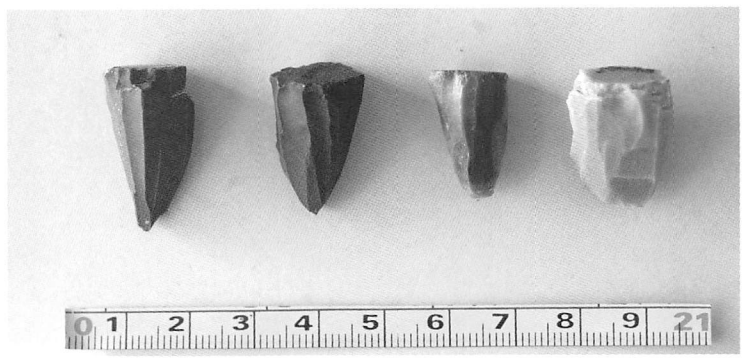


Plate 5.17 Micro-blade cores from Trench D – E.

# CHAPTER 6

## LITHIC ASSEMBLAGES FROM TB75 AND TB130

# 6. LITHIC ASSEMBLAGES FROM TB75 AND TB130

Katsuhiko OHNUMA

## Introduction

This is the report of techno-typology of the lithic assemblages from TB75 and TB130 unearthed in the 2005 and 2006 field seasons. Also to be presented in this report is a hypothetical dating of these lithic assemblages in the Epi-Paleolithic to Proto-Neolithic chronological framework of the Zagros Mountains.

## Overall Description of the Lithic Artifacts (See Appendix for inventories of the lithic artifacts from all of the layers)

The lithic artifacts unearthed from TB75 (Haji Bahrami Cave) and TB130 in the 2005 and 2006 field seasons total 10,703. Of these, unbroken, complete pieces total 3,922 from the 2005 season, consisting of 1,250 pieces from TB75 and TB130, and 2,672 pieces from the 2006 season at TB75.

Manufactured on chert-like flint, the lithic artifacts of TB75 and TB130 vary in colour from dark-brown to green, and the sizes of raw materials are small, especially towards the upper layers. In accordance with the size of raw materials, the largest lithic artifact for the lower Layers 6 and 5 of TB75 is a blade core from Layer 5 measuring 82 mm long, 53 mm wide and 48 mm thick. The lithic artifacts of the upper Layers 4 to 1 are very small, and the largest one except for an end-scraper on blade (53 mm long, 22 mm wide and 6 mm thick) from Layer 4 is the initial core with a single flake scar from Layer 1, measuring 47 mm long, 24 mm wide and 24 mm thick, demonstrating that in Layers 4 to 1 the reduction of cores started using small raw materials in most cases.

Classified into débitage pieces, core rejuvenation flakes, chips or retouch-flakes, retouched pieces and cores, the lithic artifacts bear consistent features throughout the layers in tool typology. The technological features of their manufacture, however, change from

layer to layer gradually and continuously.

The débitage pieces, defined to be intentional flake products derived from core reduction, are classified into cortical flakes, partially-cortical flakes and non-cortical flakes, the last of which are further classified into flakes, blades and micro-blades. Blades are defined here to be flakes with the length equal to or more than twice the width, and micro-blades are defined to be blades of which the width is less than 1.2 cm.

Few traces of cresting operation for the production of blades and micro-blades are recognized, indicating that in most cases the detachment of blades and micro-blades started following ridges left by the removal of one or two flakes at the beginning of core reduction, and not following crested ridges prepared on core surface prior to the start of blade and/or micro-blade core reduction.

The shapes of the blade cores are mainly prismatic, and those of the micro-blade cores are conical, pyramidal and prismatic, but only a few examples of the typical "bullet" core for micro-blades were unearthed.

The core rejuvenation flakes consist of core tablets, core bottom flakes, core-surface removing flakes and change of orientation flakes.

The chips are defined here to be bi-product flakes from core reduction, and the retouch-flakes are defined to be flakes from retouch modification. It is difficult, however, to differentiate these two unless they are refitted. Included in the retouch-flake categories are burin spalls and edge-rejuvenation flakes of end-scrapers.

The retouched pieces consist of tools and/or weapons such as backed pieces, notched pieces, side-scrapers, end-scrapers, thumb-nail scrapers and burins. They are very small in most cases, and many of them can be defined to be non-geometric microliths, such as backed, retouched and notched micro-blades. Added to the non-geometric microliths are geometric microliths of the lunate and trapezoid categories, though small in number.

It is noteworthy that pressure-flaked blades, characteristic of the later Neolithic industries in the region, were not unearthed at all. Also noteworthy is the absence of heat treatment, a technological operation said to have been invented in Neolithic period to improve the quality of raw materials to make easier the manufacture of lithic artifacts by pressure. In addition, no pieces with sickle gloss to testify harvesting of planted cereals were unearthed.

No micro-burins were unearthed, and their absence at TB75 and TB130 strongly suggests that the geometric microliths from the sites were manufactured by means of retouching on micro-blades, and not by the micro-burin technique. This suggestion is supported by the widths of the micro-blades themselves, 2 to 5 mm and those of the geometric microliths which are smaller.

The absence of the micro-burin technique at TB75 and TB130 leads us to suppose that this technique had been already ceased to use by the inhabitants of Tang-e Bolaghi or had not ever been known in the area.

## Layer by Layer Description of Lithic Artifacts of TB75 and TB130

This section describes the lithic artifacts from the layers of TB75 and TB130 with specimens numerous enough for discussion as assemblages.

### TB75

Layer 6 of Trench D (2006: 580 pieces): Round scrapers (Fig.6-1-1) represent the retouched pieces (Fig.6-1-4, 5, 6). Non-geometric microliths such as backed micro-blades (Fig.6-1-7, 8) exist in a considerably large number. The shapes of flake/blade/micro-blade

cores are prismatic (Fig.6-1-9, 10). Both the blades and micro-blades or small blades (Fig.6-1-2, 3) are detached by percussion from the same cores, and the core reduction ended with the final detachment of a micro-blade or small blade.

Layer 5 of Trench D (2006: 530 pieces): Retouched pieces (Fig.6-2-1, 2, 3, 6) include end-scrapers (Fig.6-2-4) and thumb-nail scrapers (Fig.6-2-5). Non-geometric microliths, backed micro-blades in particular, exist in a considerably large number. The shapes of the cores of the blades (Fig.6-2-7) and/or micro-blades are mainly prismatic. Like in Layer 6, both the blades and micro-blades were detached by percussion from the same cores until core reduction ended with the final detachment of a micro-blade or small blade. The cores of this kind do not exhibit such regularity as is seen on the micro-blade cores from the upper layers.

Layer 4 of Trench C (2006: 141 pieces): Retouched pieces include end-scrapers (Fig.6-3-1), burins and thumb-nail scrapers. Non-geometric microliths such as backed micro-blades (Fig.6-3-2) exist. One geometric microlith of the trapezoid category (Fig.6-3-4) was unearthed, which measures 22 mm long, 10 mm wide and 4 mm thick. This size is bigger than those of the geometric microliths from the upper Layer 2 of Trench B and Layer 2 of Trench E of TB130. The cores for flakes and blades are reduced by percussion, and the micro-blade cores are reduced by pressure.

Layer 4 of Trench D (2006: 2,601 pieces): Retouched pieces include side-scrapers, end-scrapers, thumb-nail scrapers, round scrapers, denticulated pieces and notched pieces. Non-geometric microliths such as backed micro-blades exist. The cores (Fig.6-3-9) for flakes and blades are irregular or prismatic in shape and reduced by percussion, and the micro-blade cores are prismatic or conical in shape and reduced by pressure (Fig.6-3-7). It is noteworthy that the inhabitants at TB75 of this layer period tried to pressure-flake micro-blades from the raw materials used for blade production by percussion, splitting them into the size appropriate to start micro-blade production by pressure. The cores of this kind show that with these raw materials the inhabitants did not succeed in detaching micro-blades as they wanted, resulting in quick abandonment of cores at the very beginning of the core reduction. In this regard, it is highly probable that the inhabitants started to collect at some distant place raw materials of quality good enough for micro-blade production by pressure. This kind of raw materials is very glassy and of fine texture.

Layer 3 of Trench B (2005: 1,145 pieces): Retouched pieces (Fig.6-3-3) include notched pieces (Fig.6-3-5), side-scrapers, end-scrapers, thumb-nail scrapers (Fig.6-3-6) and retouched blades. Non-geometric microliths such as retouched micro-blades exist. The cores for flakes and blades are of irregular shape and reduced by percussion, and the micro-blade cores are conical in shape and reduced by pressure.

Layer 3 of Trench C (2006: 347 pieces): Retouched pieces (Fig.6-4-7) include side-scrapers and thumb-nail scrapers. Non-geometric microliths such as side-scrapers and transversal scrapers exist. The cores for flakes and blades are reduced by percussion, and the micro-blade cores, conical or prismatic in shape, are reduced by pressure quite elaborately, 2 of them being qualified to be called "bullet" type (Fig.6-4-8).

Layer 3 of Trench D (2006: 1,006 pieces): Retouched pieces include side-scrapers, notched pieces (Fig.6-4-6) and thumb-nail scrapers (Fig.6-4-5). Non-geometric microliths such as backed micro-blades and side-scrapers exist (Fig.6-4-1). The cores for flakes and blades are prismatic in shape and reduced by percussion, and the micro-blade cores are prismatic and conical in shape (Fig.6-4-11), exhibiting a great deal of regularity on the flaking surface. The reduction of micro-blade cores by pressure used raw materials different from those used for the blade core reduction.

Layer 2 of Trench B (2005: 404 pieces): Retouched pieces (Fig.6-5-1) include side-scrapers and end-scrapers. Non-geometric microliths such as backed micro-blades exist. Geometric microliths of the lunate category also exist. The cores for flakes and blades are of

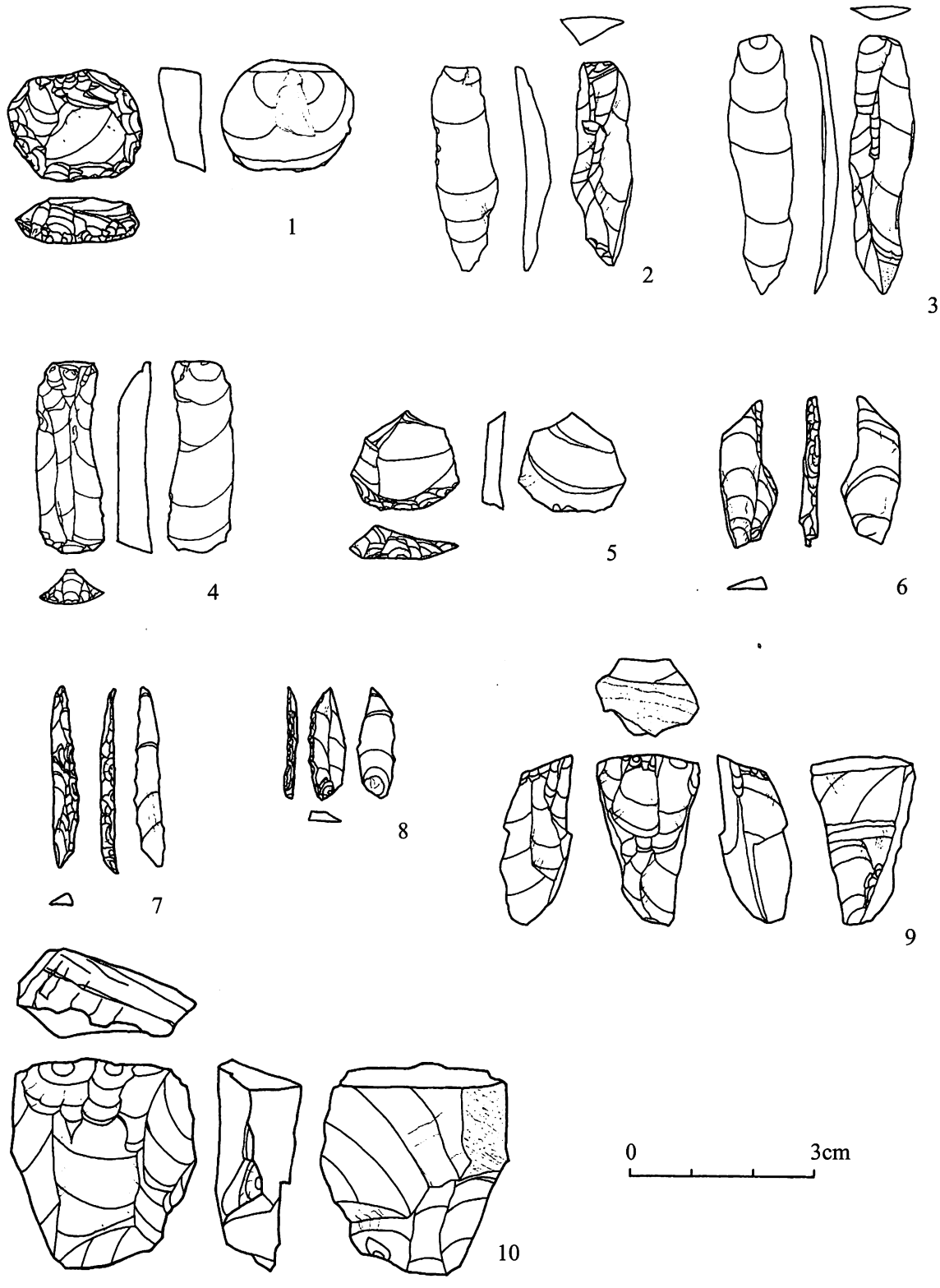



Fig.6.1 Lithic artifacts of Phase 1 (All of the artifacts are from Layer 6 of Trench D, Tang-e Bolaghi 75).

1. Round scraper; 2. Blade or micro-blade; 3. Blade or micro-blade; 4. End-scraper; 5. Thumb-nail scraper; 6. Notched piece; 7. Backed micro-blade; 8. Backed micro-blade; 9. Prismatic core; 10. Prismatic core

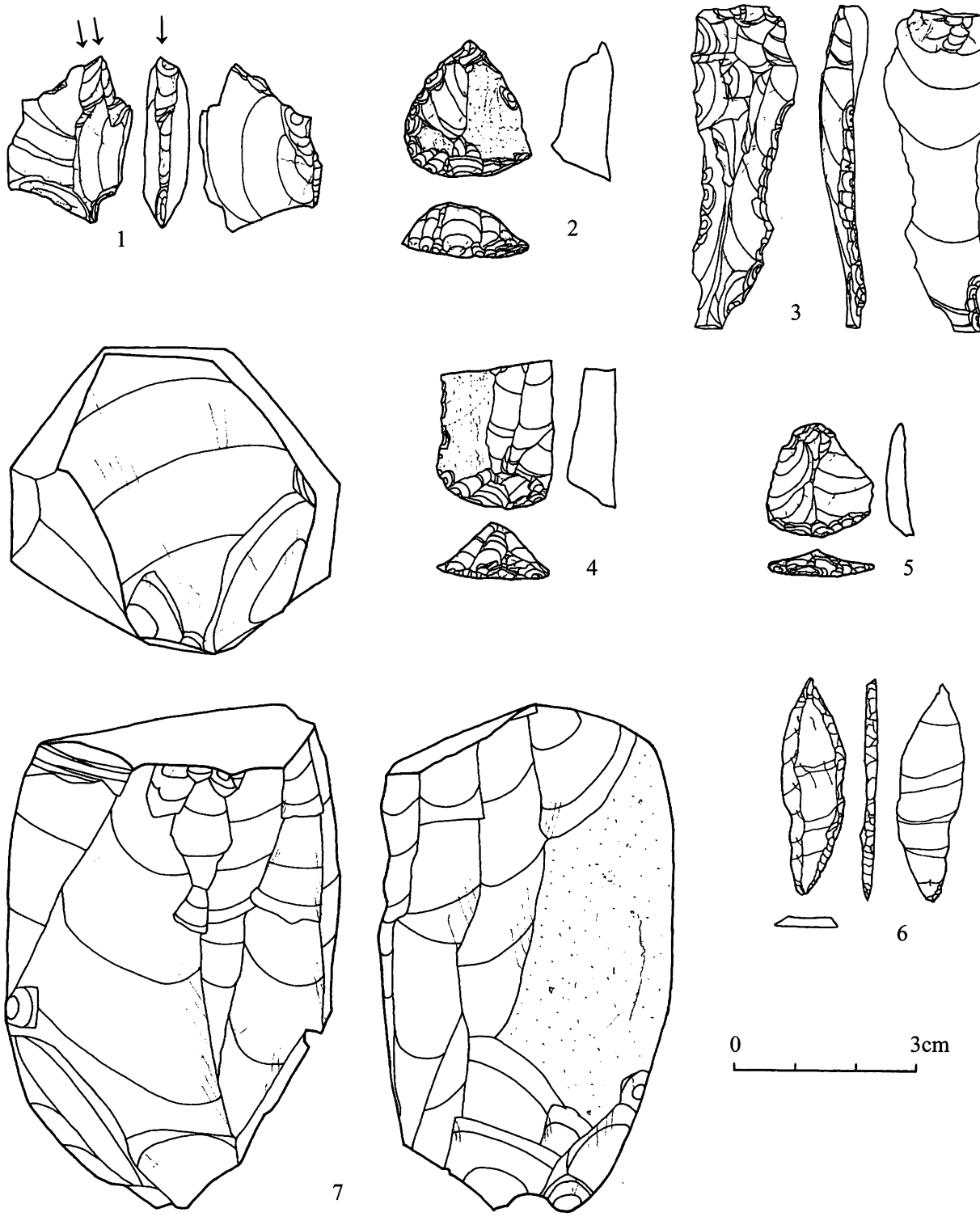



Fig.6.2 Lithic artifacts of Phase 2 (All of the artifacts are from Layer 5 of Trench D, Tang-e Bolaghi 75).

1. Burin on a retouched truncation; 2. Scraper; 3. Denticulated piece; 4. End-scraper; 5. Thumb-nail scraper; 6. Backed blade; 7. Prismatic core for blades

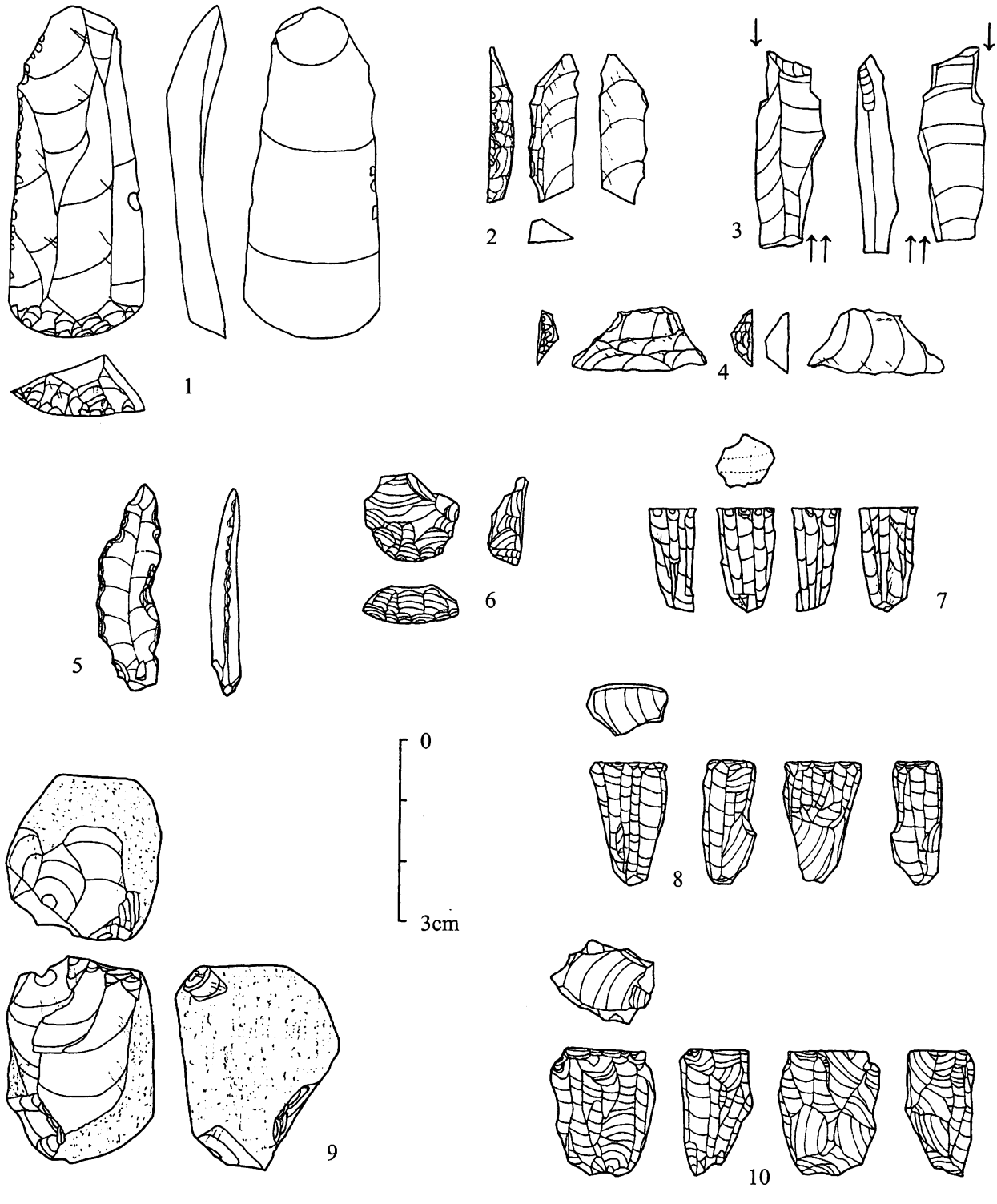



Fig.6.3 Lithic artifacts of Phase 3 (TB: Tang-e Bolaghi / Tr: Trench / L: Layer).
1. End-scraper (TB75/TrC/L4); 2. Backed micro-blade (TB75/TrC/L4); 3. Burin on a break probably of Phase 3 (TB75/TrB/L3); 4. Geometric microlith of the trapezoid category (TB75/TrC/L4); 5. Notched/Denticulated blade probably of Phase 3 (TB75/TrB/L3); 6. Thumb-nail scraper probably of Phase 3 (TB75/TrB/L3); 7. Conical core for micro-blades (TB75/TrD/L4); 8. Prismatic core for micro-blades (TB130/TrB/L4); 9. Prismatic core for micro-blades at the initial stage of reduction (TB75/TrD/L4); 10. Prismatic core for micro-blades (TB130/TrB/L4)

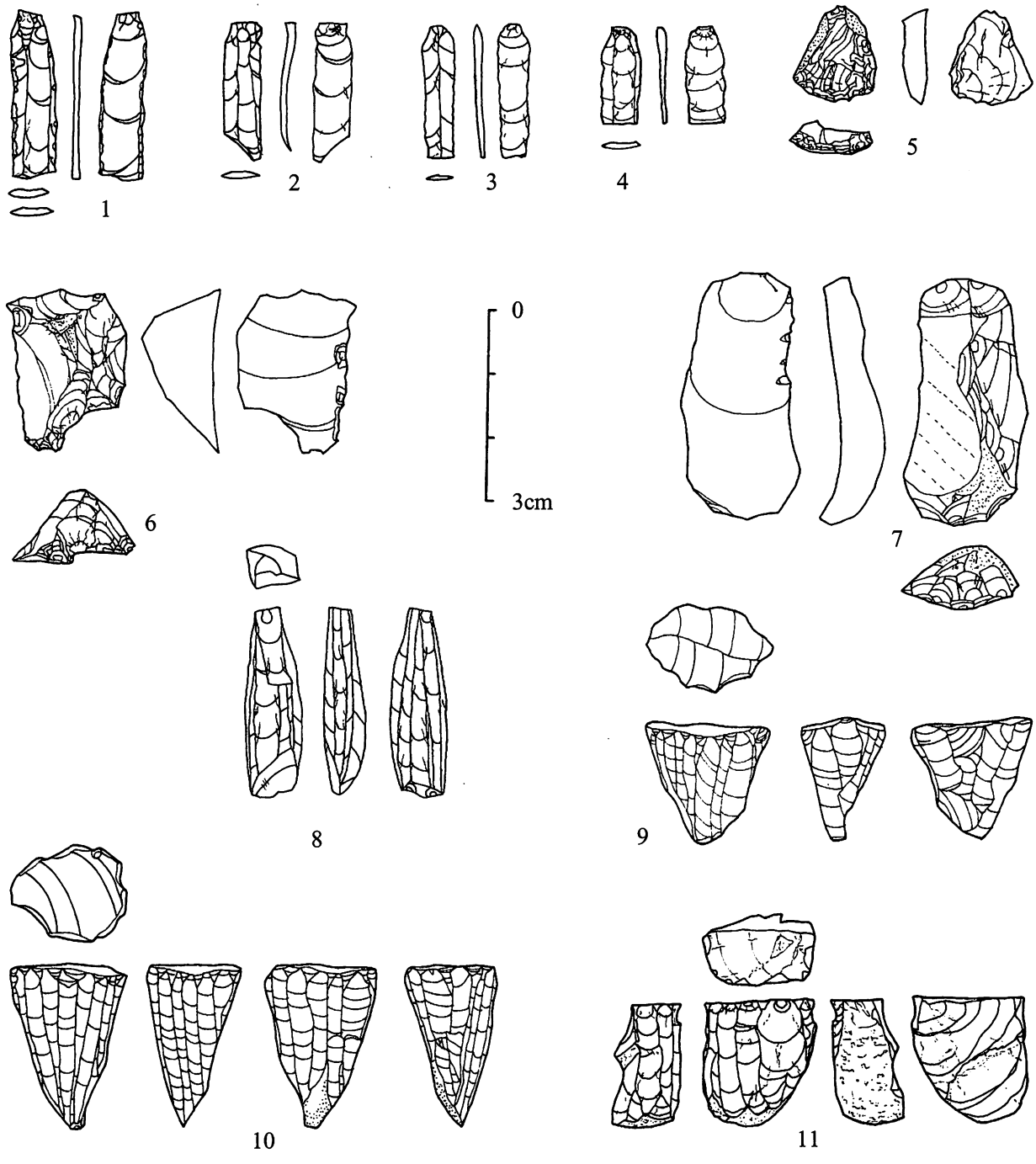



Fig.6.4 Lithic artifacts of Phase 4 (TB: Tang-e Bolaghi / Tr: Trench / L: Layer).
1. Retouched micro-blade (TB75/TrD/L3); 2. Micro-blade (TB75/TrD/L3); 3. Micro-blade (TB75/TrD/L3); 4. Micro-blade (TB75/TrD/L3); 5. Thumb-nail scraper (TB75/TrD/L3); 6. Notched scraper (TB75/TrD/L3); 7. End-scraper (TB75/TrC/L3); 8. "Bullet" type core for micro-blades (TB75/TrC/L3); 9. Conical core for micro-blades (TB130/TrD/L3); 10. Conical core for micro-blades (TB130/TrD/L3); 11. Prismatic core for micro-blades (TB75/TrD/L3)

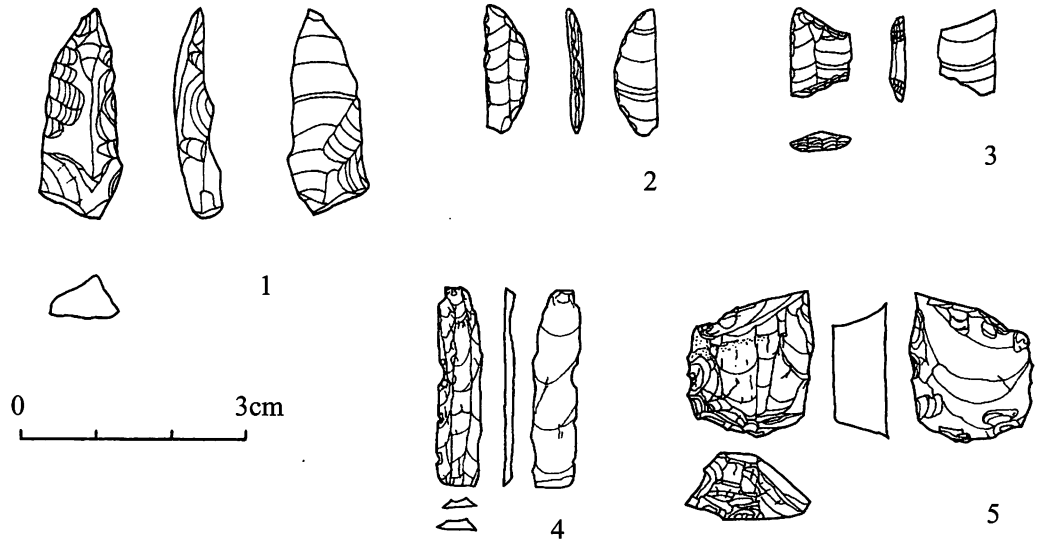



Fig.6.5 Lithic artifacts of Phase 5 (TB: Tang-e Bolaghi / Tr: Trench / L: Layer).
1. Pointed flake (TB75/TrB/L2); 2. Geometric microlith of the lunate category (TB130/TrE/L2); 3. Geometric microlith of the trapezoid category (TB130/TrE/L2); 4. Micro-blade probably of Phase 5 (TB75/TrD/L2); 5. End-scraper probably of Phase 5 (TB75/TrD/L2)

irregular shape and reduced by percussion, and the micro-blade cores are conical in shape and reduced by pressure.

TB130

Layer 4 of Trench B (2005: 403 pieces): Retouched pieces include notched pieces, side-scrapers and thumb-nail scrapers. The cores for flakes and blades are prismatic in shape and reduced by percussion, and the micro-blade cores are conical in shape and reduced by pressure (Fig.6-3-8, 10).

Layer 3 of Trench D (2005: 492 pieces): Side-scrapers represent the retouched pieces. The cores for flakes are irregular in shape and reduced by percussion, and the micro-blade cores are conical in shape and reduced by pressure quite elaborately (Fig.6-4-9, 10).

Layer 2 of Trench E (2005: 410 pieces): Retouched pieces include scrapers and thumb-nail scrapers. Geometric microliths of the lunate and trapezoid categories exist (Fig.6-5-2, 3). The cores for flakes are reduced by percussion, and the micro-blade cores are reduced by pressure.

Layer 1 of Trench E (2005: 473 pieces): Retouched pieces include fan-shaped transversal scrapers. The cores for flakes and blades are irregular in shape and reduced by percussion, and the micro-blade cores are conical in shape and reduced by pressure.

## Correlation of Layers of TB75 and TB130 and Establishment of Phases

Five phases can be established for the lithic assemblages at TB75 and TB130 in the chronological order from Phase 1 to Phase 5. This phase establishment is based on the techno-typological features of the lithic artifacts.

Phase 1: Layer 6 (Trench D) of TB75 with round scrapers and non-geometric microliths. Both the blades and micro-blades or small blades were detached by percussion, and the core reduction ended with the final detachment of a micro-blade or small blade.

Phase 2: Layer 5 (Trench D) of TB75 with end-scrapers, thumb-nail scrapers and non-geometric microliths. Both the blades and micro-blades or small blades were detached by

percussion, and the core reduction ended with the final detachment of a micro-blade or small blade. These features are seen in the lithic artifacts from KMC Cave near Marvdasht in the south-eastern Zagros, dated to the late Zarzian (Rosenberg 2003). The techno-typological features of this phase are quite similar to those of Phase 1, and this phase can be unified to Phase 1. However, radiocarbon dates obtained for the Layers 6 and 5 (14,700±70BC/14,380±60BC for Layer 6 (both uncalibrated) and 10,275±50 BC/10,305±50 BC/10,690±50 BC for Layer 5 (all uncalibrated)) (Chapter 10 of this volume) have led the present author to separate these two layers into two phases.

Phase 3: Layer 4 (Trench C) of TB75, Layer 4 (Trench D) of TB75, Layer 3 (Trench B) of TB75 and Layer 4 (Trench B) of TB130 with side-scrapers, end-scrapers, thumb-nail scrapers, round scrapers, denticulated/notched pieces, burins, non-geometric microliths such as backed micro-blades and geometric microliths of the trapezoid category. The cores for flakes and blades were reduced by percussion, and the micro-blade cores were reduced by pressure of mediocre skill. It is worthy to note that the inhabitants at TB75 and TB130 of this phase period started pressure-flaking of micro-blades, using good quality raw materials obtained at some distant places.

Phase 4: Layer 3 (Trench C) of TB75, Layer 3 (Trench D) of TB75 and Layer 3 (Trench D) of TB130 with side-scrapers, notched pieces, thumb-nail scrapers, and non-geometric microliths such as backed micro-blades, side-scrapers and transversal scrapers. The cores for flakes and blades were reduced by percussion, and the micro-blade cores were reduced by pressure quite elaborately. The micro-blade production by pressure used raw materials finer in quality than those for the blade production by percussion.

Phase 5: Layer 2 (Trench B) of TB75, Layer 2 (Trench E) of TB130, Layer 1 (Trench E) of TB130 with side-scrapers, end-scrapers, thumb-nail scrapers, fan-shaped transversal scrapers and non-geometric microliths such as backed micro-blades. Geometric microliths of the lunate and trapezoid categories exist. The cores for flakes and blades were reduced by percussion, and the micro-blade cores were reduced by pressure. This phase is not to be conclusively established, and can be unified to Phase 4. Phase 5 is established, however, on the basis of the presence of geometric microliths of the lunate and trapezoid categories, that are not clearly seen in the layers of Phase 4.

## Lithic Assemblages of the Surrounding Regions

Lithic assemblages to be reviewed first for comparison in the regions surrounding TB75 and TB130 are the Zarzian materials from the rockshelter site of Warwasi in the Zagros Mountains in the province of Luristan, West Iran (Olszewski 1993). Olszewski grouped the materials into four stratigraphical units, and the artifacts commonly seen in these units are non-geometric microliths, notch/denticulates and thumb-nail scrapers. Micro-burins appear in the second earliest unit (Unit 2) in association with geometric microliths (*ibid*). Illustrations of blades and micro-blades demonstrate that pressure flaking was not employed in their detachment from single-platform or opposed-platform cores (*ibid*: 208, Fig.8-1).

In 2004, lithic artifacts comparable to those from TB75 and TB130 were reported from the Zagros Mountains in the province of Luristan, West Iran. Roustaei and others carried out Paleolithic surveys in the province, and reported on the Vare Zard site complex, a series of rockshelters with a scatter of Epi-Paleolithic and "Proto-Neolithic (Mellaart 1965: 18)" artifacts. The scatter of the artifacts extended more than 200 m along the site complex on a cliff slope (Roustaei, *et al.* 2004). Illustrations of the selected artifacts from this site complex demonstrate their high similarity to the lithic artifacts from TB75 and TB130, both being characterized by notched blades/micro-blades, end-scrapers, borers, side-scrapers, and

blades/micro-blades with parallel ridges and edges. The illustrations also demonstrate that the micro-blades at least were detached by pressure, and some of the conical micro-blade cores bearing regular flake scars can be called "bullet" cores (*ibid.* 2004: 705, Fig.11).

In addition to the materials from the Warwasi rockshelter and the Vare Zard site complex, a material of the late phase of the Zagros Zarzian was reported in 2003 from KMC Cave in the south-eastern Zagros (Rosenberg 2003).

Along the foothills of the north-west Zagros Mountains in north Iraq, Proto-Neolithic assemblages comparable to those from TB75 and TB130 were reported in detail. These Proto-Neolithic assemblages were unearthed from the open-air sites of Zawi Chemi Shanidar, M'lefaat and Karim Shahir. Outlined below are the inventories of the lithic assemblages from these sites.

Zawi Chemi Shanidar is located north-east of Mosul (Solecki 1981). Layer B of this site, dated to 8,920±300 B.C. by 14C determination, was associated with circular stone architecture, 2 m in diameter. The lithic artifacts consist of backed blades, denticulated pieces, notched pieces, truncated pieces, borers, side-scrapers, pièces esquillées and geometric microliths of the lunate category. Neither sheen-bearing pieces nor micro-burins are reported. The photographs of the cores demonstrate that the blades and micro-blades were not detached by pressure. Interestingly, possibility of domestication of sheep was proposed at this site on the basis that animal bones of infants under one year old radically increased to 60 % at this site from the percentage under 25 in the Paleolithic layers at the nearby site of Shanidar Cave (*ibid.*; Cole 1970).

At M'lefaat, located east of the plain of Mosul, three stone-made floors (4 m x 3 m each) were unearthed, and lithic artifacts such as notched pieces, micro-blades with use-nibbled edges, scrapers and perforators were unearthed from these floors (Dittemore 1983). These floors were dated to between 8,900 and 8,600 B.C. Neither geometric microliths nor micro-burins were reported. Parallel ridges and edges as well as consistent width of the micro-blades demonstrate that the pressure flaking was used to detach them (Howe 1983: 130-131; Dittemore 1983: 673-674).

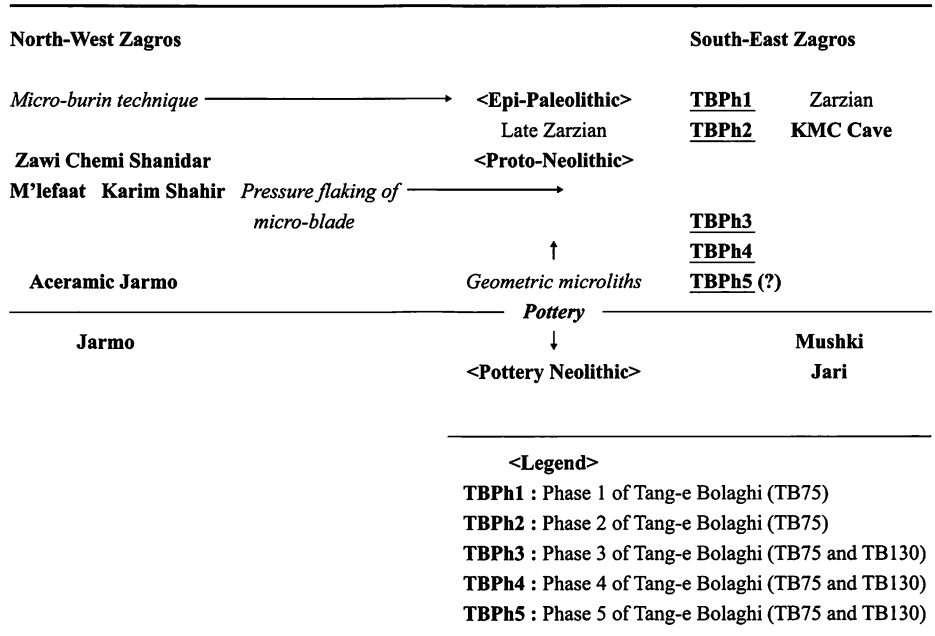
Karim Shahir is located east of Chemchemal in the province of Kirkuk. Large numbers of lithic artifacts were unearthed from a single occupation floor, composed of a stone pavement and pits in an area of 500-600 m$^2$. This floor was dated to between 8,900 and 8,600 B.C. (Howe 1983: 130-131). The lithic artifacts consist of backed micro-blades, drills, end-scrapers, side-scrapers, obliquely truncated pieces and many notched pieces. Because geometric microliths as a true category were not found, the micro-burins from this site are thought to have been the by-product pieces from the manufacture of obliquely truncated pieces, unrelated to the micro-burin technique. Most of the blade or micro-blade cores are conical in shape, and the illustrations (*ibid*: Figs. 20, 21) demonstrate that elaborate pressure flaking was used to detach micro-blades.

## Hypothetical Dating of the Lithic Assemblages of TB75 and TB130 in the Epi-Paleolithic to Proto-Neolithic Framework of the Zagros Mountains (Table 6.1)

The term "assemblage" is used here for Layers 6 to 1 of TB75 and TB130 in the sense that they had not been disturbed stratigraphically by any agency and that more than 100 lithic artifacts were unearthed from them.

At first glance, the lithic assemblages from TB75 and TB130 on the whole, which are composed of tool types such as end-scrapers, thumb-nail scrapers, denticulated pieces, notched pieces, non-geometric microliths like retouched, backed and notched micro-blades, and geometric microliths of the lunate and trapezoid categories, might be easily dated to the

Table 6.1 Hypothetical dating of Phases 1 to 5 of TB75 and TB130 in the Epi-Paleolithic to Proto-Neolithic chronological framework of the Zagros Mountains.




Epi-Paleolithic of the Zagros Mountains, best represented by the Rockshelter site of Warwasi, West Iran (Olszewski 1993).

Taking their overall techno-typology into consideration, however, the TB75 and TB130 assemblages can be more reasonably placed within the chronological framework from the Zarzian to the Proto-Neolithic of the Zagros Mountains.

This hypothetical dating is based on the discussions below.

1) Different from the Zarzian assemblages lacking in pressure flaking of micro-blades, Phases 3 to 5 of TB75 and TB130 used this flaking technique. This is a major difference between the assemblages of TB75 and TB130 and those of the Zarzian.

2) At TB75 and TB130, continuous and gradual change in the manner of micro-blade detachment is observed in Phases 3 through 5. In Phases 1 and 2, no distinction existed between the productions of blades and micro-blades, both having been detached from same cores by percussion until the core reduction ended with the final detachment of a micro-blade or small blade. In Phase 3, distinction in the production of blade and micro-blades appeared. At some point in this phase period, the inhabitants of TB75 and TB130 started to pressure-flake micro-blades using the raw materials that were being used for blade production by percussion, splitting them into an appropriate size to initiate the micro-blade production by pressure. At the same time, they started to collect raw materials, from outcrops of some distance, that were acceptable for micro-blade production by pressure. In Phases 4 and 5, production of blades and micro-blades became completely different in terms of raw materials and manner of their core reduction. Blades were still percussion-flaked using raw materials of all kinds of flakeable quality. Micro-blades, on the other hand, were elaborately pressure-flaked using raw materials of quality suited for the pressure flaking. From this, we may suggest that the inhabitants of TB75 and TB130 in the period of Phase 3 started to trade raw materials for pressure flaking, or that they at least started bringing these raw materials themselves into TB75 and TB130.

From the discussions above, Phases 1 to 5 of TB75 and TB130 are dated within the Epi-Paleolithic to Proto-Neolithic framework of the Zagros Mountains as follows.

Phase 1 is dated to the Zarzian of the Zagros Mountains, and Phase 2 is dated to the Late Zarzian such as the material from KMC Cave in the south-east Zagros Mountains.

Phase 3 with new features to be established in Phase 4 is dated to the Proto-Neolithic in the Zagros Mountains, particularly to a period posterior to the assemblages of M'lefaat and Karim Shahir. It seems that the micro-blade production by pressure which appeared in this phase was derived from the regions north of TB75 and TB130, including the Zagros foothills in north Iraq where the sites of Karim Shahir and M'lefaat are located. In Phase 4, the micro-blades were flaked off by pressure quite elaborately. Though still bearing geometric microliths, Phase 5 can be dated to the Aceramic Neolithic such as Aceramic Jarmo.

## Summary and Conclusion

As discussed in the preceding sections, the lithic assemblages from TB75 and TB130 undoubtedly present new data for the prehistoric research of the Epi-Paleolithic through Proto-Neolithic periods of the Zagros Mountains.

They are important not only for the reason that they present new data but for the reason that they present interesting data that can contribute to an essential research subject in archaeology, namely, the inter-relationship between "culture change" and "change in human behaviour".

It is hoped in the future that lithic assemblages comparable to those from TB75 and TB130 will be found at stratified sites in its proximity, providing support to the hypothetical chronology of the Epi-Paleolithic to Proto-Neolithic of the Zagros Mountains proposed in this report.

## Acknowledgements

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## Appendix Layer by Layer Inventories of the Lithic Artifacts unearthed in the 2005 and 2006 Field Seasons from Tang-e Bolaghi 75 (TB 75) and Tang-e Bolaghi 130 (TB 130)

1st : First Classification
2nd : Second Classification
3rd : Third Classification

**TB 75 (2005 Field Season)**

Trench A

Surface

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 2 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Blades | 1 |
| | | Micro-blade | 5 |
| Chips or Retouch-flakes | | | 2 |
| Fragments | | | 1 |
| | | Total | 11 |

Layer 1

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Cores | | | |
| | Non-pressure | | |
| | | Initial cores | 1 |
| | | Prismatic for flakes | 1 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Micro-blades | 1 |
| Fragments | | | 5 |
| | | Total | 8 |

Layer 2

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Micro-blades | 6 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Blades | 1 |
| | | Micro-blades | 1 |
| Core rejuvenation flakes | | | |
| | Modification flakes of flaking surface | | |
| | of micro-blade cores | | 1 |
| Chips or Retouch-flakes | | | 41 |
| Retouched pieces | | | |
| | Non-geometric microliths | | |
| | | Retouched micro-blades | 1 |
| Fragments | | | 6 |
| Core fragments | | | 67 |
| | | Total | 124 |

Layer 2 (Sieving)

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Micro-blades | 1 |
| Chips or Retouch-flakes | | | 9 |
| Retouched pieces | | | |
| | End-scrapers | | 1 |
| Cores | | | |
| | Pressure | | |
| | | Conical for micro-blades | 1 |
| | Non-pressure | | |
| | | Initial cores | 1 |
| Fragments | | | 9 |
| | | Total | 22 |

Layer 3

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 2 |
| | | Micro-blades | 1 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Blades | 3 |
| | | Micro-blades | 5 |
| Core rejuvenation flakes | | | |
| | Core tablets | | 1 |
| Retouched pieces | | | |
| | Denticulated blades | | 1 |
| Cores | | | |
| | Pressure | | |
| | | Conical for micro-blades | 1 |
| | | Prismatic for micro-blades | 1 |
| Fragments | | | 1 |
| | | Total | 16 |

Layer 3 (Sieving)

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Partially-cortical flakes | | 2 |
| | Non-cortical flakes | | |
| | | Blades | 2 |
| | | Micro-blades | 2 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Blades | 2 |
| | | Micro-blades | 6 |
| Chips or Retouch-flakes | | | 13 |
| Retouched pieces | | | |
| | Steep scrapers | | 1 |
| | Non-geometric microliths | | |
| | | Backed micro-blades | 1 |
| Broken retouched pieces | | | |
| | Retouched pieces | | 1 |
| Core fragments | | | 1 |
| | | Total | 31 |

Layer 4

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 1 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 3 |
| | | Micro-blades | 7 |
| Chips or Retouch-flakes | | | 5 |
| Retouched pieces | | | |
| | Steep scrapers | | 1 |
| Cores | | | |
| | Non-pressure | | |
| | | Prismatic for flakes | 1 |
| Core fragments | | | 1 |
| | | Total | 19 |

Layer 4 (Sieving)

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Micro-blades | 1 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Blades | 4 |
| | | Micro-blades | 12 |
| Chips or Retouch-flakes | | | 16 |
| Fragments | | | 6 |
| | | Total | 39 |

Trench B

Surface

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Micro-blades | 1 |
| Broken retouched pieces | | | |
| | Non-geometric microliths | | |
| | | Retouched micro-blades | 1 |
| Small fragments | | | 1 |
| | | Total | 3 |

Layer 1

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Partially-cortical flakes | | 2 |
| | Non-cortical flakes | | |
| | | Flakes | 2 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Blades | 2 |
| | | Micro-blades | 9 |
| Chips or Retouch-flakes | | | 13 |

| | | | |
|---|---|---|---|
| Retouched pieces | | | |
| | Non-geometric microliths | | |
| | | Backed micro-blades | 3 |
| | | Total | 31 |

Layer 2

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Cortical flakes | | 5 |
| | Partially-cortical flakes | | 4 |
| | Non-cortical flakes | | |
| | | Flakes | 12 |
| | | Crested flakes | 1 |
| | | Micro-blades | 4 |
| Core rejuvenation flakes | | | |
| | Core tablets | | 2 |
| Chips or Retouch-flakes | | | 36 |
| Retouched pieces | | | |
| | Side-scrapers | | 2 |
| | End-scrapers | | 9 |
| | Steep scrapers | | 3 |
| | Thumb-nail scrapers | | 1 |
| | Pointed blades | | 2 |
| | Retouched blades | | 1 |
| | Retouched pieces | | 5 |
| | Non-geometric microliths | | |
| | | Retouched micro-blades | 2 |
| | Geometric microliths | | |
| | | Lunates | 1 |
| | | Atypical lunates | 2 |
| Broken retouched pieces | | | |
| | Used obsidian pressure micro-blades | | 1 |
| | Retouched blades | | 2 |
| | Non-geometric microliths | | |
| | | Retouched micro-blades | 3 |
| Cores | | | |
| | Pressure | | |
| | | Conical for micro-blades | 4 |
| | Non-pressure | | |
| | | Irregular for flakes | 3 |
| Fragments | | | 238 |
| Core fragments | | | 61 |
| | | Total | 404 |

Layer 3

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Cortical flakes | | 2 |
| | Partially-cortical flakes | | 18 |
| | Non-cortical flakes | | |
| | | Flakes | 13 |
| | | Micro-blades | 13 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Micro-blades | 234 |
| Core rejuvenation flakes | | | |
| | Core tablets | | 12 |

| | | | |
|---|---|---|---|
| | Core tablets for micro-blade cores | | 1 |
| | Change of orientation flakes | | 1 |
| | Broken core bottom flakes | | 2 |
| | Modification flakes of flaking surface from micro-blade cores | | 5 |
| Chips or retouch-flakes | | | 406 |
| | Edge-rejuvenation flakes of end-scrapers | | 1 |
| Retouched pieces | | | |
| | Notched pieces | | 1 |
| | Notched blades | | 1 |
| | Notched pointed blades | | 1 |
| | Backed blades | | 1 |
| | Side-scrapers | | 2 |
| | End-scrapers | | 4 |
| | Multiple burins | | 1 |
| | Thumb-nail scrapers | | 5 |
| | Retouched blades | | 2 |
| | Retouched flakes | | 2 |
| | Pointed small flakes | | 4 |
| | Retouched small flakes | | 2 |
| | Retouched core-tablets | | 1 |
| | Non-geometric microliths | | |
| | | Burins | 1 |
| | | End-scrapers | 1 |
| | | Retouched micro-blades | 4 |
| | | Notched micro-blades | 2 |
| Broken retouched pieces | | | |
| | Retouched small flakes | | 4 |
| | Notched small flakes | | 1 |
| | End-scrapers | | 3 |
| | Retouched blades | | 2 |
| | Non-geometric microliths | | |
| | | Notched micro-blades | 3 |
| | | Retouched micro-blades | 4 |
| | | Inversely-retouched micro-blades | 1 |
| Cores | | | |
| | Pressure | | |
| | | Conical for micro-blades | 2 |
| | | Semi-conical for micro-blades | 3 |
| | | Cylindrical for micro-blades | 1 |
| | | Prismatic for micro-blades | 1 |
| | Non-pressure | | |
| | | Irregular for flakes | 3 |
| | | Conical for flakes | 1 |
| | | Prismatic for blades | 1 |
| Fragments | | | 244 |
| Core fragments | | | 128 |
| | | Total | 1,145 |

**TB 130 (2005 Field Season)**

| | | | |
|---|---|---|---|
| Trench A | | Fragments | 2 |
| Trench B | | | |
| Surface | | | |
| 1st | 2nd | 3rd | |
| Débitage pieces | | | |
| | Partially-cortical flakes | | 64 |

| | | | |
|---|---|---|---|
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Blades | 1 |
| | | Micro-blades | 1 |
| Chips or Retouch-flakes | | | 14 |
| Retouched pieces | | | |
| | Thumb-nail scrapers | | 1 |
| Fragments | | | 2 |
| | | Total | 83 |

Layer 1

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Partially-cortical flakes | | 1 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Micro-blades | 2 |
| Chips or Retouch-flakes | | | 4 |
| Fragments | | | 6 |
| Core fragments | | | 1 |
| | | Total | 14 |

Layer 2

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 2 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Crested flakes | 1 |
| | | Blades | 2 |
| | | Micro-blades | 16 |
| Core rejuvenation flakes | | | |
| | Core bottom flakes | | 1 |
| Chips or Retouch-flakes | | | 2 |
| Retouched pieces | | | |
| | Pièces esquillées | | 1 |
| | Geometric microliths | | |
| | | Lunates | 1 |
| Cores | | | |
| | Pressure | | |
| | | Pyramidal for micro-blades | 2 |
| Fragments | | | 12 |
| Core fragments | | | 1 |
| | | Total | 41 |

Layer 3

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Blades | 1 |
| | | Micro-blades | 8 |
| Core rejuvenation flakes | | | |
| | Change of orientation flakes | | 1 |
| Chips or Retouch-flakes | | | 21 |

| | | | |
|---|---|---|---|
| Retouched pieces | | | |
| | End-scrapers | | 1 |
| Broken retouched pieces | | | |
| | Retouched pieces | | 2 |
| | Non-geometric microliths | | |
| | | Backed micro-blades | 2 |
| Cores | | | |
| | Pressure (seemingly crude) | | |
| | | Semi-conical for micro-blades | 2 |
| | Non-pressure | | |
| | | Irregular for flakes | 1 |
| | | Conical for flakes | 1 |
| | | Unifacial discoidal for flakes | 1 |
| Fragments | | | 20 |
| Core fragments | | | 12 |
| | | Total | 73 |

Layer 4

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 3 |
| | | Blades | 2 |
| | | Micro-blades | 1 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Blades | 5 |
| | | Micro-blades | 90 |
| Chips or retouch-flakes | | | 112 |
| | Edge-rejuvenation flakes of end-scrapers | | 1 |
| Core rejuvenation flakes | | | |
| | Core tablets | | 1 |
| | Core bottom flakes | | 1 |
| Retouched pieces | | | |
| | Notched pieces | | 1 |
| | Side-scrapers | | 1 |
| | Steep scrapers | | 1 |
| | Thumb-nail scrapers | | 1 |
| | Retouched small flakes | | 2 |
| | Transversal scrapers | | 1 |
| Broken retouched pieces | | | |
| | Retouched blades | | 1 |
| | Notched chips | | 1 |
| | Retouched pieces | | 4 |
| Cores | | | |
| | Pressure | | |
| | | Conical for micro-blades | 4 |
| | | Prismatic for micro-blades | 1 |
| | Non-pressure | | |
| | | Irregular for flakes | 1 |
| | | Semi-conical for flakes | 1 |
| | | Prismatic for blades | 2 |
| Fragments | | | 148 |
| Core fragments | | | 17 |
| | | Total | 403 |

Trench C (Stratigraphically disturbed to a certain extent)

Surface

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Micro-blades | 2 |
| | | Total | 2 |

Layer 1

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Cortical flakes | | 1 |
| Chips or retouch-flakes | | | 2 |
| Retouched pieces | | | |
| | Retouched chips | | 1 |
| Broken retouched pieces | | | |
| | Retouched chips | | 1 |
| Fragments | | | 1 |
| | | Total | 6 |

Layer 2

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Cortical flakes | | 2 |
| | Partially-cortical flakes | | 1 |
| | Non-cortical flakes | | |
| | | Flakes | 1 |
| | | Blades | 1 |
| | | Micro-blades | 6 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Blades | 3 |
| | | Micro-blades | 14 |
| Chips or retouch-flakes | | | 47 |
| Core rejuvenation flakes | | | |
| | Core tablets | | 1 |
| Retouched pieces | | | |
| | Retouched chips | | 1 |
| | Alternate side-scrapers | | 1 |
| | Steep scrapers | | 1 |
| | End-scrapers | | 1 |
| Broken retouched pieces | | | |
| | Side-scrapers | | 1 |
| Cores | | | |
| | Non-pressure | | |
| | | Irregular for flakes | 1 |
| Fragments | | | 34 |
| | | Total | 116 |

Layer 3

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Partially-cortical flakes | | 1 |
| | Non-cortical flakes | | |
| | | Flakes | 2 |

| | | | |
|---|---|---|---|
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 2 |
| | | Blades | 7 |
| | | Micro-blades | 32 |
| Chips or retouch-flakes | | | 93 |
| Core rejuvenation flakes | | | |
| | Core tablets | | 1 |
| Retouched pieces | | | |
| | Retouched flakes | | 1 |
| | Notched blades | | 1 |
| | Pointed flakes | | 1 |
| | Thumb-nail scrapers | | 1 |
| | Side-scrapers | | 1 |
| | End-scrapers | | 2 |
| | Small end-scrapers | | 1 |
| | Non-geometric microliths | | |
| | | Thumb-nail scrapers | 1 |
| Broken retouched pieces | | | |
| | Retouched blades | | 1 |
| | Inversely-retouched scrapers | | 1 |
| Fragments | | | 48 |
| Core fragments | | | 18 |
| | | Total | 215 |

Layer 4

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Cortical flakes | | 1 |
| | Non-cortical flakes | | |
| | | Blades | 1 |
| | | Micro-blades | 2 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 4 |
| | | Blades | 2 |
| | | Micro-blades | 45 |
| Chips or retouch-flakes | | | 117 |
| | Burin spalls | | 1 |
| Core rejuvenation flakes | | | |
| | Core bottom flakes | | 1 |
| Retouched pieces | | | |
| | Thumb-nail scrapers | | 2 |
| | Convergent scrapers | | 1 |
| | Steep scrapers | | 2 |
| | Non-geometric microliths | | |
| | | Retouched micro-blades | 1 |
| | Geometric microliths | | |
| | | Lunates | 1 |
| Broken retouched pieces | | | |
| | Backed flakes | | 1 |
| | Retouched pieces | | 3 |
| Cores | | | |
| | Pressure | | |
| | | Semi-conical for micro-blades | 1 |
| | | Cylindrical for micro-blades | 1 |
| | Non-pressure | | |
| | | Irregular for flakes | 1 |

| | | | |
|---|---|---|---|
| Fragments | | | 32 |
| Core fragments | | | 18 |
| | | Total | 238 |

Trench D

Surface

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 1 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Micro-blades | 3 |
| Chips or retouch-flakes | | | 14 |
| Fragments | | | 5 |
| Core fragments | | | 2 |
| | | Total | 25 |

Layer 1

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Cortical flakes | | 1 |
| | Partially-cortical flakes | | 2 |
| | Non-cortical flakes | | |
| | | Flakes | 8 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Blades | 6 |
| | | Micro-blades | 24 |
| Chips or retouch-flakes | | | 85 |
| Retouched pieces | | | |
| | Backed flakes | | 1 |
| | Side-scrapers | | 2 |
| Cores | | | |
| | Non-pressure | | |
| | | Irregular for flakes | 1 |
| Fragments | | | 12 |
| Core fragments | | | 3 |
| | | Total | 145 |

Layer 2

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Cortical flakes | | 1 |
| | Non-cortical flakes | | |
| | | Flakes | 7 |
| | | Micro-blades | 2 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 1 |
| | | Blades | 1 |
| | | Micro-blades | 126 |
| Chips or retouch-flakes | | | 303 |
| | Burin spalls | | 2 |
| | Edge-rejuvenation flakes of end-scrapers | | 1 |

| | | | |
|---|---|---|---|
| Core rejuvenation flakes | | | |
| | Core tablets | | 2 |
| Retouched pieces | | | |
| | Side-scrapers | | 4 |
| | Transversal scrapers | | 1 |
| | Steep scrapers on core tablet | | 1 |
| | Burins on retouched truncation | | 1 |
| | End-scrapers | | 2 |
| | Thumb-nail scrapers | | 5 |
| Broken retouched pieces | | | |
| | Retouched pieces | | 5 |
| | Thumb-nail scrapers | | 1 |
| Cores | | | |
| | Non-pressure | | |
| | | Prismatic for blades | 2 |
| | | Irregular for flakes | 5 |
| | Pressure | | |
| | | Conical for micro-blades | 2 |
| | | Cylindrical for micro-blades | 1 |
| Fragments | | | 27 |
| Core fragments | | | 21 |
| | | Total | 524 |

Layer 3

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Crested flakes | 1 |
| | | Micro-blades | 104 |
| Chips or retouch-flakes | | | 290 |
| Core rejuvenation flakes | | | |
| | Flakes removing flaking surface | | 1 |
| Retouched pieces | | | |
| | Retouched flakes | | 1 |
| | Pointed chips | | 1 |
| | Atypical thumb-nail scrapers | | 2 |
| | Side-scrapers | | 1 |
| | Steep scrapers on core | | 1 |
| | Transversal scrapers | | 1 |
| Broken retouched pieces | | | |
| | Side-scrapers | | 1 |
| Cores | | | |
| | Non-pressure | | |
| | | Irregular for flakes | 2 |
| | Pressure | | |
| | | Conical for micro-blades | 1 |
| | | Pyramidal for micro-blades | 1 |
| | | Prismatic for miro-blades | 1 |
| Fragments | | | 68 |
| Core fragments | | | 15 |
| | | Total | 492 |

Trench E

Surface

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Chips or retouch-flakes | | | 49 |

| | | | |
|---|---|---|---|
| | Burin spalls | | 1 |
| Broken retouched pieces | | | |
| | Non-geometric microliths | | |
| | | Retouched micro-blades | 1 |
| Fragments | | | 27 |
| Core fragments | | | 12 |
| | | Total | 90 |

Layer 1

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Cortical flakes | | 1 |
| | Partially-cortical flakes | | 3 |
| | Non-cortical flakes | | |
| | | Flakes | 2 |
| | | Micro-blades | 3 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Blades | 4 |
| | | Micro-blades | 42 |
| Chips or retouch-flakes | | | 270 |
| | Burin spalls | | 1 |
| Retouched pieces | | | |
| | Steep scrapers | | 1 |
| | Transversal scrapers (fan-shaped) | | 2 |
| | End-scrapers | | 1 |
| Broken retouched pieces | | | |
| | Non-geometric microliths | | |
| | | Retouched micro-blades | 2 |
| Cores | | | |
| | Pressure | | |
| | | Semi-conical for micro-blades | 1 |
| | Non-pressure | | |
| | | Irregular for flakes | 2 |
| Fragments | | | 109 |
| Core fragments | | | 29 |
| | | Total | 473 |

Layer 2

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Partially-cortical flakes | | 1 |
| | Non-cortical flakes | | |
| | | Flakes | 3 |
| | | Blades | 1 |
| | | Micro-blades | 1 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Blades | 5 |
| | | Micro-blades | 1 |
| Chips or retouch-flakes | | | 154 |
| Retouched pieces | | | |
| | Retouched flakes | | 1 |
| | Retouched chips | | 3 |
| | End-notched pieces | | 1 |
| | Side-scrapers | | 1 |
| | Steep scrapers on core tablet | | 1 |

| | | | |
|---|---|---|---|
| | Thumb-nail scrapers | | 2 |
| | Geometriuc microliths | | |
| | | Lunates | 1 |
| | | Trapezoids | 1 |
| Broken retouched pieces | | | |
| | Retouched flakes | | 1 |
| | Non-geometric microliths | | |
| | | Retouched micro-blades | 1 |
| | | Notched micro-blades | 1 |
| Cores | | | |
| | Pressure | | |
| | | Conical for micro-blades | 2 |
| | | Pyramidal for micro-blades | 1 |
| | | Semi-cylindrical for micro-blades | 1 |
| | Non-pressure | | |
| | | Irregular for flakes | 2 |
| | | Semi-conical for flakes | 1 |
| Fragments | | | 189 |
| Core fragments | | | 34 |
| | | Total | 410 |

Layer 3

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Micro-blades | 15 |
| Chips or retouch-flakes | | | 34 |
| Fragments | | | 17 |
| Core fragments | | | 1 |
| | | Total | 67 |

**TB 75 (Haji Bahrami Cave: 2006 Field Season)**

Trench C

Layers 1~2 (Unclear stratification)

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 1 |
| | | Blades | 1 |
| Chips or retouch-flakes | | | 6 |
| Broken retouched pieces | | | |
| | Retouched blades | | 1 |
| | | Total | 9 |

Layer 3

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Cortical flakes | | 3 |
| | Partially-cortical flakes | | 2 |
| | Non-cortical flakes | | |
| | | Flakes | 7 |
| | | Blades | 6 |
| | | Micro-blades | 11 |

| | | | |
|---|---|---|---|
| Broken débitage pieces | | | |
| | Non-cortical Flakes | | |
| | | Flakes | 8 |
| | | Crested flakes | 1 |
| | | Blades | 20 |
| | | Micro-blades | 178 |
| Core rejuvenation flakes | | | |
| | Modification flakes of flaking surface | | 1 |
| | Modification flakes of flaking surface from micro-blade cores | | 1 |
| Chips or retouch-flakes | | | 66 |
| Retouched pieces | | | |
| | Side-scrapers | | 3 |
| | End-scrapers | | 1 |
| | Thumb-nail scrapers | | 2 |
| | Drills | | 1 |
| | Pièces esquillées | | 1 |
| | Backed small flakes | | 1 |
| Broken retouched pieces | | | |
| | Notched small flakes | | 1 |
| | Retouched blades | | 1 |
| | Non-geometric microliths | | |
| | | Side scrapers | 1 |
| | | Transversal scrapers | 1 |
| Cores | | | |
| | Pressure | | |
| | | Conical for micro-blades | 5 |
| | | Semi-conical for micro-blades | 1 |
| | | Prismatic for micro-blades | 5 |
| | | "Bullet" type for micro-blades | 2 |
| | Non-pressure | | |
| | | Conical for flakes | 1 |
| | | Prismatic for flakes | 1 |
| Fragments | | | 4 |
| Core fragments | | | 7 |
| Hammer stones | | | 1 |
| Pebbles | | | 2 |
| Broken flat circular pebbles | | | 1 |
| | | Total | 347 |

Layer 4

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Cortical flakes | | 3 |
| | Partially-cortical flakes | | 7 |
| | Non-cortical flakes | | |
| | | Flakes | 6 |
| | | Blades | 6 |
| | | Micro-blades | 11 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 6 |
| | | Crested flakes | 2 |
| | | Blades | 12 |
| | | Micro-blades | 19 |
| Core rejuvenation flakes | | | |
| | Core bottom flakes | | 2 |
| Chips or retouch-flakes | | | 44 |

| | | | |
|---|---|---|---|
| Retouched pieces | | | |
| | End-scrapers | | 3 |
| | Burins on retouched truncation | | 1 |
| | Burins on notch | | 1 |
| | Thumb-nail scrapers | | 1 |
| | Convergent scrapers | | 1 |
| | Inversely-retouched scrapers | | 1 |
| | "Tayac" points | | 1 |
| | Non-geometric microliths | | |
| | | Pointed micro-blades | 1 |
| | Geometric microliths | | |
| | | Trapezoids | 1 |
| Broken retouched pieces | | | |
| | End-scrapers | | 1 |
| | Backed flakes | | 1 |
| | Backed blades | | 1 |
| | Pointed blades | | 1 |
| | Non-geometric microliths | | |
| | | Backed micro-blades | 2 |
| Cores | | | |
| | Pressure | | |
| | | Semi-conical for micro-blades | 1 |
| | | Prismatic for micro-blades | 2 |
| | | Cylindrical for micro-blades | 1 |
| | Non-pressure | | |
| | | Initial for micro-blades | 1 |
| Fragments | | | 1 |
| | | Total | 141 |

Layer 5

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 2 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 1 |
| Retouched pieces | | | |
| | End-scrapers | | 1 |
| | | Total | 4 |

Layer 6

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Cortical flakes | | 1 |
| | Non-cortical flakes | | |
| | | Micro-blades | 2 |
| | | Total | 3 |

Trench D

Wall Cleaning

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 1 |

| | | | |
|---|---|---|---|
| Chips or retouch-flakes | | | |
| | Burin spalls | | 1 |
| | | Total | 2 |

Layer 2

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 2 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Micro-blades | 4 |
| Chips or retouch-flakes | | | 1 |
| Retouched pieces | | | |
| | Steep scrapers | | 1 |
| | Round scrapers | | 1 |
| Cores | | | |
| | Pressure | | |
| | | Cylindrical for micro-blades | 1 |
| | | Prismatic for micro-blades | 2 |
| | | Total | 12 |

Layer 3

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Cortical flakes | | 6 |
| | Partially-cortical flakes | | 8 |
| | Non-cortical flakes | | |
| | | Flakes | 7 |
| | | Blades | 1 |
| | | Micro-blades | 20 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 67 |
| | | Crested flakes | 1 |
| | | Blades | 7 |
| | | Micro-blades | 532 |
| Core rejuvenation flakes | | | |
| | Modification flakes of flaking surface | | |
| | from micro-blade cores | | 40 |
| Chips or retouch-flakes | | | 209 |
| Retouched pieces | | | |
| | Notched pieces | | 2 |
| | Side-scrapers | | 4 |
| | Thumb-nail scrapers | | 2 |
| | Steep scrapers | | 1 |
| | Non-geometric microliths | | |
| | | Backed micro-blades | 1 |
| | | Side-scrapers | 4 |
| Broken retouched pieces | | | |
| | Notched pieces | | 1 |
| | End-scrapers | | 1 |
| | Side-scrapers | | 2 |
| | Scrapers | | 5 |
| Cores | | | |
| | Pressure | | |
| | | Conical for micro-blades | 3 |

| | | | |
|---|---|---|---|
| | | Semi-conical for micro-blades | 2 |
| | | Prismatic for micro-blades | 6 |
| | | Cylindrical for micro-blades | 1 |
| | Non-pressure | | |
| | | Irregular for flakes | 1 |
| | | Prismatic for flakes | 1 |
| | | Prismatic for blades | 2 |
| | | Initial for micro-blades | 3 |
| Fragments | | | 21 |
| Core fragments | | | 45 |
| | | Total | 1,006 |

Layer 4

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Cortical flakes | | 20 |
| | Partially-cortical flakes | | 37 |
| | Non-cortical flakes | | |
| | | Flakes | 52 |
| | | Blades | 18 |
| | | Micro-blades | 117 |
| Broken débitage pieces | | | |
| | Non cortical flakes | | |
| | | Flakes | 155 |
| | | Crested flakes | 3 |
| | | Blades | 104 |
| | | Micro-blades | 539 |
| Core rejuvenation flakes | | | |
| | Modification flakes of flaking surface from blade cores | | 3 |
| | Modification flakes of flaking surface from micro-blade cores | | 17 |
| Chips or retouch-flakes | | | 1,013 |
| Retouched pieces | | | |
| | Side-scrapers | | 5 |
| | Steep scrapers | | 8 |
| | End-scrapers | | 7 |
| | Thumb-nail scrapers | | 10 |
| | Denticulated pieces | | 4 |
| | Transversal scrapers | | 2 |
| | Round scrapers | | 7 |
| | Convergent scrapers | | 2 |
| | Double side-scrapers | | 1 |
| | Fan-shaped scrapers | | 3 |
| | Backed blades | | 1 |
| | Retouched flakes | | 1 |
| | Retouched blades | | 1 |
| | Nibbled blades | | 1 |
| | Pointed flakes | | 1 |
| | Notched scrapers | | 1 |
| | Notched pieces | | 3 |
| | End-notched pieces | | 1 |
| | Pièces esquillées | | 3 |
| | Cleavers | | 1 |
| | Non-geometric microliths | | |
| | | Backed micro-blades | 3 |
| | | Retouched micro-blades | 1 |
| | | Denticulated micro-blades | 1 |

| | | | |
|---|---|---|---|
| Broken retouched pieces | | | |
| | End-scrapers | | 1 |
| | Side-scrapers | | 3 |
| | Scrapers | | 5 |
| | Round scrapers | | 3 |
| | Burins on retouched truncation | | 1 |
| | Denticulated pieces | | 2 |
| | Backed blades | | 1 |
| | Notched pieces | | 2 |
| | Notched blades | | 1 |
| | Drills | | 1 |
| Cores | | | |
| | Pressure | | |
| | | Conical for micro-blades | 6 |
| | | Semi-conical for micro-blades | 10 |
| | | Cylindrical for micro-blades | 4 |
| | | Prismatic for micro-blades | 14 |
| | | Initial for micro-blades | 1 |
| | Non-pressure | | |
| | | Irregular for flakes | 7 |
| | | Prismatic for flakes | 3 |
| | | Prismatic for blades | 1 |
| | | Prismatic for blades and micro-blades | 5 |
| | | Prismatic for micro-blades | 9 |
| | | Initial for flakes | 8 |
| | | Initial for micro-blades | 1 |
| Fragments | | | 267 |
| Core fragments | | | 84 |
| Split pebbles | | | 9 |
| Pebble fragments | | | 2 |
| Hammer stones | | | 1 |
| Broken mace-heads | | | 1 |
| Broken grinding stones | | | 1 |
| Querns | | | 1 |
| | | Total | 2,601 |

Layer 5

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Cortical flakes | | 4 |
| | Partially-cortical flakes | | 9 |
| | Non-cortical flakes | | |
| | | Flakes | 22 |
| | | Blades | 9 |
| | | Micro-blades | 42 |
| Broken débitage pieces | | | |
| | Non-cortical flakes | | |
| | | Flakes | 15 |
| | | Blades | 9 |
| | | Micro-blades | 80 |
| Core rejuvenation flakes | | | |
| | Modification flakes from flaking surface | | 3 |
| Chips or retouch-flakes | | | 173 |
| | Burin spalls | | 2 |
| Retouched pieces | | | |
| | Backed blades | | 2 |
| | Side-scrapers | | 2 |
| | End-scrapers | | 1 |

| | | | |
|---|---|---|---|
| | Steep end-scrapers | | 6 |
| | Burins on retouched truncation | | 1 |
| | Thumb-nail scrapers | | 4 |
| | Pointed flakes | | 1 |
| | Denticulated blades | | 1 |
| | Notched/Denticulated pieces | | 1 |
| | End-notched pieces | | 1 |
| | Drills | | 1 |
| | Non-geometric microliths | | |
| | | Backed micro-blades | 4 |
| Broken retouched pieces | | | |
| | End-scrapers | | 6 |
| | Truncated pieces | | 1 |
| | Non-geometric microliths | | |
| | | Backed micro-blades | 3 |
| Cores | | | |
| | Pressure | | |
| | | Prismatic for micro-blades | 2 |
| | Non-pressure | | |
| | | Irregular for flakes | 4 |
| | | Conical for micro-blades | 2 |
| | | Prismatic for flakes | 2 |
| | | Prismatic for blades | 2 |
| | | Prismatic for blades/micro-blades | 4 |
| | | Prismatic for micro-blades | 1 |
| Fragments | | | 89 |
| Core fragments | | | 20 |
| Hammer stones | | | 1 |
| | | Total | 530 |

Layer 6

| 1st | 2nd | 3rd | |
|---|---|---|---|
| Débitage pieces | | | |
| | Cortical flakes | | 1 |
| | Partially-cortical flakes | | 10 |
| | Non-cortical flakes | | |
| | | Flakes | 22 |
| | | Crested flakes | 1 |
| | | Blades | 4 |
| | | Micro-blades | 31 |
| Broken débitage pieces | | | |
| | Non cortical flakes | | |
| | | Flakes | 10 |
| | | Blades | 21 |
| | | Micro-blades | 62 |
| Core rejuvenation flakes | | | |
| | Modification flakes of flaking surface from blade cores | | 4 |
| Chips or retouch-flakes | | | 266 |
| | Edge-rejuvenation flakes of end-scrapers | | 1 |
| Retouched pieces | | | |
| | Side-scrapers | | 2 |
| | End-scrapers | | 1 |
| | Fan-shaped scrapers | | 1 |
| | Thumb-nail scrapers | | 1 |
| | Round scrapers | | 7 |
| | Transversal scrapers | | 1 |
| | Non-geometric microliths | | |

| | | | |
|---|---|---|---|
| | | Backed micro-blades | 7 |
| | | Backed small flakes | 1 |
| | | Burins on break | 1 |
| Broken retouched pieces | | | |
| | End-scrapers | | 1 |
| | Non-geometric microliths | | |
| | | Backed micro-blades | 6 |
| | | Backed small flakes | 1 |
| Cores | | | |
| | Pressure | | |
| | | Prismatic for micro-blades | 1 |
| | Non-pressure | | |
| | | Irregular for flakes | 1 |
| | | Prismatic for blades | 4 |
| | | Prismatic for micro-blades | 5 |
| Fragments | | | 93 |
| Core fragments | | | 12 |
| Pebbles | | | 1 |
| | | Total | 580 |

# CHAPTER 7

## ACHAEMENID AND POST-ACHAEMENID OBJECTS FROM TB75, TB130 AND THE GENERAL SURVEY

# 7. ACHAEMENID AND POST-ACHAEMENID OBJECTS FROM TB75, TB130 AND THE GENERAL SURVEY

Takuro ADACHI

Most pottery found in Layer 2, TB75, is datable to the late Achaemenid or the post-Achaemenid period. Some iron and a bronze artifact unearthed in layer 2 were certainly also late Achaemenid or post-Achaemenid objects. Since some potsherds of ribbed pithos were found in layer 2 in the first season, we had already confirmed that the date of layer 2 belonged to the late Achaemenid period. Furthermore, the typical objects of the late Achaemenid period, a canteen jar (or a pilgrim flask) and a trilobate arrowhead, were found in the second season. Some potsherds, however, which belong to the post-Achaemenid period, were also unearthed from layer 2 of TB75. At this moment, we consider that layer 2 of TB 75 belongs to the late Achaemenid and the post-Achaemenid period, although some non-diagnostic potsherds were found there.

## Pottery from TB75

Most of pottery from layer 2, TB75 is wheel made and well fired. The surface colors vary from yellowish gray to orange, and a few are light gray in color. Most of our specimens have grit-tempered paste and horizontal wet-smoothed treatments, but a few are scraped or burnished.

The most diagnostic pottery of the late Achaemenid period from this site are the ribbed pithos sherds (Fig.7.1.1, 3, 5-8; Pl.7.4). The ribbed decorations are various in shape and interval. Although the specimens from Persepolis (Schmidt 1957: Pl.73:7), Tall-i Takht, Pasargadae (Stronach 1978: Fig.121:10) and Tape Suruvan (Aratashi 1963: Pl. 17) have broad ribbed decorations, the interval of the ribbed decoration of the materials from TB75 seems to be relatively narrower. Two of them are slipped in a light gray or light yellow orange color (Fig.7.1.5, 8: Pl.7.4.1, 2), found in Pit 1 of Trench D. The paste is coarse, grit tempered and well fired. The core and inner surface is orange in color. Both surface treatments are horizontally wet-smoothed.

A jar rim fragment was also unearthed from the same pit (Fig.7.2.4; Pl.7.15). It has a

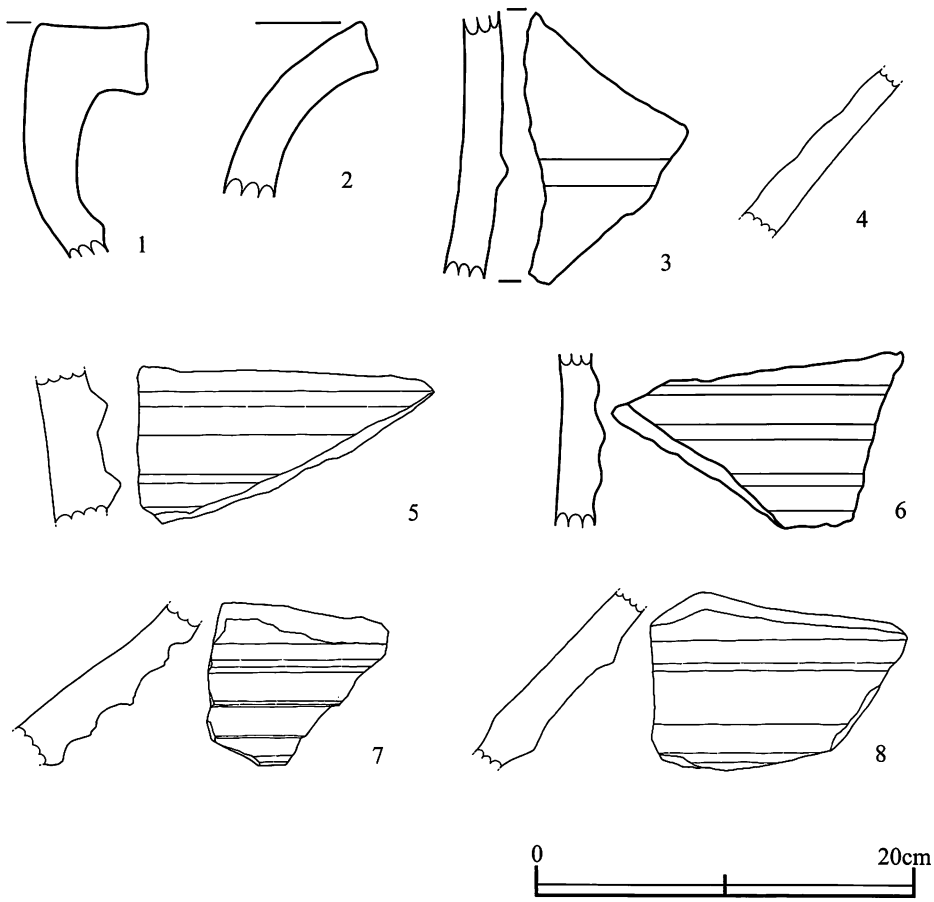


Fig.7.1 Pottery from TB75.

| No. | Form | Layer | Loc. | Size | Outer surface | Inner surface | Paste | Remarks |
|---|---|---|---|---|---|---|---|---|
| 1 | Ribbed pithos, rim | Layer 2 | TB75. Tr.A. 2005. No.14 | | Buff slip | Orange slip | Grey, fine, white sand | the nothern room of the secondary structure in "Harem Street", Persepolis (Schmidt 1957: Pl.73:7). |
| 2 | Pithos, rim | Layer 2 | TB75. Tr.A. 2005. No.11 | | Grey slip | Grey slip | Grey, fine, white sand | Tall-i Takht, Pasargadae (Stronach 1978: Fig. 121: 4) |
| 3 | Pithos, body | Layer 2 | TB75. Tr.A. 2005. No.11 | | Grey slip | Grey slip | Grey, fine, white sand | |
| 4 | Pithos, body | Layer 2 | TB75. Tr.D. 2006. No.2 | | Orange (2.5YR7/6), horizontal wet smooth | Orange (2.5YR7/6), horizontal wet smooth | Orange (2.5YR7/6), coarse, hard, less than 2 mm white & brown sand (3%) | Pl.7.3.1 |
| 5 | Ribbed pithos, body | Layer 2 | TB75. Tr.D. 2006. No.5, Pit 1 | | Slip (light gray: 2.5Y8/1), horizontal wet smooth | Orange (2.5YR7/8), horizontal wet smooth | Orange (2.5YR7/8), coarse, hard, less than 2mm white (10%) & brown (3%) sand | Pl.7.4.2 |
| 6 | Pithos, body | Layer 2 | TB75. Tr.B. 2006. No.13 | | Grey slip | Grey slip | Grey, fine, white sand | |
| 7 | Ribbed pithos, body | Layer 2 | TB75. Tr.C. 2006. No.13 | | Dull orange (7.5YR7/4), horizontal wet smooth | Orange (7.5YR6/6), horizontal wet smooth | Dull orange (7.5YR6/4), coarse, less than 1mm white & brown sand (1%) | Pl.7.4.3 |
| 8 | Ribbed pithos, body | Layer 2 | TB75. Tr.C. 2006. No.11 | | Slip (light yellow orange: 10YR8/2), horizontal wet smooth | Orange (2.5YR7/6), horizontal wet smooth | Dull orange (5YR6/4), coarse, hard, less than 3mm white & brown sand (5%) | Pl.7.4.1 |

very fine paste with very small white and black sand inclusions. Both surface treatments are horizontally wet-smoothed. Parallels of this piece were reported from Tall-i Takht, Pasargadae (Stronach 1978: Fig.118:1,2,4-6,8,9) and Tape Suruvan (Atarashi and Horiuchi 1963: Pl. 15: 9). The date of the vessel shape is identified to the late Achaenenid or post-Achaemenid period.

Only one fragment of a canteen jar (or a pilgrim flask) was found in layer 2 (Fig.7.2.10;

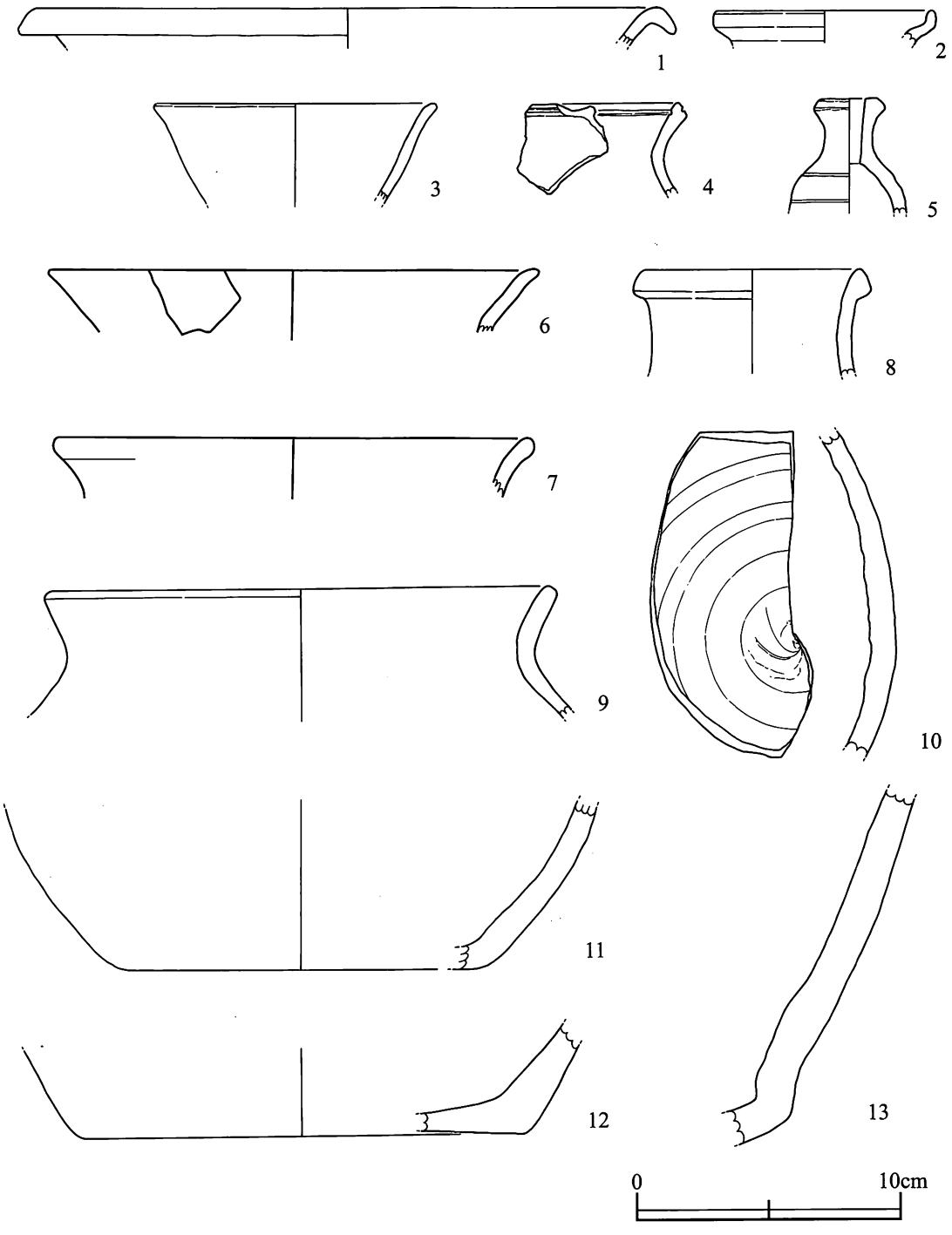


Fig.7.2 Pottery from TB75.

| No. | Form | Layer | Loc. | Size | Outer surface | Inner surface | Paste | Remarks |
|---|---|---|---|---|---|---|---|---|
| 1 | Bowl? rim | Surface layer | TB75. 2005.7.17 | D. 47.0cm | Red brown, horizontal wet smooth | Red or dark red slip, horizontal wet smooth | Red brown, 1mm gray & black sand (5%) | |
| 2 | Jar, rim | Layer 1 | TB75. Tr.C. 2006. No.7 | D. 8.0cm | Orange (5YR7/6), horizontal wet smooth | Dull reddish brown (5YR5/4), horizontal wet smooth | Dull reddish brown (5YR5/4), coarse, soft, less than 2mm white & black sand (10%) | Pl.7.1.4; Tall-i Takht, Pasargadae (Stronach 1978: Fig.119: 26) |
| 3 | Bowl, rim | Layer 2 | TB75. Tr.A. 2005. No.9 | D. 10.5cm | Yellowish white, horizontal wet smooth | Yellowish white, horizontal wet smooth | Yellowish white, less than 1mm brown sand (5%) | |
| 4 | Jar, rim | Layer 2 | TB75. Tr.D. 2006. No.5. Pit 1 | | Dull orange (7.5YR7/4), horizontal wet smooth | Dull orange (7.5YR7/4), horizontal wet smooth | Dull orange (7.5YR7/4), fine, less than 0.5mm white & black sand (1%) | Pl.7.1.5; Tall-i Takht, Pasargadae (Stronach 1978: Fig.118:1,2,4-6,8,9); Tape Suruvan (Aratashi 1963: Pl. 15: 9) |
| 5 | Bottle, rim & body | Layer 1 | TB75. Tr.D. 2006. No.1 | D. 2.2cm | Orange (2.5YR7/6), wet smooth by spatula (lip), horizontal wet smooth (body) | Orange (2.5YR7/6), wet smooth | Orange (2.5YR7/6), coarse, soft, less than 2mm white & black sand (10%) | Pl.7.1.1; Tall-i Takht, Pasargadae (Stronach 1978: Fig. 116: 7-10, 12, 13) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6 | Jar, rim | Layer 1 | TB75. Tr.A. 2005. No.12 | D.18.4cm | Brown slip | Brown slip | Grey, fine, white sand | |
| 7 | Jar, rim | Layer 1 | TB75. Tr.A. 2005. No.12 | D.17.8cm | Brown slip | Brown slip | Grey, fine, white sand | |
| 8 | Jar, rim | Layer 1 | TB75.Tr.C. 2006. No.9 | D. 8.2cm | Brownish gray (7.5YR6/1), horizontal wet smooth | Dull yellow orange (10YR6/3), horizontal wet smooth | Brownish gray (7.5YR6/1), fine, hard, less than 1mm black (7%) & white (1%) sand | Pl.7.1.3 |
| 9 | Jar, rim | Layer 1 | TB75. Tr.D. 2006. No.1 | D. 18.8cm | Dull orange (2.5YR6/4), horizontal wet smooth | Dull orange (2.5YR6/4), horizontal & oblique scraped | Brownish gray (10YR6/1), coarse, hard, less than 1mm white sand (3%) | Pl.7.1.2 |
| 10 | Pilgrim flask, body | Layer 2 | TB75. Tr.D. 2006. No.3 | | Orange (5YR7/6), light burnish | Orange (2.5YR7/8), wet smooth, twisted trace | Orange (2.5YR7/8), core (olive gray: 5GY5/1), fine, hard, less than 1mm white sand (2%) | Pl.7.2.2 |
| 11 | Jar? base | Surface layer | TB75. Tr.B. 2005. No.1 | D. 13.0cm | Red brown, wet smooth | Red brown, horizontal wet smooth | Red brown, 0.5mm white & gray sand (5%) | Pl.7.3.2 |
| 12 | Jar? base | layer 2 | TB75. Tr.D. 2006. No.2 | D. 16.8cm | Dull yellowish orange (10YR7/2), horizontal wet smooth (coarse) | Yellowish gray (2.5Y5/1), horizontal wet smooth | Yellowish gray (2.5Y5/1), coarse, hard, less than 2mm black and white sand (7%) | Pl.7.2.1 |
| 13 | Jar? body & base | Layer 3 | TB75. Tr.D. 2006. No.3 | | Light gray (2.5Y8/1), horizontal wet smooth | Light gray (2.5Y8/1), horizontal wet smooth | Light gray (2.5Y8/1), coarse, soft, less than 3mm black sand (3%) | |

Pl.7.2.2). It has a very fine paste with small white sand inclusions. Canteen jars are one of the typical vessel forms of late Achamenid and post-Acaemenid pottery. Though this piece is a body fragment, it can be designated as a canteen jar judging from the inner treatment, circular wet-smooth and a twisted trace for detaching unnecessary clay. The outer surface is lightly burnished and orange in color. The dark core in the section is olive gray in color.

Yellowish gray potsherds were most frequently found in layer 2 of TB75. Since most of the potsherds are small and fragmentary, it is very difficult to reconstruct their vessel shape. One of them is a flat jar base fragment (Fig.7.2.12; Pl.7.2.1). The inner surface is wet-smoothed, both horizontally and finely. The paste is coarse and hard. The inner and paste are yellowish gray and the outer surface is dull yellowish orange.

There are a few light gray potsherds. One of them is a jar fragment (Fig.7.2.13). The jar is wheel made and horizontally wet-smoothed. The paste is coarse, soft and grit tempered.

Although layer 1 belongs to the Islamic period, the late Achaemenid and post-Achaemenid potsherds were also found. A rim fragment, unearthed from layer 1, seems to be the late Achaemenid or post-Acahaemenid variety (Fig.7.2.2; Pl.7.1.4). The same vessel shapes were unearthed from Tall-i Takht, Pasargadae (Stronach 1978: Pl.119:26). The paste is coarse and grit tempered. The outer surface is orange and the inner surface and paste are dull reddish brown. A bottle rim fragment, found from layer 1, also would be datable to about the late Achaemenid or post-Achaemenid period (Fig.7.2.5; Pl.7.1.1). Parallels are reported from Tall-i Takht, Pasargadae (Stronach 1978: Fig.116: 7-10, 12, 13).

## Other Objects from TB75

A few iron artifacts were found from TB75. A remarkable piece is a tanged trilobate arrowhead (Fig.7.3.1). Although socketed bronze trilobate arrowheads are common items in Achaemenid inventories, the iron specimens are exceptional. One tanged iron trilobate arrowhead, however, was reported from Treasury of Persepolis (Schmidt 1957: Pl.76: 15). Furthermore, an iron four flanged arrowhead was unearthed from Village Perse-Achéménide, Susa (Ghirshman 1954: Pl. 43: G.S. 1030c). It should be pointed out that the specimen resembles the tanged iron trilobate arrowhead from TB75 in shape. Additionally, fragments

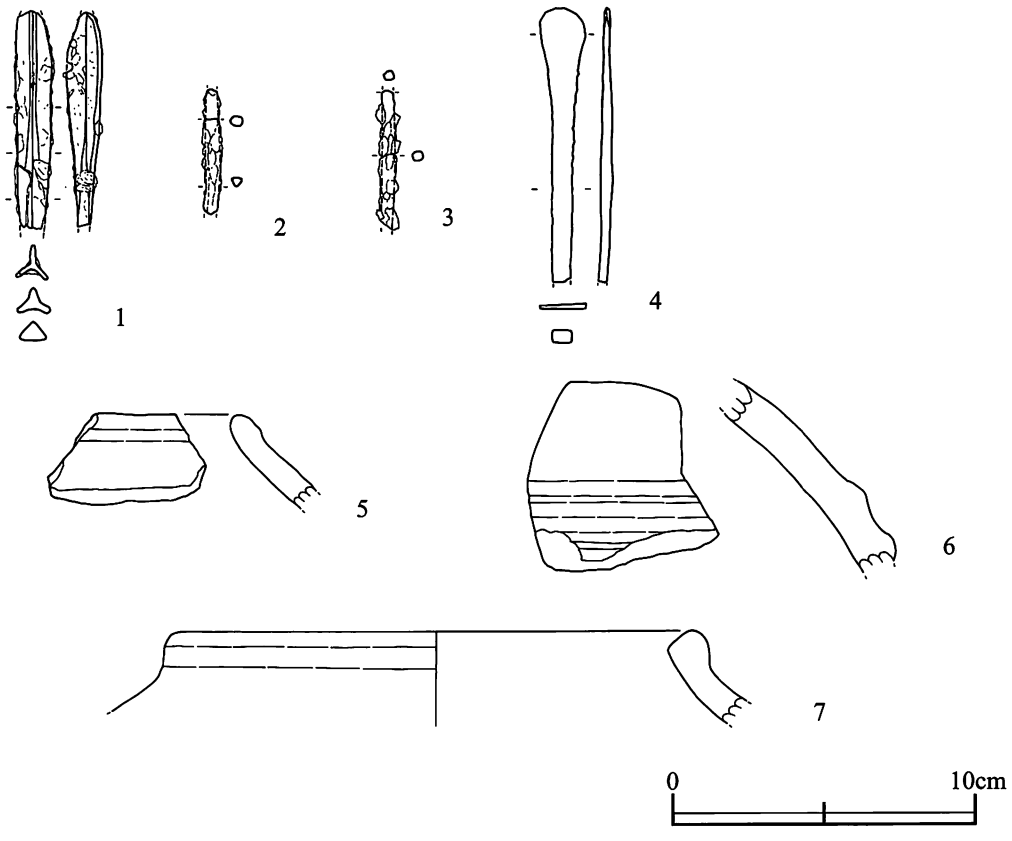


Fig.7.3 Metal objects from TB75-2(1-4) and Pottery from TB130 (5-7).

| No. | Form | Layer | Loc. | Size | Raw material | Remarks |
|---|---|---|---|---|---|---|
| 1 | Tanged trilobate arrowhead | Layer 2 | TB75. Tr.C. 2006. No.11 | L. 7.2cm W. 1.2cm | Iron | Treasury, Room 8, Persepolis (Schmidt 1957: Pl.76:15). |
| 2 | Nail? | Layer 2 | TB75. Tr.A. 2005. No.11 | L. 4.1cm | Iron | Pl.7.5.2 |
| 3 | Nail? | Layer 2 | TB75. Tr.A. 2005. No.11 | L. 4.6cm | Iron | Pl.7.5.1 |
| 4 | Spatula | Layer 1 | TB75. Tr.C.2006. No.1. Sieving | L. 9.0cm W. 1.5cm T. 0.4cm | Bronze | niveau 1, Chaour, Susa (Labrousse and Boucharlat 1974: Fig. 28: 2, 3) ; Tall-i Takht, Pasargadae (Stronach 1978: Fig. 91: 12) |

| No. | Form | Layer | Loc. | Size | Outer surface | Inner surface | Paste | Remarks |
|---|---|---|---|---|---|---|---|---|
| 5 | Jar, rim | Layer 1 | TB130. Tr.C.2005. No.1 | | Dark gray brown, Wet smooth | Dark gray brown, wet smooth | Dark gray brown, less than 2mm white sand (8%) | |
| 6 | Jar, body | Layer 1 | TB130. Tr.C. 2005. No.1 | | Grey brown, wet smooth | Grey brown, unknwon | Grey brown, less than 1mm white & dark brown sand (5%) | |
| 7 | Jar, body | Layer 2 | TB130. Tr.C. 2005. No.3 | L. 17.0cm | Brown, wet smooth | Brown, unknwon | Brown, 1mm white sand (5%) | |

of an iron pin or nail were unearthed from layer 2 (Fig.7.3.2, 3; Pl.7.5.1, 2). Both ends were broken and the section is irregular-shaped.

Only one bronze spatula was found from layer 1 and its lower part was broken (Fig.7.3.4). Comparisons of this piece were unearthed from Tall-i Takht, Pasargadae (Stronach 1978: Fig. 91: 12) and niveau 1, Chaour, Susa (Labrousse 1974: Fig.28:2,3). The specimen from Pasargadae is dated to the post-Achaemenid period, and those from Susa from the Sassanid or early Islamic period.

## Pottery from TB130

We found a small quantity of potsherds from TB130 (Fig.7.3.5-7). The materials, naturally adhered calcic soil, could not be observed in the surface treatment, color and paste.

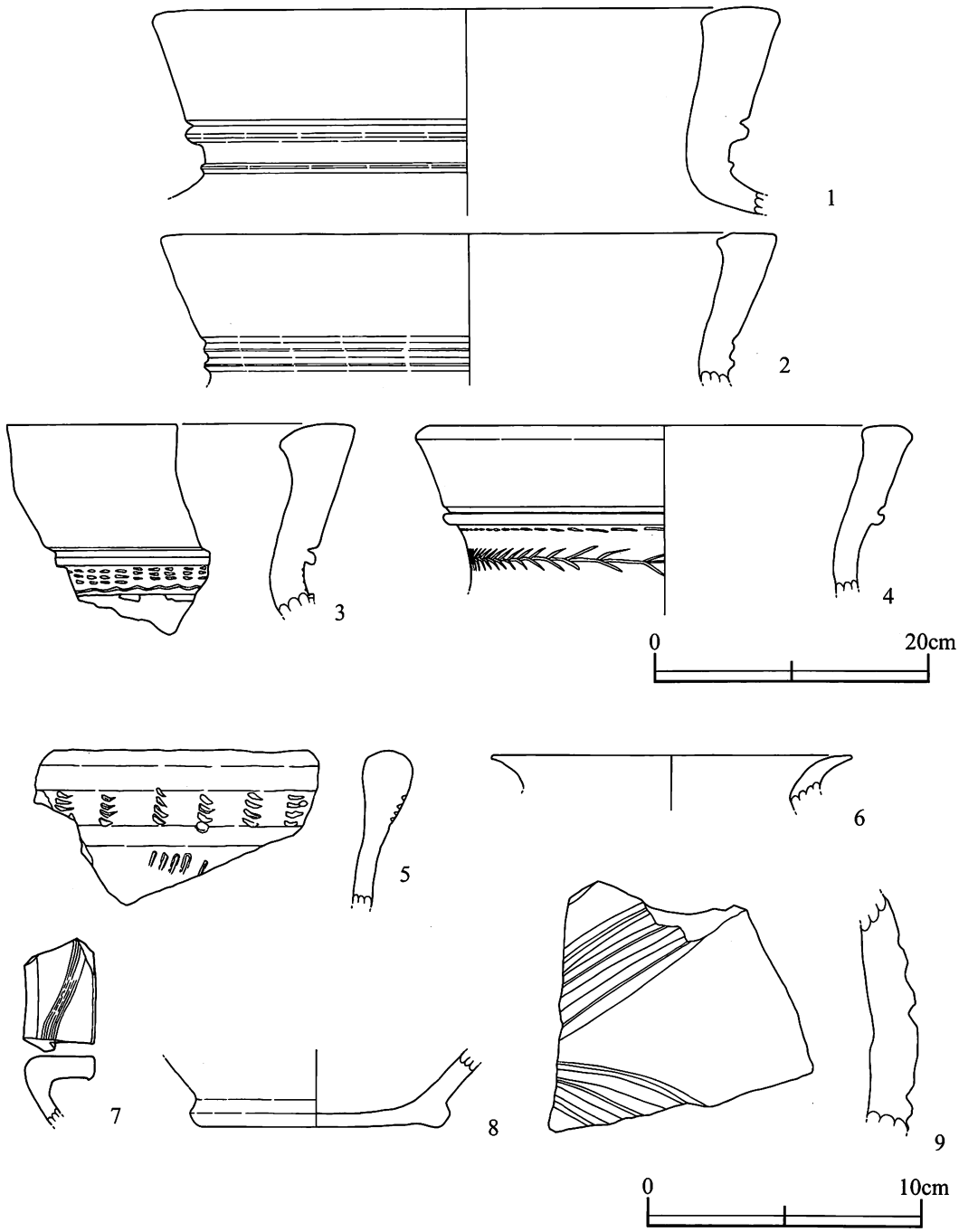


Fig.7.4 Pottery from the general survey.

| No. | Form | Layer | Loc. | Size | Outer surface | Inner surface | Paste | Remarks |
|---|---|---|---|---|---|---|---|---|
| 1 | Pithos, rim | Surface collection | N: 30°08'844" E: 53°05'665" | D. 45.8cm | Red brown, fine horizontal wet smooth | Red brown, fine horizontal wet smooth | Red brown (gray core), 1-3mm white & gray sand (8%) | Pl.7.6; North of "Royal Hunting Ground". See chapter 11, Fig.11. |
| 2 | Pithos, rim | Surface collection | N: 30°08'844" E: 53°05'665" | D. 44.8cm | Red orange, fine horizontal wet smooth | Red orange, fine horizontal wet smooth | Red orange, 1mm white, gray and red brown sand (8%) | North of "Royal Hunting Ground". See chapter 11, Fig.11. |
| 3 | Pithos, rim | Surface collection | N: 30°08'844" E: 53°05'665" | | Red brown, fine wet smooth, incised decorations | Red brown, wet smooth | Red brown, 1-2mm white & black sand (8%) | Pl.7.7; North of "Royal Hunting Ground". See chapter 11, Fig.11. |
| 4 | Pithos, rim | Surface collection | N: 30°08'844" E: 53°05'665" | D.36.2cm | Gray, fine horizontal wet smooth, incised decorations | Gray, fine horizontal wet smooth | Gray, less than 1mm black & whiote sand (8%) | Pl.7.8; North of "Royal Hunting Ground". See chapter 11, Fig.11. |
| 5 | Jar, rim | Surface collection | N: 30°10'094" E: 53°04'547" | | Red brown, horizontal wet smooth, incised decorations | Red brown, horizontal wet smooth | Red brown, less than 2mm white & brown sand (1%) | In a small valley of northern part of Tang-e Bolaghi. |
| 6 | Jar, rim | Surface collection | N: 30°09'810" E: 53°09'235" | | Orange, horizontal wet smooth | Orange, horizontal wet smooth | Orange, fine | Tang-e Bolaghi near Dokhtarbor, see chapter 11, Fig.11.6. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | Jar, rim | Surface collection | N: 30°10'132" E: 53°04'420" | Red brown, horizontal wet smooth | Red brown, horizontal wet smooth, wavy lines by a wooden piece | Red brown (Gray core), 0.5mm white & black sand (5%) | Tang-e Bolaghi near Tirandâz, see chapter 11, Fig.11.10. |
| 8 | Bow, base | Surface collection | N: 30°08'759" E: 53°08'079" | horizontal wet smooth, white wash | horaizontal wet smooth, white wash, green glazed | Red brown, fine | In a small valley of northern part of Tang-e Bolaghi. |
| 9 | Large jar, body | Surface collection | N: 30°08'962" E: 53°06'447" | Gray brown, fine wet smooth, incised decorations | Gray brown, wet smooth | Gray brown, 1mm white, gray and black sand (5%) | Northeast of "Royal Hunting Ground". See chapter 11, Fig.11.12. |

As the situation stands, the date of the potsherds from TB130 cannot be identified.

## Pottery from the General Survey

The general survey results are reported in chapter 11. Some characteristic potsherds are shown here. Pithos rims have a flat end and horizontal grooves (Fig.7.4.1-4; Pl.7.6-8). Some of them have incised decorations. The same shaped specimen, reported in Tape Suruvan (Atarashi and Horiuchi 1963: Pl.16:13) [1] and Susa (Niveau 3, Chaour: Larbrousse and Boucharlat 1974: Fig.48:2), has a similar paste as the materials from the general survey. The pithoi, therefore, could be datable to the late Achaemenid period. Islamic glazed pottery is shown here (Fig.7.4.8). The base is covered with white wash on the both surfaces and glazed a green color on the inner surface.

## Conclusion

Although we have no clear diagnostic objects of the post-Achaemenid period in TB75, TB130 and the general survey, for examples, "fish plate", "ringed base bowl with inturned rim" and others, as we can see at Tall-i Takht, Pasargadae, some pottery fragments from layer 2, TB75 can be datable to the post-Achaemenid period. However, we cannot for certain divide our specimens into the two periods, the Achaemenid and post-Acaemenid period. In the future it is important to compare objects from layer 2, TB75, with those from Pasargadae, TB76, 77, 85 and 88 (Iranian Centre for Archaeological Research 2006, 2007), in order to consider the chronological sequence of the Achaemenid and post-Achaemenid material culture at Tang-e Bolaghi.

## Notes

(1) Courtesy of Dr. Yoshihiro Nishiaki, the author observed the specimen from Tape Suruvan (Atarashi and Horiuchi 1963: Fig.16:13) in the Museum of University of Tokyo.

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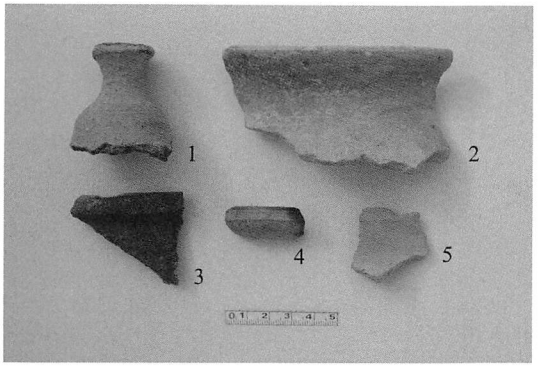


Plate 7.1 Achaemenid or post-Achaemenid Pottery.

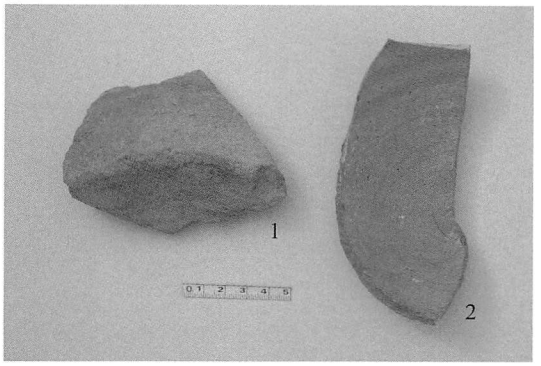


Plate 7.2 Achaemenid or post-Achaemenid Pottery.

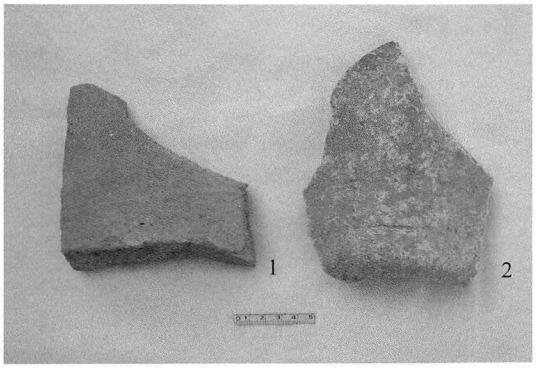


Plate 7.3 Achaemenid or post Achaemenid Pottery.

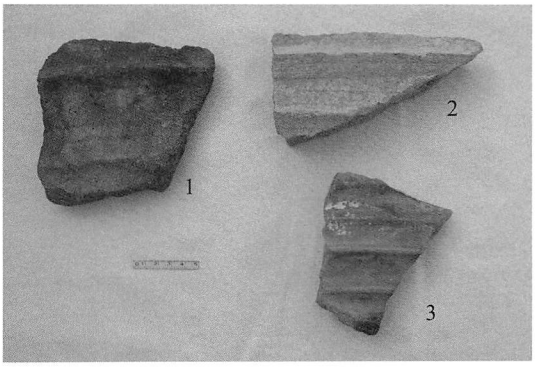


Plate 7.4 Ribbed pithos.

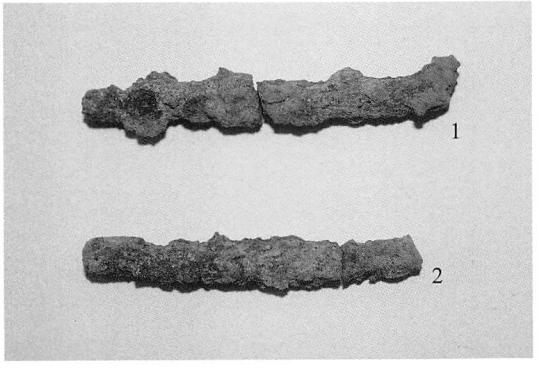


Plate 7.5 Iron objects.

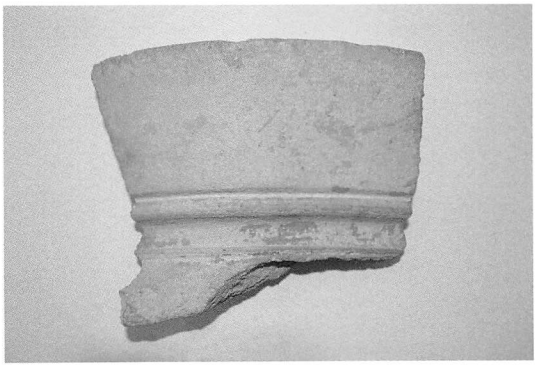

Plate 7.6 Pithos from the general survey.

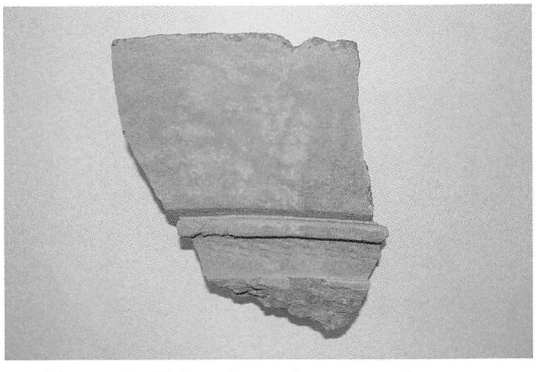

Plate 7.7 Pithos from the general survey.

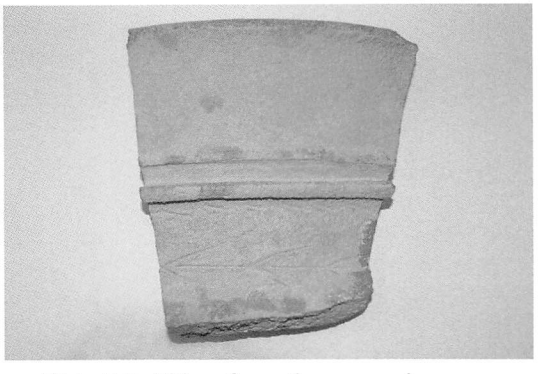

Plate 7.8 Pithos from the general survey.

# CHAPTER 8

## FAUNAL REMAINS FROM TB75

# 8. FAUNAL REMAINS FROM TB75

Hitomi HONGO and Marjan MASHKOUR

## Introduction

Recent progress in the research of Neolithisation, which has demonstrated the Middle East and Indus Valley as the two world oldest birthplaces of food production technology, leads our attention to its diffusion processes to the neighboring regions. In this context the importance of the large region that extends in the south of Zagros, or the plateau of southwest Iran is much emphasized, because it is situated in the middle of the two major provinces, and could represent the possible links in-between. The study of the Faunal remains of TB75 (Eshkaft-e Haji Bahrami) is in this respect extremely meaningful.

This report presents preliminary results of the analysis of faunal remains from TB75, a cave site situated on the southern slope of the Bolaghi Mountains in the province of Fars in the southwest of Iran and the southern parts of Zagros Range. The material analyzed was recovered during two seasons of excavation conducted by a joint Iranian-Japanese team as a part of the salvage project for the Sivand Dam area. Faunal remains were collected from Trenches A and B in the 2005 season and Trenches C and D in the 2006 season.

## Material Analyzed

Faunal remains from Trench A (2005 season) were analyzed by M. Mashkour. Preliminary analysis of the material from Trenches B (2005 season), C and D (2006 season) was carried out by M. Diab in the field in 2006, with the material being restudied by H. Hongo in 2007. Three periods were recognized at the site: Layers 1 and 2 belong to the historic periods (Islamic and Achaemenid Period respectively). Layers 3 and 4 are from the Proto-Neolithic Period (c. 10000-8500 uncal. bp). Layers 5 and 6 belong to the Epi-Paleolithic Period (c. 16000-12000 uncal. bp).

Since the material recovered from Trench B consists of only a small amount (total of c.

2.5 grams) of small shaft fragments and shells, they are not included in this report. The faunal remains from Trench C consist of those coming from Layers 1 and 2 as well as material from Proto-Neolithic Layers. The stratigraphic affiliation of the material, however, still needs to be assessed carefully. Therefore, the present report will focus on the faunal remains from Trenches A and D.

All excavated deposits were screened using 5 mm and 2 mm mesh, resulting in an excellent recovery of small mammal (mainly rodent) bones. Many of the bones from Trench D were burnt, most of them were charred and exhibit black color, and a few were completely calcined. About 63% of the bones from Layers 3-4 and about 47% of the bones from Layers 5-6 in Trench D show traces of fire. Much of the material from Trench A is also burnt. Chewing marks, either by carnivores or rodents, are rarely found, even though rodent bones were commonly encountered in the assemblage.

About 1300 animal bone fragments (c. 1150 grams) were recovered from Trench A. About two thirds of the material belongs to Layers 3-4, which are Proto-Neolithic Layers, and the rest to Layer 2 (Achaemenid Period). Faunal remains from Trench D consist of about 3000 fragments (c. 4500 grams), including material from Layer 2 (Achaemenid Period, but including a few fragments from the Islamic Period Layer 1 on the surface), Layers 3-4 (Proto-Neolithic), and Layers 5-6 (Epi-Paleolithic). Due to fragmentation, only about 8 % of recovered bone fragments could be identified. Consequently, the number of identified specimens both in the Epi-Paleolithic and Achaemenid Periods are very small, 47 and 27 respectively, which makes it very difficult to see reliable statistical changes through time in animal exploitation at the site.

## Results of Identification

The results of identification from each layer of Trench A and D are summarized in Table 8.1.

**Gazelle (*Gazella* sp.)**

Gazelle is the most commonly encountered taxon both in the Epi-Paleolithic and Proto-Neolithic Layers and occupies about 28% (in number) of the identified specimens (Plate 8.1). The proportion of gazelle in the assemblage is much smaller in the Achaemenid Period Layer, occupying only about 10% in number of identified specimens. Although it is likely that the species which existed at the site was *Gazella subgutturosa*, identification of the species of gazelles at the site is tentative. *Gazella bennetti* has also been reported from sites in southeastern Iran, but the northern boundaries of its distribution in the past is not clear (Uerpmann 1987).

**Sheep (*Ovis* sp.) and goats (*Capra* sp.)**

The proportion of sheep and goats in the assemblage increases dramatically in the Proto-Neolithic Layers (Plate 8.2 & 3). The total of sheep and goats (including specimens that could be identified as sheep or goat) comprises about 17% of the number of identified specimens in the Epi-Paleolithic Layers, then increases to about 46% in the Proto-Neolithic Layers. There are less sheep and goats in the Achaemenid Period, and the proportion is about 33%. Sheep seems to be more common in the Epi-Paleolithic Layers, but this observation is a preliminary one due to a very small number of specimens in the sample (3 sheep bones and 1 goat). The proportion of goats increases in the Proto-Neolithic layers, where the sheep: goat ratio is 1: 1.2. Goats became much more important than sheep in the Achaemenid Period, where the sheep: goat ratio is 1: 6.

**Large Bovid and Cervid**

Cattle (*Bos* sp.) was not encountered in the Epi-Paleolithic Layers, but a single molar

## Table 8.1 Summary of identification of faunal remains from TB75.

Layer 2 (Achaemenid) (note: Trench D material includes some specimens from Layer 1- Islamic Period)

| | Trench A | | | | Trench D | | | | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NISP | % | Weight (g) | % | NISP | % | Weight (g) | % | NISP | % | Weight (g) | % |
| Gazella | 3 | 13.6 | 6.7 | 10.7 | 0 | 0.0 | 0 | 0.0 | 3 | 11.1 | 6.7 | 4.1 |
| Ovis | 1 | 4.5 | 10.5 | 16.8 | 0 | 0.0 | 0 | 0.0 | 1 | 3.7 | 10.5 | 6.4 |
| Capra | 6 | 27.3 | 16.4 | 26.3 | 0 | 0.0 | 0 | 0.0 | 6 | 22.2 | 16.4 | 10.1 |
| Ovis/ Capra | 0 | 0.0 | 0 | 0.0 | 2 | 40.0 | 12 | 12.0 | 2 | 7.4 | 12 | 7.4 |
| Bos | 0 | 0.0 | 0 | 0.0 | 2 | 40.0 | 88 | 87.6 | 2 | 7.4 | 88 | 54.1 |
| Cervus | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Sus | 2 | 9.1 | 11.7 | 18.8 | 0 | 0.0 | 0 | 0.0 | 2 | 7.4 | 11.7 | 7.2 |
| Vulpes | 1 | 4.5 | 1.7 | 2.7 | 0 | 0.0 | 0 | 0.0 | 1 | 3.7 | 1.7 | 1.0 |
| Canid | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| small carnivore | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Lepus | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Equid | 8 | 36.4 | 13.6 | 21.8 | 0 | 0.0 | 0 | 0.0 | 8 | 29.6 | 13.6 | 8.4 |
| small rodent | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Aves | 0 | 0.0 | 0 | 0.0 | 1 | 20.0 | 0.4 | 0.4 | 1 | 3.7 | 0.4 | 0.2 |
| Testudo | 1 | 4.5 | 1.8 | 2.9 | 0 | 0.0 | 0 | 0.0 | 1 | 3.7 | 1.8 | 1.1 |
| reptile | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| frog | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| reptile/amphibian | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| fish | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| shell | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Total | 22 | 100 | 62.4 | 100 | 5 | 100 | 100.4 | 100 | 27 | 100.0 | 162.8 | 100 |
| | | | | | | | | | | | | |
| large mammal | 4 | | 12.7 | | 0 | | 0 | | 4 | | 12.7 | |
| large bovid/cervid | 1 | | 24.9 | | 0 | | 0 | | 1 | | 24.9 | |
| medium mammal | 23 | | 85.5 | | 6 | | 23 | | 29 | | 108.5 | |
| medium bovid/cervid | 3 | | 13.8 | | 0 | | 0 | | 3 | | 13.8 | |
| small mammal | 29 | | 35.8 | | 1 | | 1 | | 30 | | 36.8 | |
| micro mammal | 1 | | 0.1 | | 0 | | 0 | | 1 | | 0.1 | |
| fragments | 247 | | 100.9 | | 0 | | 0 | | 247 | | 100.9 | |
| Fragments TOTAL | 308 | | 273.7 | | 7 | | 24 | | 315 | | 297.7 | |
| | | | | | | | | | | | | |
| Total recovered | 330 | | 336.1 | | 12 | | 124.4 | | 342 | | 460.5 | |

Layer 3-4 (Proto-Neolithic)

| | Trench A | | | | Trench D | | | | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | NISP | % | Weight (g) | % | NISP | % | Weight (g) | % | NISP | % | Weight (g) | % |
| Gazella | 9 | 22.5 | 10.4 | 10.3 | 69 | 28.8 | 249.1 | 29.8 | 78 | 27.9 | 259.5 | 27.7 |
| Ovis | 8 | 20 | 31.3 | 31.1 | 31 | 12.9 | 182.2 | 21.8 | 39 | 13.9 | 213.5 | 22.8 |
| Capra | 19 | 47.5 | 46.3 | 45.9 | 28 | 11.7 | 160.8 | 19.2 | 47 | 16.8 | 207.1 | 22.1 |
| Ovis/ Capra | 0 | 0 | 0 | 0.0 | 43 | 17.9 | 133.2 | 15.9 | 43 | 15.4 | 133.2 | 14.2 |
| Bos | 1 | 2.5 | 10.1 | 10.0 | 0 | 0.0 | 0 | 0.0 | 1 | 0.4 | 10.1 | 1.1 |
| Cervus | 0 | 0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Sus | 3 | 7.5 | 2.7 | 2.7 | 0 | 0.0 | 0 | 0.0 | 3 | 1.1 | 2.7 | 0.3 |
| Vulpes | 0 | 0 | 0 | 0.0 | 2 | 0.8 | 0.7 | 0.1 | 2 | 0.7 | 0.7 | 0.1 |
| Canid | 0 | 0 | 0 | 0.0 | 1 | 0.4 | 1 | 0.1 | 1 | 0.4 | 1 | 0.1 |
| small carnivore | 0 | 0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Lepus | 0 | 0 | 0 | 0.0 | 8 | 3.3 | 10.2 | 1.2 | 8 | 2.9 | 10.2 | 1.1 |
| Equid | 0 | 0 | 0 | 0.0 | 2 | 0.8 | 60.4 | 7.2 | 2 | 0.7 | 60.4 | 6.5 |
| small rodent | 0 | 0 | 0 | 0.0 | 3 | 1.3 | 0.5 | 0.1 | 3 | 1.1 | 0.5 | 0.1 |
| Aves | 0 | 0 | 0 | 0.0 | 4 | 1.7 | 2 | 0.2 | 4 | 1.4 | 2 | 0.2 |
| Testudo | 0 | 0 | 0 | 0.0 | 18 | 7.5 | 25.4 | 3.0 | 18 | 6.4 | 25.4 | 2.7 |
| reptile | 0 | 0 | 0 | 0.0 | 6 | 2.5 | 1.4 | 0.2 | 6 | 2.1 | 1.4 | 0.1 |
| frog | 0 | 0 | 0 | 0.0 | 8 | 3.3 | 0.8 | 0.1 | 8 | 2.9 | 0.8 | 0.1 |
| reptile/amphibian | 0 | 0 | 0 | 0.0 | 11 | 4.6 | 1.2 | 0.1 | 11 | 3.9 | 1.2 | 0.1 |
| fish | 0 | 0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| shell | 0 | 0 | 0 | 0.0 | 6 | 2.5 | 6.6 | 0.8 | 6 | 2.1 | 6.6 | 0.7 |
| Total | 40 | 100 | 100.8 | 100 | 240 | 100 | 835.5 | 100 | 280 | 100 | 936.3 | 100 |
| | | | | | | | | | | | | |
| large mammal | 10 | | 49.6 | | 1 | | 53 | | 11 | | 102.6 | |
| large bovid/cervid | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| medium mammal | 82 | | 170.9 | | 1419 | | 2046 | | 1501 | | 2216.9 | |
| medium bovid/cervid | 53 | | 73.8 | | 124 | | 234.7 | | 177 | | 308.5 | |
| small mammal | 59 | | 110.7 | | 459 | | 131.8 | | 518 | | 242.5 | |
| micro mammal | 1 | | 0.3 | | 51 | | 5.8 | | 52 | | 6.1 | |
| fragments | 722 | | 305.4 | | 147 | | 102 | | 869 | | 407.4 | |
| Fragments TOTAL | 927 | | 710.7 | | 2201 | | 2573.3 | | 3128 | | 3284 | |
| | | | | | | | | | | | | |
| Total recovered | 967 | | 811.5 | | 2441 | | 3408.8 | | 3408 | | 4220.3 | |

| | Layer 5-6 (Epi-Paleolithic) Trench D | | | |
|---|---|---|---|---|
| | NISP | % | Weight (g) | % |
| Gazella | 13 | 27.7 | 25.4 | 7.6 |
| Ovis | 3 | 6.4 | 24.8 | 7.4 |
| Capra | 1 | 2.1 | 62 | 18.5 |
| Ovis/ Capra | 4 | 8.5 | 30.8 | 9.2 |
| Bos | 0 | 0.0 | 0 | 0.0 |
| Cervus | 1 | 2.1 | 52.6 | 15.7 |
| Sus | 0 | 0.0 | 0 | 0.0 |
| Vulpes | 0 | 0.0 | 0 | 0.0 |
| Canid | 0 | 0.0 | 0 | 0.0 |
| small carnivore | 1 | 2.1 | 0.2 | 0.1 |
| Lepus | 0 | 0.0 | 0 | 0.0 |
| Equid | 3 | 6.4 | 135.2 | 40.3 |
| small rodent | 17 | 36.2 | 3.5 | 1.0 |
| Aves | 1 | 2.1 | 0.2 | 0.1 |
| Testudo | 1 | 2.1 | 0.4 | 0.1 |
| reptile | 0 | 0.0 | 0 | 0.0 |
| frog | 1 | 2.1 | 0.2 | 0.1 |
| reptile/amphibian | 0 | 0.0 | 0 | 0.0 |
| fish | 1 | 2.1 | 0.2 | 0.1 |
| shell | 0 | 0.0 | 0 | 0.0 |
| Total | 47 | 100 | 335.5 | 100 |
| | | | | |
| large mammal | 9 | | 60.4 | |
| large bovid/cervid | 4 | | 84.2 | |
| medium mammal | 216 | | 294.8 | |
| medium bovid/cervid | 23 | | 42.3 | |
| small mammal | 109 | | 40.4 | |
| micro mammal | 88 | | 20.5 | |
| fragments | 39 | | 29.4 | |
| Fragments TOTAL | 488 | | 572.0 | |
| | | | | |
| Total recovered | 535 | | 907.5 | |

and two cranium fragments were identified in the Proto-Neolithic and Achaemenid Layers respectively. The mandibular molar (M1 or M2) from the Proto-Neolithic Layer is rather small (occlusal length 27.5mm) for Aurochs. However, the date of the Proto-Neolithic Layer at the site at around 8500 uncalibrated bp seems to be too early for the existence of domestic cattle in this region. With only one isolated tooth from this layer, it is impossible to assess the status of cattle in the Proto-Neolithic Layer at TB 75. Also, we cannot entirely exclude the possibility of intrusion from upper layers.

Red Deer (*Cervus elaphus*) is represented by a maxillary fragment with molar teeth (M1 and M2) found in the Epi-Paleolithic Layer (Plate 8.4).

**Pigs (*Sus scrofa*)**

Pigs were not found in the Epi-Paleolithic Layers, but a few specimens were found both in the Proto-Neolithic and Achaemenid Layers. Of the three pig bones from the Proto-Neolithic Layers of Trench A, two are unfused phalanges and another is a rib fragment. A rib and a tooth fragment were found from the Achaemenid Layers. Without measurable specimens, wild or domestic status of these pigs could not be determined.

**Equids**

Two equid maxillary teeth and a mandibular cheek tooth were found in the Epipalaeolithic Layers of Trench D. One of the upper cheek teeth (a premolar 3 or 4), with estimated length 29 mm, breadth 26.7 mm, belongs to a horse (*Equus. caballus*) (Photo 8.5) The measurements fall within the range of Przewalski horses (measurements courtesy of Dr. Vera Eisenmann). The distribution range of horse extended during the Paleolithic, which has been attested at other sites in the central Iranian Plateau (Mashkour *et al.* in prep). Also a mandibular cheek tooth with the morphological features of hemion (*E. hemionus*, cf. onager) (Photo 6-a, b) and an equid metapodial shaft were recovered from the Proto-Neolithic layers of Trench D. Unidentified teeth fragments were found from an Achaemenid Period pit in

Trench A. The Equid remains are undergoing more detailed investigation.

**Carnivores**

A few fox (*Vulpes vulpes*) bones were found both in the Proto-Neolithic and Achaemenid Layers, but not in the Epi-Paleolithic Layers. An unidentified canid third metatarsal was found in the Proto-Neolithic Layer of Trench D. With a measurement of proximal breadth 5.3 mm and depth 8.4 mm, it is larger than fox, but smaller than modern jackal bone in M. Mashkour's comparative collection in Tehran. An ulna of a small carnivore was found in the Epi-Paleolithic Layer, but it could not be identified to species.

**Miscellaneous small mammals and other animals**

Hare (*Lepus capensis*) bones were found only in the Proto-Neolithic Layers of Trench D. There are at least two species of small rodents in the assemblage, and detailed identification is being carried out by N. Hashemi (UMR 5197-CNRS/MNHN and Ferdwosi University of Mashad). Bird (Plate 8.7), reptile, and amphibian bones were occasionally found. Among reptile bones, land turtle is relatively common. Fish bone is rare in the assemblage, and only one pectoral spine was found from the Epipalaeolithic Layer. Molluscs, including both bivalves and freshwater snails, were recovered only from the Proto-Neolithic Layers (Plate 8.8).

## Size of sheep and goats

Measurements of goats, sheep, gazelles, equids and cervids from TB75 are listed in Tables 8.2-8.6. Measurements of post-cranial elements of sheep and goats were compared using the "difference of logs" or "log size index" (LSI) technique (Meadow 1981, 1983,

Table 8.2 Measurements of *Capra* from TB 75.

Scapula

| Trench | Layer | Specimen no. | note | SLC | GLP | LG | BG | HN |
|---|---|---|---|---|---|---|---|---|
| D | 3 | 116 | | 24.4 | 38.2 | 30.8 | 25.1 | 30.9 |

Humerus

| Trench | Layer | Specimen no. | note | Bd | Dd | BT | HT | AD | BT/HT |
|---|---|---|---|---|---|---|---|---|---|
| A | 3-4 | | | | | 28.9 | 17.4 | 14.0 | 0.6 |
| A | 3-4 | | | | | 26.8 | 15.8 | 13.5 | 0.6 |
| D | 4 | 96 | | 34.7 | 31.1 | 33.5 | 21.2 | | |

Radius

| Trench | Layer | Specimen no. | note | Bp (estimated) |
|---|---|---|---|---|
| D | 4 | 82 | | (35.2)* |

*: measurements in parenthesis are estimated

Astragalus

| Trench | Layer | Specimen no. | note | GLl | GLm | LA | Dl | Dm | Bd | BFp |
|---|---|---|---|---|---|---|---|---|---|---|
| D | 4 | 51 | burnt | 27.8 | 26.8 | 22.7 | 15.3 | 16.5 | 18.6 | 17.1 |

Metapodial

| Trench | Layer | Specimen no. | note | Bp | 3* | 4* | BT |
|---|---|---|---|---|---|---|---|
| A | 3-4 | | metapodial | | 12.7 | 11.6 | |
| D | 4 | 112 | metapodial | | | | 16.4 |
| D | 4 | 109 | metatarsal | (24.1) | | | |

3: breadth of medial trochlea 4: depth of medial condyle (following Payne 1969)

Ph1

| Trench | Layer | Specimen no. | note | Bp | Dp | Bd | Dd |
|---|---|---|---|---|---|---|---|
| D | 4 | 41 | | | | 12.3 | 11.1 |
| D | 4 | 71 | | 15.1 | 16.3 | | |
| D | 3 | 111 | | 14.2 | 16.7 | | |

Ph2

| Trench | Layer | Specimen no. | note | Bp | Dp | SD | Depth of diaphysis | Bd | Dd | GL |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 3-4 | | | | | 12.5 | | 13.0 | 13.2 | |
| A | 3-4 | | | 16.4 | 15.6 | 12.5 | | 12.9 | 14.5 | 30.5 |
| D | 4 | 39 | | 16.1 | 14.9 | 11.9 | 12.0 | 13.1 | 14.3 | 31.6 |
| D | 3 | 113 | prox.unfused | | | | | 10.4 | 12.6 | |
| D | 3 | 129 | | | | | | 10.2 | 11.3 | |

Ph3

| Trench | Layer | Specimen no. | note | MBS | DLS | Ld | H | Bf | Lf |
|---|---|---|---|---|---|---|---|---|---|
| A | | | | 6.0 | 28.5 | 19.1 | | | |
| A | | | | 6.0 | 34.6 | 22.3 | | | |
| D | 4 | 47 | concretion | 8.8 | 33.4 | (26.7) | 18.5 | 9.3 | |
| D | 4 | 75 | | 5.5 | 27.8 | 22.6 | 15.0 | 8.9 | 12.8 |
| D | 4 | 90 | burnt | 4.7 | 30.0 | 26.1 | 16.0 | 8.0 | 11.7 |
| D | 4 | 91 | burnt | 5.0 | | | | 10.6 | 13.8 |
| D | 4 | 117 | burnt | 6.7 | | | 17.6 | 9.3 | |
| D | 4 | 118 | burnt | 6.4 | | | 15.2 | 9.0 | |

## Table 8.3 Measurements of *Ovis* from TB 75.

Scapula

| Trench | Layer | Specimen no. | note | SLC | GLP | LG | BG | HN |
|---|---|---|---|---|---|---|---|---|
| A | 2 | | | | 36.9 | 29.3 | 24.2 | |
| D | 6 | 1 | | 29.2 | 43.2 | 31.8 | 28.8 | 30.8 |

Humerus

| Trench | Layer | Specimen no. | note | Bd | Dd | BT | GLT |
|---|---|---|---|---|---|---|---|
| D | 4 | 97 | | 37.1 | (30.0) | 33.6 | 22.8 |

Radius

| Trench | Layer | Specimen no. | note | Dp | Bdf |
|---|---|---|---|---|---|
| D | 4 | 93 | | (17.2) | |
| D | 4 | 102 | unfused | | 31.5 |

Ulna

| Trench | Layer | Specimen no. | note | BPC | smallest length of articular facet |
|---|---|---|---|---|---|
| D | 4 | 42 | | 20.6 | 17.5 |

Metapodial

| Trench | Layer | Specimen no. | note | Bd | Dd | 3 | 4 | Dt |
|---|---|---|---|---|---|---|---|---|
| A | 3-4 | | metacarpal | 26.3 | 17.8 | 11.5 | 12.0 | |
| A | 3-4 | | metacarpal | 24.5 | 15.8 | 11.3 | 11.5 | |
| A | 3-4 | | metapodial | | | 9.4 | 11.8 | |
| D | 4 | 55 | metacarpal | 26.0 | | 12.3 | 12.5 | 16.9 |
| D | 4 | 83 | metacarpal, burnt | | | 11.14 | 11.0 | 16.3 |

3: breadth of medial trochlea 4: depth of medial condyle (following Payne 1969)

Femur

| Trench | Layer | Specimen no. | note | Bd | Dd |
|---|---|---|---|---|---|
| D | 3 | 123 | | 38.46 | (47.0) |

Astragalus

| Trench | Layer | Specimen no. | note | GLl | GLm | LA | Dl | Dm | Bd | BFp |
|---|---|---|---|---|---|---|---|---|---|---|
| D | 3 | 247 | burnt | 27.4 | | 23.9 | 16.4 | | 17.9 | |
| D | 4 | 53 | burnt | 30.5 | 28.2 | 24.3 | 17.1 | 17.4 | 18.6 | 17.9 |
| D | 4 | 81 | burnt | 28.6 | (26.7) | 23.7 | 15.4 | 15.0 | 16.9 | (17.5) |
| D | 4 | 94 | | 28.4 | 26.5 | 22.7 | 16.0 | 16.6 | 19.2 | 16.7 |
| D | 4 | 98 | | 31.7 | 29.2 | 25.4 | 18.0 | 19.3 | 20.9 | 20.9 |

Calcaneum

| Trench | Layer | Specimen no. | note | GB | GD | Ltub | GL | 1* | 2* |
|---|---|---|---|---|---|---|---|---|---|
| D | 4 | 95 | | 23.5 | | 45.9 | 67.9 | 23.8 | 12.9 |
| D | 5 | 20 | burnt | 19.9 | 25.4 | 50.0 | 70.6 | 23.4 | 11.9 |
| D | 5 | 36 | unfused | 18.4 | 23.5 | | | 22.2 | 10.7 |

1: Length from distal end to the proximal margin of articular surface for Os malleolus

2: Length of the articular surface for Os malleolus

Ph1

| Trench | Layer | Specimen no. | note | Bp | Dp | SD | Depth of diaphysis | Bd | Dd | GL |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 3-4 | | | 13.4 | 15.8 | | | | | |
| D | 3 | 110 | | 14.4 | 17.0 | | | | | |
| D | 3 | 119 | | 12.9 | 14.8 | 10.4 | 10.2 | 11.3 | (10.5) | (37.8) |
| D | 3 | 120 | burnt | | | | | 15.0 | 12.4 | |
| D | 3 | 121 | burnt | | | | | 12.0 | 10.6 | |
| D | 3 | 136 | | | | | | 13.9 | 12.4 | |
| D | 5 | 34 | burnt | 12.3 | 15.1 | | | | | |

Ph2

| Trench | Layer | Specimen no. | note | Bp | Dp | SD | Depth of diaphysis | Bd | Dd | GL |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 3-4 | | | 12.0 | 11.7 | 9.0 | | 9.8 | 10.5 | 26.5 |
| D | 3 | 114 | burnt | 12.4 | 13.6 | 8.0 | 9.0 | 9.4 | 11.1 | 25.6 |
| D | 3 | 115 | burnt | 12.6 | 13.6 | 7.9 | 9.1 | 9.9 | 10.7 | 26.1 |
| D | 5 | 21 | burnt | 12.1 | 12.3 | 8.9 | 8.5 | 9.3 | 10.5 | 23.9 |

Ph3

| Trench | Layer | Specimen no. | note | MBS | DLS | Ld | H | Bf | Lf |
|---|---|---|---|---|---|---|---|---|---|
| D | 4 | 104 | | 7.1 | 31.3 | 23.4 | 16.8 | 9.8 | |
| D | 3 | 122 | | 7.6 | 32.2 | 27.2 | 18.0 | 10.2 | |
| D | 4 | 62 | | 7.1 | 33.9 | | 16.7 | 10.1 | 12.5 |
| D | 4 | 89 | | 7.2 | | | | 10.0 | 12.5 |

Axis

| Trench | Layer | Specimen no. | note | BFcr | B den |
|---|---|---|---|---|---|
| D | 5 | 19 | burnt | (39.9) | 21.6 |

## Table 8.4 Measurements of equid from TB 75.

| Trench | Layer | Specimen no. | Element | note | 1 | 2 | 3 | 4 | 5 | 6 | B | protocone L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D | 5 | 31 | Lower cheek tooth | | 70.4 | 26.7 | 9.0 | 15.1 | 12.3 | 14.5 | | |
| D | 5 | 50 | Upper P2 | | (53.6) | 25.7 | | | | | 21.4 | 10.7 |
| D | 6 | 9 | Upper molar | | | (29.0) | | | | | (26.7) | 12.6 |
| D | 6 | 12 | Lower cheek tooth | | | 26.0 | | 14.4 | 9.4 | 15.6 | | |

Measurement criteria following Eisenmann et al. 1988
B: bucco-lingual breadth

## Table 8.5 Measurements of cervid from TB 75.

| Trench | Layer | Specimen no. | Element | note | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D | 6 | 8 | Upper Molars | red deer | M2 L | 31.3 | B | 23.8 | M1L | 26.6 | B | 21.3 |
| D | 4 | 40 | Ph1 | | Bd | 14.6 | Dd | 12.5 | | | | |

## Table 8.6 Measurements of *Gazella* from TB 75.

Scapula

| Trench | Layer | Specimen no. | note | GLP | LG | BG | HN |
|---|---|---|---|---|---|---|---|
| D | 4 | 44 | | | | (21.8) | |
| D | 4 | 101 | | 32.7 | 23.3 | 22.4 | 17.2 |

Humerus

| Trench | Layer | Specimen no. | note | Bd | Dd | BT | GLT |
|---|---|---|---|---|---|---|---|
| D | 4 | 27 | | 32.1 | 28.3 | 31.3 | 20.3 |

Radius

| Trench | Layer | Specimen no. | note | Bp | Dp |
|---|---|---|---|---|---|
| D | 4 | 7 | | (27.5) | (14.8) |

Metapodial

| Trench | Layer | Specimen no. | note | Bp | Bd | 3 | 4 | Dt |
|---|---|---|---|---|---|---|---|---|
| D | 3 | 133 | metacarpal, burnt | | | 9.7 | 12.0 | (15.2) |
| D | 3 | 134 | metacarpal, burnt | | 21.9 | 10.4 | 13.2 | 17.5 |
| D | 4 | 29 | metacarpal, burnt, unfused | | | 9.2 | 11.9 | 16.2 |
| D | 4 | 80 | metacarpal, burnt | | 21.9 | 10.6 | 14.0 | 18.2 |
| D | 4 | 92 | metatarsal | 20.1 | | | | |
| D | 5 | 26 | metacarpal, unfused | | | 9.1 | 12.2 | 16.2 |

Astragalus

| Trench | Layer | Specimen no. | note | GLl | GLm | LA | Dl | Dm | Bd | BFp |
|---|---|---|---|---|---|---|---|---|---|---|
| D | 4 | 52 | | 30.4 | 28.3 | 24.6 | 16.9 | 17.3 | 18.4 | 17.0 |
| D | 4 | 54 | | 30.0 | 27.5 | 23.8 | 17.2 | 17.1 | 17.9 | 15.2 |

Calcaneum

| Trench | Layer | Specimen no. | note | GB | GD | Ltub | GL | 1 | 2 |
|---|---|---|---|---|---|---|---|---|---|
| D | 4 | 73 | concretion | 20.1 | 25.1 | 47.6 | 68.6 | 22.6 | 12.1 |

1: Length from distal end to the proximal margin of articular surface for Os malleolus
2: Length of the articular surface for Os malleolus

Ph1

| Trench | Layer | Specimen no. | note | Bp | Dp | SD | Bd | Dd | GL |
|---|---|---|---|---|---|---|---|---|---|
| A | 3-4 | | | | | 6.8 | 8.0 | 8.7 | |
| D | 3 | 124 | burnt | | | | 9.9 | 10.5 | |
| D | 3 | 125 | burnt | | | | 10.7 | 9.7 | |
| D | 3 | 126 | burnt | 11.9 | 14.6 | 10.0 | 10.7 | 9.2 | 14.6 |
| D | 3 | 127 | burnt | | | | 10.1 | 10.7 | |
| D | 3 | 128 | burnt, unfused | 12.3 | 14.7 | | | | |
| D | 4 | 28 | burnt, unfused | 12.1 | 14.7 | | | | |
| D | 4 | 43 | | | | | 9.9 | 10.7 | |
| D | 4 | 56 | | 13.2 | 16.5 | | | | |
| D | 4 | 57 | | | | | 9.6 | 10.7 | |
| D | 4 | 64 | | | 14.6 | | | | |
| D | 4 | 70 | burnt | 11.1 | 16.0 | | | | |
| D | 4 | 87 | burnt | | | | 9.9 | 9.8 | |
| D | 4 | 88 | burnt | | | | 9.7 | 9.9 | |
| D | 4 | 103 | | | | | 11.5 | 10.2 | |
| D | 5 | 35 | burnt | 10.2 | 14.1 | | | | |
| D | 6 | 2 | burnt | | | | 9.3 | 9.4 | |

Ph2

| Trench | Layer | Specimen no. | note | Bp | Dp | SD | Depth of diaphysis | Bd | Dd | GL |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 3-4 | | | 10.0 | 12.9 | 7.6 | | 9.5 | 12.1 | 25.3 |
| A | 3-4 | | | 9.2 | 12.0 | 6.7 | | 7.7 | 10.5 | 22.4 |
| A | 3-4 | | | 8.9 | 12.7 | 6.5 | | 8.0 | 11.0 | 23.3 |
| A | 3-4 | | | 9.0 | 12.1 | 7.0 | | 8.1 | 10.1 | 24.1 |
| D | 4 | 59 | anterior | 11.5 | 13.9 | 7.9 | 8.1 | 9.8 | 11.9 | 23.3 |
| D | 4 | 58 | posterior | 10.9 | 11.7 | 8.4 | 7.3 | 9.1 | 9.8 | 24.0 |
| D | 3 | 130 | burnt | 9.4 | 12.6 | 6.4 | 6.9 | 7.9 | 10.3 | 23.2 |
| D | 3 | 131 | burnt | 10.0 | 14.0 | 7.6 | 7.9 | 9.1 | 11.3 | 25.9 |
| D | 4 | 86 | burnt | 11.7 | 12.0 | 8.3 | 8.0 | 9.2 | 10.1 | 24.1 |
| D | 4 | 99 | | 9.4 | 12.8 | 6.9 | 7.8 | 8.3 | 8.2 | 23.3 |
| D | 4 | 106 | burnt | | | | | 11.3 | | |
| D | 5 | 22 | burnt | 9.0 | 11.7 | 6.6 | 6.1 | 7.8 | 9.6 | 22.1 |
| D | 5 | 33 | | 9.2 | 13.1 | 6.5 | 6.7 | 7.7 | 10.2 | 23.5 |
| D | 6 | 10 | | 9.1 | 11.8 | 6.5 | 7.1 | 7.9 | 10.9 | 22.6 |

Ph3

| Trench | Layer | Specimen no. | note | MBS | DLS | Ld | H | Bf |
|---|---|---|---|---|---|---|---|---|
| A | 3-4 | | | 5.3 | 25.5 | 16.7 | | |
| D | 3 | 132 | | 5.5 | 26.6 | 22.7 | 13.5 | 8.8 |
| D | 4 | 30 | burnt | 6.1 | 29.0 | | 16.2 | 9.5 |
| D | 4 | 46 | concretion | 6.2 | 24.7 | | 14.6 | 8.3 |
| D | 4 | 61 | | | | | | 8.7 |

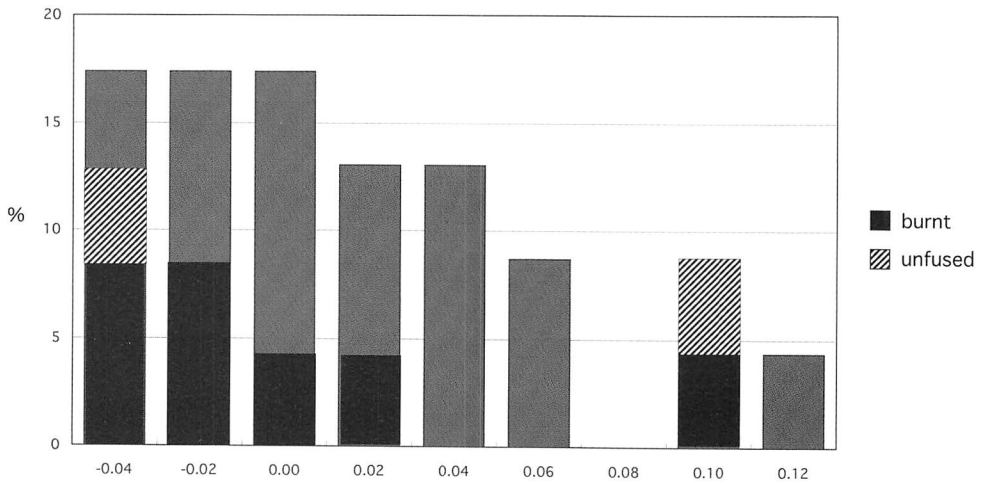


Fig.8.1 TB75 *Ovis* Log Size Index (n=23).

1999; Uerpmann 1979). The standard measurement for the calculation of the LSI for sheep was taken from a female wild sheep from Iran (Chicago Field Museum, specimen # FMC57951). The standard measurements for goats are based on the average element dimensions of one female and one male wild goat from southern Turkey (Natural History Museum, London, specimen # BMNH653M and 653L2) (Uerpmann and Uerpmann 1994: Tables 12&14).

Fig. 8.1 shows the LSI distribution of sheep from TB75. The three specimens at the larger end of the range clearly come from large male wild sheep. One of them is a scapula from the Epipalaeolithic Layer, another is an unfused epiphysis of distal radius from the Proto-Neolithic Layer, and the third one is a first phalanx from the Epipalaeolithic Layer. There are four specimens from the Epipalaeolithic Layer, and their LSI values are all larger than 0. Many of the specimens (but not all) toward the smaller end of the distribution range are burnt, which is indicated by solid colour in the figure. It is possible that the measurements of these burnt bones tend to be smaller due to shrinkage from burning. Excluding these burnt bones and unfused specimens, the distribution of LSI indicates that sheep from the Epipalaeolithic and Proto-Neolithic layers at the site are probably all wild sheep (*Ovis orientalis*). There is one specimen from the Achaemenid Period, which is a large animal with a LSI value of 0.05. This specimen, however, cannot be readily identified as a

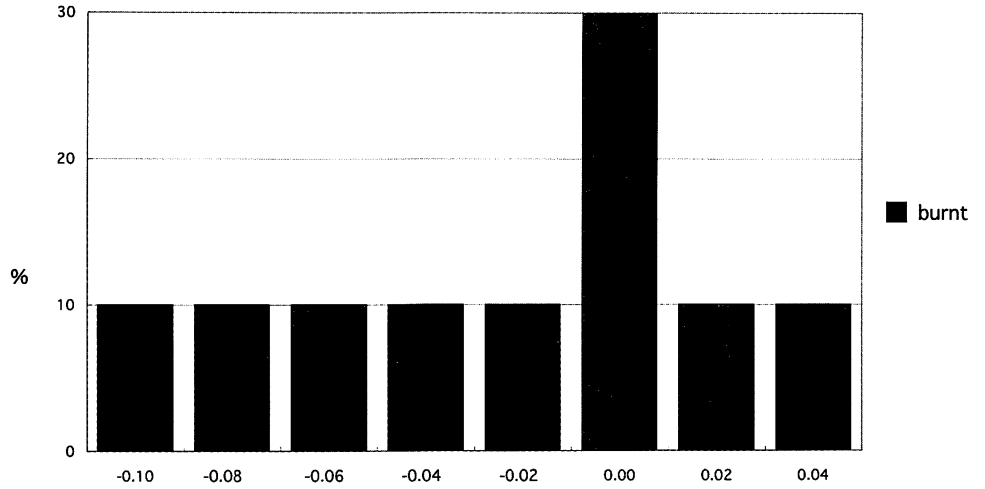


Fig.8.2 TB75 *Capra* Log Size Index (n=10).

wild specimen because improved breeds that might be similar in size to the wild animals exist in the historical periods. Especially, it is extremely difficult to distinguish domestic males from wild specimens. There are, however, a few specimens from Proto-Neolithic layers whose LSI values are on the smaller side, ranging between -0.04 to -0.01. Although we do not know the size range of wild sheep in the Fars province nor the degree of sexual dimorphism, and we cannot entirely determine the domestic or wild status of these relatively small specimens, they are probably small female wild sheep. The date of the Proto-Neolithic Layer seems to be too early for the existence of domestic sheep in the region. A sheep humerus (specimen no. 97 from Trench D, with LSI value 0.05) from Layer 4 (Proto-Neolithic) was directly dated to 8598±49 bp (7650-7575cal. BC, 1 sigma, intcal 04.14C, sample number AA74918. note: personal communication, Dr. P.J. Reimer, Queen's University, Belfast and J.F. Saliege, Universite Pierre et Marie Curie, Paris) using apatite. The date corresponds well to results of 14C dating from the site using charcoal fragments (see Capter 10 in this volume).

All the goat specimens used for LSI analysis came from Proto-Neolithic Layers (Fig. 2), but due to small sample size, it is difficult to evaluate the size of goats at the site. Comparison of individual measurements of second phalanges (specimen no. 39 from Trench D and the specimen from Trench A, see Table 8.2) indicates that the greatest length (31.6 and 30.5 respectively) is comparable to those from the Paleolithic sites, in the upper size range of the modern wild goats of northern and central Zagros, and larger than the modern wild goats of southern Zagros (Zeder 2005: Table 4; Zeder 2006). It should also be noted that there are a few relatively small specimens with LSI values at –0.07 and –0.1. It is likely that the goats from Proto-Neolithic Layers of TB75 are mostly wild goats (*Capra aegagrus*), however, in the absence of data on the kill-off patterns it is difficult to assess wild, predomestic or domestic status of goats at the site. This question needs to be further investigated, including direct dating of the specimens at the smaller end of the size distribution.

## Discussion

The Province of Fars is little known from an archaeozoological point of view and constitutes not only one probable passage of the currents of Neolithisation between the west and east, but also a passage between the low and the high altitude zones of Zagros

mountains. During the last 5 years, a number of important archaeological investigation in the Fars Province made it possible to investigate the most debated topic of the archaeozoologists working in the Middle/Near East, the process of domestication, on the Iranian Plateau after the pioneer work of William Sumner in 1972. In 2002-2003 within the framework of a French-Japanese collaboration project (CNRS/ JSPS) archaeozoologists began the analysis of the faunal remains of several site of the Marvdasht plain (Tal-i-Mushki, Jari B and Jari A, Tal-i-Gap) excavated by a Japanese archaeological team during the late 1950's (Fukai et al. 1973; Nishiaki & Mashkour 2006; Mashkour et al. 2006; Mashkour & Vigne Unpublished report 2008). Until then, the only part of the material that had been partially investigated were the equid bones, studied by Sebastian Payne who was interested in documenting the presence of *Equus hydruntinus* in the region (Payne, 1991).

In the mean time an archaeological team directed by K. Abdi, Susan Pollock and Reinhard Bernbeck began an archaeological investigation in Tol-e-Bashi (Abdi et al. 2003; Mashkour & Bailon in press). In 2004, Abbas Alizadeh of the Oriental Institute of Chicago (2004) re-visited the Marvdasht sites (Mushki, Jari B, Jari A, Bakun) , previously excavated by the Japanese archaeologists and the faunal material of which has been analysed (Mashkour et al. 2006). Also, an Irano-Australian team investigated the Nurabad plain where late Neolithic layers were also present. Other recent investigations in Fars are more focused on salvage projects due to massive dam constructions (Tepe Mehr Ali – Lapui period, now immersed). Faunal remains from these sites have been also studied (Mashkour 2006, Sheikhi 2008 and Sheikhi & Mashkour in prep.). An abundant radiocarbon set of data now exists for all these sites and it clearly appears that the earliest Neolithic sites in the Province are Tall-i Mushki followed by Jari B [7500 BP] (partially contemporary to some contexts of Tol- e-Bashi). It is especially in Mushki that we could trace the history and the process of the ungulate domestication in southern Zagros, where goat is clearly domesticated and sheep is very scarcely represented with the shy presence of domestic cattle in parallel to the Aurochs.

On the basis of our present knowledge on the process of animal domestication in the southern Zagros, it is clear that sites such as TB75 are of great importance for a better description of the domestication process. If still possible, and the logistic situation makes it feasible, the site of TB75 and similar sites in the vicinity of the dam that might have remained out of the water should be investigated deeper for more data collection.

## Summary

The results of analysis of faunal remains from TB75 suggest that a wide range of fauna was exploited during the prehistoric periods at the site. Medium sized bovids were the most important game in this broad-spectrum resource exploitation, of which gazelles were the most significant during the Epipaleolithic and Proto-Neolithic period. An increase in the proportion of sheep and goats, especially goats, from the Epipalaeolithic Period to the Proto-Neolithic Period is evident at the site. Whether or not this change in the exploitation patterns of bovids in the Proto-Neolithic Period was related to the beginning of domestication of sheep and goats could not be determined with the evidence at hand. Distribution of LSI for both sheep and goats suggest a rather homogeneous population, and comparison of individual measurements of goats also indicated that the specimens are within the size range for wild goats.

Pigs and cattle were not found in the Epipalaeolithic Layers, but appear from the Proto-Neolithic Layers. Although a cattle tooth was found in the Proto-Neolithic Layer, cattle might be a later arrival in the region, and it was only in the Achaemenid Period that its significance increased.

Most of the sheep, goat, cattle, and pig remains in the Achaemenid and Islamic Layers are probably domestic. These taxa together make up more than half of the identified specimens in the Achaemenid Period. Gazelle hunting still continued, but its importance was reduced compared to the prehistoric period. Equid remains also increased dramatically in the Achaemenid Period, reflecting the strategic importance of the site in the vicinity of Presepolis.

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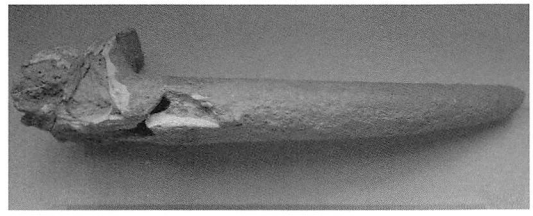

Plate 8.1 Horncore of gazelle (Trench D Layer 5, #13).

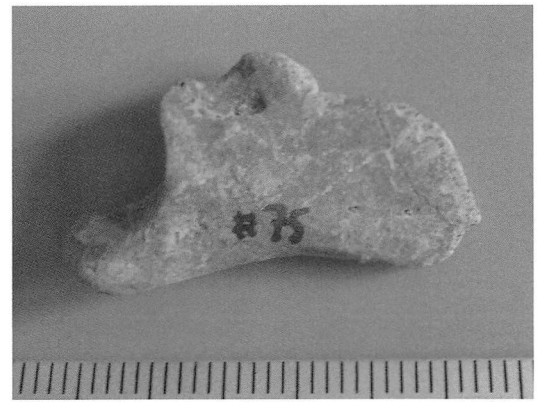

Plate 8.2 Thrid phalanx of goat (Trench D Layer 4, #75).

Plate 8.3 Metacarpal of sheep (Trench D Layer 4, #55).

Plate 8.5 Maxillary tooth of equid (Trench D Layer 6, #9).

Plate 8.4 Maxillary teeth of red deer (Trench D layer 6, #8).

Plate 8.6a Mandibular tooth of equid (Trench D Layer 4, #31).

Plate 8.6b Occlusal surface of #31.

Plate 8.7 Medium size birds (Trench D Layer 4, #76 & 77).

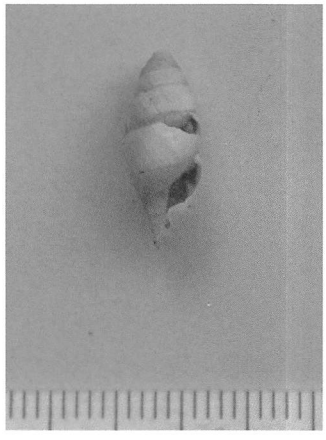

Plate 8.8 Shell (Trench D Layer 4).

# CHAPTER 9

## PLANT REMAINS FROM TB75

# 9. PLANT REMAINS FROM TB75

Ken-ichi TANNO

Charred remains collected with a small-scale manual water-sieve during the excavation were sent to me for analysis. Location, date and other sample information are given in Table 9.1. The source amounts of soil were not measured, and only small numbers of charred seeds were recovered. The identifiable seeds are reported here to provide an initial plant list for the site. The sample results are given in Table 9.2; four of the samples received did not contain botanical material and are not described further here.

## Sample 2 (Epi-Paleolithic)

Three Leguminosae, one Gramineae and one indeterminable seeds were found in sample 2. Among the three Leguminosae, one seed is probably either to *Astragalus* sp. or *Trigonella* sp. (Fig. 9.1). These two genera are difficult to distinguish, except in the case of certain distinctive species. This is mainly because the morphology of *Astragalus* seeds can be highly variable, even within one pod. The other Leguminosae seeds and one Gramineae

Table 9.1 Sampling location of botanical remains.

| Sample Number | Trench | Layer | Period | Date of sampling |
|---|---|---|---|---|
| No.1 | C | 5 | Epi-Paleolithic | 2006.8.2 |
| No.2 | C | 5 | Epi-Paleolithic | 2006.7.26 |
| No.3 | C | 6 | Epi-Paleolithic | 2006.8.2 |
| No.4 | D | 4 | Proto-Neolithic | 2006.8.2 |
| No.5 | D | 5 | Epi-Paleolithic | 2006.7.31 |
| No.6 | D | 4-5 | Proto-Neolithic | 2006.8.2 |
| No.7 | C | 5 | Epi-Paleolithic | 2006.7.26 |
| No.8 | D | 5 | Epi-Paleolithic | 2006.8.2 |
| No.9 | C | 3 | Proto-Neolithic | 2006.8.2 |
| No.10 | C | 4 | Proto-Neolithic | 2006.8.2 |

Table 9.2 Results of archaeobotanical remains.

| Sample Number | No.1 | No.2 | No.3 | No.4 | No.5 | No.6 | No.7 | No.8 | No.9 | No.10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Recovered charred remain (ml) | 0.05 | 0.5 | 0.05 | 0.05 | 0.2 | 0.5 | 0.2 | 0.6 | 0.3 | 0.05 |
| *Stipa* sp. | | 1 cf. | | | | | | 1 cf. | | |
| *Triticum* cf. *aestivum* | | | | | | | 1 | | | |
| *Triticum* lower spikelet base | | | | | 1 | | | | | |
| *Hordeum vulgare* | | | | | | | 1 | | | |
| Gramineae (*Setaria* sp.) | | | | | | | | 1 | | |
| *Lens* sp. | | | | | | 1 | | | | |
| *Astragalus/Trigonella*-type | | 1 | | | | | | 1 | | |
| Leguminosae | | 2 | | | | | 2 | 1 | | |
| Papaveraceae | | | | | | | 1 | | | |
| *Prunus/Amygdalus* sp. | | | | | | | 2 | | | |
| Nut shell | | | | | | | | 1 | | |
| indeterminable seed | | 1 | | | | | | | | |
| Mouse dropping | | | | | | 1 | | | 1 | |
| Note | None | | None | None | | | | | | None |

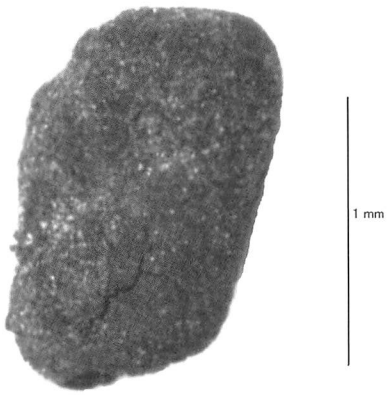


Fig.9.1 *Astragalus/Trigonella*-type.

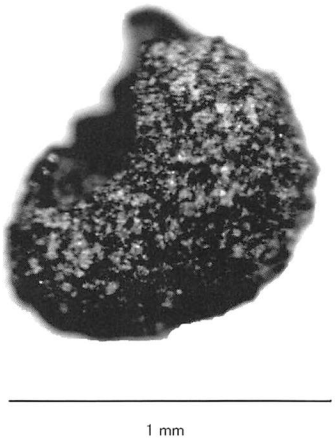


Fig.9.2 Papaveraceae.

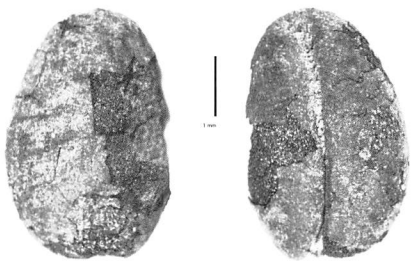

Fig.9.3 *Triticum* cf. *aestivum*.

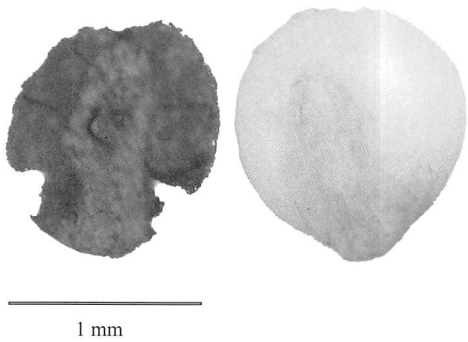


Fig.9.4 Gramineae remain (left) and modern *Setaria italica* (right).

seed were difficult to identify due to damage. The cylindrical shape of the latter is close to the characteristic shape of *Stipa* sp. The indeterminable seed in sample 2 may belong to *Malva* sp., but its morphology is not very typical for this species and has a degraded surface, so identification was not possible.

### Sample 6 (Proto-Neolithic)

One fragment of lentil (*Lens* sp.) was found, and a mouse dropping that may contain further botanical material (see also sample 9, Table 9.2).

### Sample 7 (Epi-Paleolithic)

This sample yielded the largest number of identifiable items: an intact wheat grain, a barley grain fragment, *Prunus* or *Amygdalus* nut fragments, a Papaveraceae seed (Fig. 9.2) and Leguminosae seeds. The intact wheat grain was most probably a bread wheat (Fig. 9.3), although spike-internodes are needed to most accurately distinguish bread wheat from durum wheat. As the oldest known naked wheats (bread and durum wheats) are from 7250-6650 BC of Tell Bouqras, Syria, the wheat grain appearing here in the Epi-Paleolithic layer of Haji Bahrami may be intrusive from a younger layer.

### Sample 8 (Epi-Paleolithic)

The remains in sample 8 were somewhat similar to those in sample 2. Two Leguminosae and two Gramineae seeds were found. Of the two Leguminosae, one was *Astragalus / Trigonella* type. One Gramineae seed is probably *Stipa* sp. and another is similar in morphology to *Setaria* sp. (Fig. 9.4, see also Acknowledgements). The latter is not very common from early archaeological sites in West Asia.

## Discussion

Haji Bahrami is thought to comprise of Epi-Paleolithic and Proto-Neolithic levels. Plant remains from these periods in this region have not been reported previously. *Astragalus/Trigonella*–type legumes and probable *Stipa* are frequently found in early archaeological sites in West Asia, and the present results are consistent with this. The unexpected presence of naked wheat (sample 7) may indicate intrusion or contamination in the excavation area. The very small number of charred remains recovered limits the accuracy of identification. Indeed, no botanical remains were found in samples 1, 3, 4 and 10. More detailed investigations are needed to detect any general trends in vegetation history and plant use in this region.

## Acknowledgement

I would like to thank Prof. Tsuneki for allowing me to work on the samples, Dr. George Willcox (CNRS, France) who checked some seeds for identification and Dr. Peter Matthews (National Museum of Ethnology, Japan) for correction of English. This botanical analysis was partly supported by JSPS grant (No. 18820056) and by RIHN, Japan (SATO project contribution No.7).

After this manuscript was submitted, Dr. Dorian Fuller (University College of London) kindly identified the presumed *Setaria* seed in this sample as definitely *Setaria*, and most probably *S. italica*. I thank him for this observation.

# CHAPTER 10

## RADIOCARBON DATING

# 10-1. RADIOCARBON DATING OF CHARCOAL REMAINS EXCAVATED FROM TB75

Toshio NAKAMURA and Masayo MINAMI

## Abstract

Ten charcoal samples collected from an archeological site of TB75 (Haji Bahrami Cave) located in the Bolaghi Valley, Fars Province, of southern Iran were radiocarbon dated with a Tandteron AMS system at Nagoya University. Four charcoal samples collected from excavation layers attributed to the Proto-Neolithic period were dated at 8480±45 BP to 10190±45 BP and five samples from the Epi-Paleolithic at 12225±50 BP to 16650±70 BP in $^{14}C$ age. The $^{14}C$ ages were calibrated to be 7590-7490 cal BC to 10115-9760 cal BC and 12290-11980 cal BC to 18000-17600 cal BC, respectively, within a two-sigma error range by using the IntCal04 data set. The $^{14}C$ ages and the calibrated dates of the samples from the two historical stages are quite consistent with their respective age classifications, Proto-Neolithic and Epi-Paleolithic periods, as estimated from their archeological context.

## 1. Introduction

In chronological studies of archeology worldwide, radiocarbon ($^{14}C$) dating is commonly used to estimate the period when archeological sites were intensively used for residence or living, on human organic remains excavated at the sites, for ages of younger than 50,000BP (Libby 1955). In particular, $^{14}C$ age measurements based on accelerator mass spectrometry (AMS) have been applied to the remains of small sample sizes, because AMS $^{14}C$ dating normally requires only a few milligrams of carbon in the final stages of measurement (Nakamura et al. 2000).

Ten charcoal samples collected from an archeological site of TB75 located in the Bolaghi Valley in the Fars district of southern Iran were delivered to the authors for precise age estimation, by Prof. Akira Tsuneki of the University of Tsukuba. The meaning of $^{14}C$ ages for the samples is described in the other part of this volume. The authors dated the

samples with a Tandteron $^{14}C$ AMS system at the Center for Chronological Research, Nagoya University, and report the results here.

## 2. Sample preparation

Characteristics of the charcoal samples for the $^{14}C$ dating are summarized in Table 10.1. Four samples are classified as being from the Proto-Neolithic period and six samples are from the Epi-Paleolithic. The second column of Table 10.1 denotes the trench, basket and layer number of the sampling points, as described in other part of this volume.

Chemical and physical cleaning of the charcoal samples, $CO_2$ separation from them, graphite target production and AMS $^{14}C$ dating were performed at the Center for Chronological Research, Nagoya University (Nakamura et al. 2004). We describe the procedure briefly as follows. The charcoal samples were rinsed with distilled water by using a supersonic cleaner, and treated twice with 1.2 M HCl for 2 hours at 80°C, to remove any possible carbonate contaminants. Next, the samples were treated with 0.4 M NaOH solution for 2 hours at 80°C. The alkaline treatment was repeated several times with different concentrations of up to 1.2M NaOH, depending on the sample condition. When a serious loss of the charcoal sample occurred during this process, the treatment was stopped immediately. After the NaOH treatment, the samples were then treated again with 1.2 M HCl for 2 hours at 80°C, and rinsed with distilled water to remove the HCl component completely.

Two charcoal samples nos. 24 and 33 easily dissolved during the first treatment with the 0.4M NaOH solution that followed after the HCl treatment. These samples may have been produced under lower temperatures so they were not charred perfectly and easily dissolved in NaOH solution. We therefore recovered a humic acid fraction from the NaOH solution for

Table 10.1 Characteristics and some specific values during sample preparation procedures for charcoal fragment remains excavated from TB75.

| Sample No. | Trench – basket No. – layer* | Dated materials | Weight of materials for combustion | $CO_2$ yield ($CO_2$ collection efficiency) | $\delta^{13}C_{PDB}$ (‰) by IRMS** | Age expected from archeological contexts | |
|---|---|---|---|---|---|---|---|
| | | | | | | Period | Supposed date (cal BC) |
| 2 | D-4-3 | charcoal fragment | 6.15 | 1.42 (23.1%) | n.m. | Proto-neolithic | 7000-10000 |
| 7 | D-9-4 | charcoal fragment | 6.21 | 3.69 (59.1%) | -26.4 | Proto-neolithic | 8000-10000 |
| 13 | D-12-4 | charcoal fragment | 6.20 | 3.91 (63.0%) | -25.3 | Proto-neolithic | 8000-10000 |
| 22 | D-16-4 | charcoal fragment | 6.30 | 3.75 (59.5%) | -23.3 | Proto-neolithic | 8000-10000 |
| 24 | D-19-5 | humic acid from charcoal fragment | n.m. | 5.90 (n.m.) | -23.8 | Epi-paleolithic | 10000-12000 |
| 25 | D-19-5 | charcoal fragment | 6.20 | 4.53 (73.1%) | -26.2 | Epi-paleolithic | 10000-12000 |
| 28 | D-19-5 | charcoal fragment | 6.15 | 3.70 (60.2%) | -26.6 | Epi-paleolithic | 10000-12000 |
| 33 | D-23-6 | Humic acid from charcoal fragment | n.m. | n.m. | n.m. | Epi-paleolithic | 10000-12000 |
| 34 | D-23-6 | charcoal fragment | 6.30 | 3.83 (60.8%) | -23.4 | Epi-paleolithic | 10000-12000 |
| 35 | D-24-6 | charcoal fragment | 6.27 | 3.45 (55.1%) | -25.1 | Epi-paleolithic | 10000-12000 |

* denotes the trench, basket and layer number of the excavated points for each sample.

** defined as $\delta^{13}C_{PDB} = [(^{13}C/^{12}C)_{sample}/(^{13}C/^{12}C)_{PDB} - 1.0] \times 1000$ (‰),

where $(^{13}C/^{12}C)_{PDB}$ means the carbon stable-isotope ratio for a Pee Dee Belemnite standard material. The values were measured by an isotope-ratio mass spectrometer (Finnigan MAT-252) for $CO_2$ prepared from charcoal samples as described in the text, with one-sigma uncertainty of ±0.1‰.

n.m. denotes not measured because of small sample size.

use in the $^{14}C$ measurements. We added 1.2M HCl to the NaOH solution to solidify the humic acid component. After decantation of its solution part, HCl and water components were evaporated to produce solid and dry humic acid fractions, in a hot-water bath. It is normally accepted that acid and alkali treatments of the samples may remove contaminant carbon fractions that have adsorbed on sample surfaces when the samples were kept under environmental conditions. Thus the two humic acid fractions separated from charcoal samples nos. 24 and 33, may be partly contaminated with foreign carbon and therefore the $^{14}C$ ages of the two are less reliable than those of the other charcoal samples which remained after the complete set of treatments with acid and alkali solutions.

The eight charcoal and two humic-acid samples were then dried in an electric oven at 90°C. The charcoal samples of about 6 mg in weight, and all of the two humic-acid fractions individually were placed in Vycor tubes of about 350mm long and 9mm outer diameter, with granular CuO of about 500mg, and then the tubes were connected to a vacuum line, evacuated completely and sealed to a tube length of 300mm. The Vycor tubes were heated to 900°C for 2 hours to oxidize the charcoal and humic acid to $CO_2$ completely and the produced $CO_2$ was purified cryogenically in a vacuum line. The Vycor tube containing sample no.33 was broken during the heating and all combusted gases were lost. For eight charcoal samples, the amounts of $CO_2$ recovered ranged from 1.42 mg to 4.53 mg in carbon weight, and the corresponding recovery rates were between 23.1% and 73.1%, as shown in Table 10.1. A typical recovery rate of $CO_2$ for normal charcoal samples is 40-60%. The rather small yield rate for sample no.2 may be caused by the incomplete separation of charcoal from sand or soil materials in the combustion procedure.

## 3. $^{14}C$ analysis with AMS

The graphite prepared from carbon samples was pressed into an aluminum holder and used as a target for $^{14}C$ dating with a Tandetron AMS system (model 4130-AMS by HVEE, the Netherlands) at Nagoya University (Nakamura et al. 2000; 2004). We obtained $^{14}C/^{12}C$ and $^{13}C/^{12}C$ ratios for a sample as well as for a NIST oxalic acid standard (HOxII). We then calculated R $[=(^{14}C/^{12}C)_{spl}/(^{14}C/^{12}C)_{std}]$ to represent the carbon isotope ratio for a sample $[(^{14}C/^{12}C)_{spl}]$ in the ratio to the NIST oxalic acid standard $[(^{14}C/^{12}C)_{std}]$, corrected for sample $^{14}C$ blank caused by sample preparation and carbon-isotope measurements with AMS as well as carbon isotopic fractionation, and finally multiplied a constant to normalize R and to define the sample whose R value is unity as being formed in AD 1950 (Mook and van der Plicht 1999). Conventional $^{14}C$ ages were calculated from R, and were calibrated to calendar years using the IntCal04 data set (Reimer et al. 2004). All errors quoted for $^{14}C$ dates are ±1 sigma uncertainty. We obtained calibrated dates for both ±1 and ±2 sigma error ranges, with respective probabilities, as shown in Table 10.2. The carbon stable-isotope ratio, $\delta^{13}C_{PDB}$, was also measured and defined as

$$\delta^{13}C_{PDB}=[(^{13}C/^{12}C)_{sample}/(^{13}C/^{12}C)_{PDB} - 1.0] \text{ X } 1000 \text{ (‰)},$$

where $(^{13}C/^{12}C)_{PDB}$ means the carbon stable-isotope ratio for a Pee Dee Belemnite standard material. The $\delta^{13}C_{PDB}$ has been measured both for $CO_2$ prepared from charcoal sample, as well as for graphite converted from the $CO_2$, as shown in Tables 10.1 and 10.2, respectively.

Table 10.2 $\delta^{13}C_{PDB}$, $^{14}C$ dates and calibrated ages of charcoal fragment remains excavated from TB75.

| Sample No. | Trench – basket No. – layer* | $\delta^{13}C_{PDB}$ (‰) by AMS** | $^{14}C$ age (BP) | Dates calibrated from $^{14}C$ ages (Reimer et al, 2004), with $\pm1\sigma$ uncertainty (probability) | Dates calibrated from $^{14}C$ ages (Reimer et al, 2004), with $\pm2\sigma$ uncertainty (probability) | Lab. No. (NUTA2-) |
|---|---|---|---|---|---|---|
| 2 | D-4-3 | -28±1 | 8480±45 | 7575 - 7530 cal BC (100%) | 7590- 7490cal BC (100%) | 12455 |
| 7 | D-9-4 | -26±1 | 9265±45 | 8595 - 8590 cal BC (2.0%)<br>8570 - 8435 cal BC (91.0%)<br>8370 - 8350 cal BC (7.0%) | 8620 - 8340 cal BC (100%) | 12456 |
| 13 | D-12-4 | -22±1 | 9965±45 | 9645 - 9610 cal BC (14.5%)<br>9520 - 9505 cal BC (6.6%)<br>9455 - 9320 cal BC (78.9%) | 9665 - 9570 cal BC (20.2%)<br>9560 - 9300 cal BC (79.8%) | 12457 |
| 22 | D-16-4 | -22±1 | 10190±45 | 10040 - 9860 cal BC (94.8%)<br>9835 - 9820 cal BC (5.2%) | 10115 - 9760 cal BC (100%) | 12459 |
| 24 | D-19-5 | -23±1 | 12640±50 | 13090 - 12820 cal BC (100%) | 13215 - 12690 cal BC (100%) | 12460 |
| 25 | D-19-5 | -26±1 | 12255±50 | 12235 - 12090 cal BC (100%) | 12430- 12010 cal BC (100%) | 12461 |
| 28 | D-19-5 | -26±1 | 12225±50 | 12200 - 12065 cal BC (100%) | 12290 - 11980 cal BC (100%) | 12462 |
| 33 | D-23-6 | n.m. | n.m. | | | |
| 34 | D-23-6 | -22±1 | 16330±60 | 17590 - 17480 cal BC (100%) | 17830- 17740 cal BC (7.8%)<br>17630- 17360 cal BC (92.2%) | 12463 |
| 35 | D-24-6 | -24±1 | 16650±70 | 17940 - 17840 cal BC (57.2%)<br>17730 - 17642 cal BC (42.8%) | 18000 - 17600 cal BC (100%) | 12464 |

* denotes the trench, basket and layer number of the excavated points for each sample.

** the same $\delta^{13}C_{PDB}$ defined in Table 1, but measured by a Tandetron AMS system on graphite material synthesized from $CO_2$, with one-sigma uncertainty of ±1 ‰.

n.m. denotes not measured because of small sample size.

## 4. Results and discussion

Four charcoal samples nos. 2 to 22 collected from excavation layers attributed to the Proto-Neolithic period were dated as 8480±45 BP to 10190±45 BP, and five samples nos. 24 to 35 from the Epi-Paleolithic as 12225±50 BP to 16650±70 BP in $^{14}C$ age. The $^{14}C$ ages were calibrated to be 7590-7490 cal BC to 10115-9760 cal BC and 12290-11980 cal BC to 18000-17600 cal BC, respectively, within two-sigma error range by using the IntCal04 data set, as shown in Table 10.2. The $^{14}C$ ages and the calibrated dates for the two groups of the samples are quite consistent with the respective age classifications, Proto-Neolithic and Epi-Paleolithic periods, based on archeological contexts (Table 10.1).

Samples nos. 24, 25 and 28 are from the same layer and their $^{14}C$ dates are consistent with one another, although the $^{14}C$ age of no.24 is a bit older than those of the other two. This may be as a result of contamination of the extracted humic-acid fraction for no.24 sample by foreign older carbon, as described in sample preparation. All other $^{14}C$ ages get older as the sample collection layers become deeper, and are quite consistent with the ones expected archeologically (Table 10.1), although the calibrated dates for samples nos. 34 and 35 are older by 5000-6000 years than expected. Fig.10.1 compares the $^{14}C$ ages with the IntCal04 data set.

The $\delta^{13}C_{PDB}$ values measured for $CO_2$ prepared from charcoal samples by an isotopic-ratio mass spectrometer (IRMS) were almost consistent with respective values measured for graphite material by a Tandetron AMS system. Because carbon isotopic fractionation occurred during the production of graphite from $CO_2$, the $\delta^{13}C_{PDB}$ values measured by a Tandetron AMS system are a bit different from those from an IRMS. Previous research indicates that (Nakamura et al. 2004), the difference of relevant values, which can be considered as the uncertainty of the $\delta^{13}C_{PDB}$ measured by a Tandetron AMS system, is normally ±1 ‰. The $\delta^{13}C_{PDB}$ values measured by an IRMS are normally accepted as realistic values and used for further analyses. The $\delta^{13}C_{PDB}$ ranged from -23.3 to -26.6‰ for the charcoal samples, and this suggests that all charcoal samples were produced from C3 plants

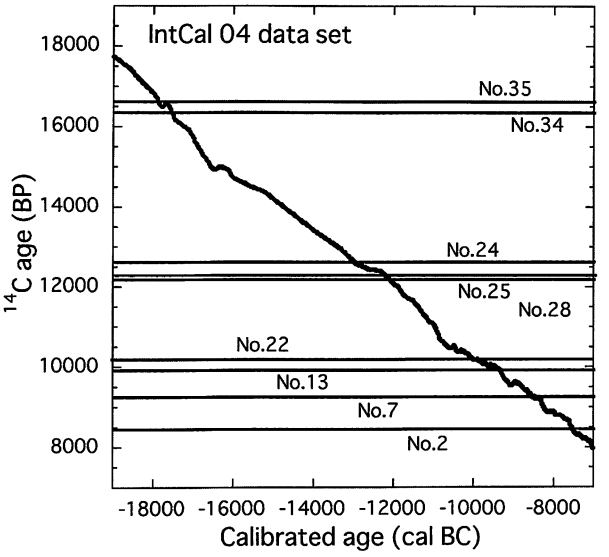


Fig.10.1 Comparison of $^{14}$C ages with the IntCal04 calibration data sets, for charcoal samples collected from TB75.

(O'leary 1988).

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## 10-2. RADIOCARBON DATING OF CHARCOAL SAMPLES FROM TB75

Minoru YONEDA

The lumps of charcoal collected from the excavation in 2006 at TB75 (Haji Bahrami Cave) were measured for conventional radiocarbon ages by an accelerator mass spectrometer (Table 10.3). The samples were cleaned by acid-base-acid (ABA) treatment to remove humic contamination from the surrounding matrix (de Vries and Barendsen, 1954). At first, 0.1 M hydrochloric acid removed the adhered secondary carbonates at a temperature of 80°C for 12 hours. Then the samples were washed with disorganized distilled water (MilliQ water) and the same acid treatment was conducted again. The alkali treatment was started using weaker alkali solution (0.00001 M NaOH) and then stronger solution was used if the charcoal did not dissolve. Each reaction took 12 hours at a temperature of 80°C. The highest content of NaOH for each sample is shown in Table 10.4. For the removal of absorbed atmospheric carbon dioxide, the samples were reacted with 1.0 M HCL for 12 hours at a temperature of 80°C. After removing the acid completely with pure water, the samples were freeze-dried.

About 1.0 ~ 1.5 mg of each charcoal was burnt in an elemental analyzer into $CO_2$ and trapped by cryogenic traps (Yoneda et al., 2004). The purified $CO_2$ was heated at 650°C with hydrogen and iron catalysis to turn carbon dioxide into graphite (Kitagawa et al. 1993). The

Table 10.3 Samples analyzed for radiocarbon dating.

| sample no. | Sample type | Trench | Basket No. | Layer | Assigned period |
|---|---|---|---|---|---|
| 3 | charcoal | D | 6 | 4 | Proto-Neolithic |
| 5 | charcoal | D | 7 | 4 | Proto-Neolithic |
| 6 | charcoal | D | 8 | 4 | Proto-Neolithic |
| 9 | charcoal | C | 13 | 4 | Proto-Neolithic |
| 11 | charcoal | C | 13 | 4 | Proto-Neolithic |
| 12 | charcoal | C | 13 | 4 | Proto-Neolithic |
| 18 | charcoal | C | 15 | 5 | Epi-Paleolithic |
| 19 | charcoal | C | 15 | 5 | Epi-Paleolithic |
| 27 | charcoal | C | 17 | 5 | Epi-Paleolithic |
| 29-1 | charcoal | C | 17 | 5 | Epi-Paleolithic |

Table 10.4 The contents of NaOH for alkali treatment.

| sample no. | NaOH (M) |
|---|---|
| 3 | 0.01 |
| 5 | 0.01 |
| 6 | 0.01 |
| 9 | 0.01-1.0 |
| 11 | 0.001 |
| 12 | 0.001 |
| 18 | 0.001 |
| 19 | 0.001 |
| 27 | 0.001 |
| 29-1 | 0.001 |

Table 10.5 Conventional radiocarbon and calibrated ages.

| sample | Conventional $^{14}C$ (BP) | | | $\delta^{13}C$ | range of 1 sigma (calBP) | | | Lab ID |
|---|---|---|---|---|---|---|---|---|
| 3 | 8403 | +/- | 43 | -26.1 | 9490 | - | 9330 | TERRA-070407a30 |
| 5 | 9421 | +/- | 47 | -28.9 | 10710 | - | 10580 | TERRA-070407a33 |
| 6 | 9452 | +/- | 47 | -28.8 | 10750 | - | 10590 | TERRA-070407a34 |
| 9 | 1368 | +/- | 33 | -24.9 | 1310 | - | 1270 | TERRA-070407a35 |
| 11 | 1448 | +/- | 33 | -25.1 | 1365 | - | 1305 | TERRA-070407a36 |
| 12 | 1407 | +/- | 36 | -27.8 | 1340 | - | 1290 | TERRA-070407a37 |
| 18 | ND | | | | | | | |
| 19 | 11930 | +/- | 56 | -21.6 | 13850 | - | 13720 | TERRA-072307a03 |
| 27 | 14774 | +/- | 61 | -25.7 | 18050 | - | 17780 | TERRA-072307a04 |
| 29-1 | 13231 | +/- | 56 | -22.3 | 15850 | - | 15480 | TERRA-072307a05 |

mixture of graphite (1 mg) and iron (1 mg) was pressed into an aluminum sample holder for accelerator mass spectrometry (AMS). The AMS at the National Institute for Environmental Studies, NIES-TERRA, was employed for this study. Each sample was measured for 30 minutes for $^{14}C$, $^{13}C$ and $^{12}C$. The ratio between $^{14}C$ and $^{12}C$ was standardized with NBS oxalic acid (SRM-4990c) and $^{13}C/^{12}C$ ratios were applied for correcting isotopic fractionation in each sample. The typical uncertainty with conventional radiocarbon age is 0.5% corresponding to about 40 $^{14}C$ years (Tanaka et al., 2000).

The results are shown in Table 10.5. Conventional radiocarbon ages were calibrated into calibrated radiocarbon ages based on IntCAL04 by using OxCAL ver. 3.10 (Bronk Ramsey 1995, 2001; Reimer et al. 2004). Three charcoal samples indicated much younger ages, around 1400 BP than the others between 8400 BP and 15000 BP. Because all of the younger $^{14}C$ ages were produced from samples from basket #13, it is highly possible that they were contaminated from the upper layers in this basket. It is likely that the other older ages matched the general archaeological context recorded at the site. The stratigraphy and materials were held in situ at Loci 4 and 13.

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# CHAPTER 11

## ARCHAEOLOGICAL SURVEY IN THE BOLAGHI VALLEY AND ITS VICINITY

# 11. ARCHAEOLOGICAL SURVEY IN THE BOLAGHI VALLEY AND ITS VICINITY

Kazuya YAMAUCHI and Shin'ichi NISHIYAMA

## 1. Introduction

The archaeological survey by the Iran-Japan joint expedition to the Sivand dam salvage area was carried out in 2005 and 2007 to investigate past transhumance routes and related archaeological remains in the Bolaghi (locally pronounced bolâghî) Valley and its vicinity, especially in the Pasargadae Plain (fa. dasht-e pâsârgâd or dasht-e morghâb) (Fig.11.1). Although the primary aim of the survey was to record the archaeological remains which were to be submerged under dam water, the survey more specifically focused on two aspects of the given geographic area, namely (1) investigation of the relationship between past transhumance routes and related archaeological remains, and (2) investigation of archaeological remains related to the road, water management and defence systems during the Achaemenid period (ca. 6-4th century BC).

For (1), our goal was to clarify the relationship of archaeological remains distributed along past transhumance routes through the comparison of transhumance routes and the lifestyle of modern nomadic pastoralists. Therefore we conducted the survey not only in the Bolaghi Valley (though this was our main research area), but also in Toll-e Gholâm in the north of the Pasargadae Plain where one of the transhumance routes which passes through the Bolaghi Valley is located. Since the activities of nomadic pastoralists are one of the characteristic features of historical development in Fars (Alizadeh 2003), we chose to conduct the survey from such a viewpoint[1].

For (2), in order to clarify the historical importance of the Bolaghi Valley, we cannot ignore the relationship of the valley with the site of Pasargadae, the first capital of the Achaemenid Empire. Although the valley is considered to be one of the major entrances to the Pasargadae Plain, no detailed surveys concerning the Achaemenid period have been conducted in the valley up till today. To understand the importance of the valley as a whole, we intended to focus on infrastructure works, namely road, water management and defence systems, executed and maintained by the Achaemenid Empire.

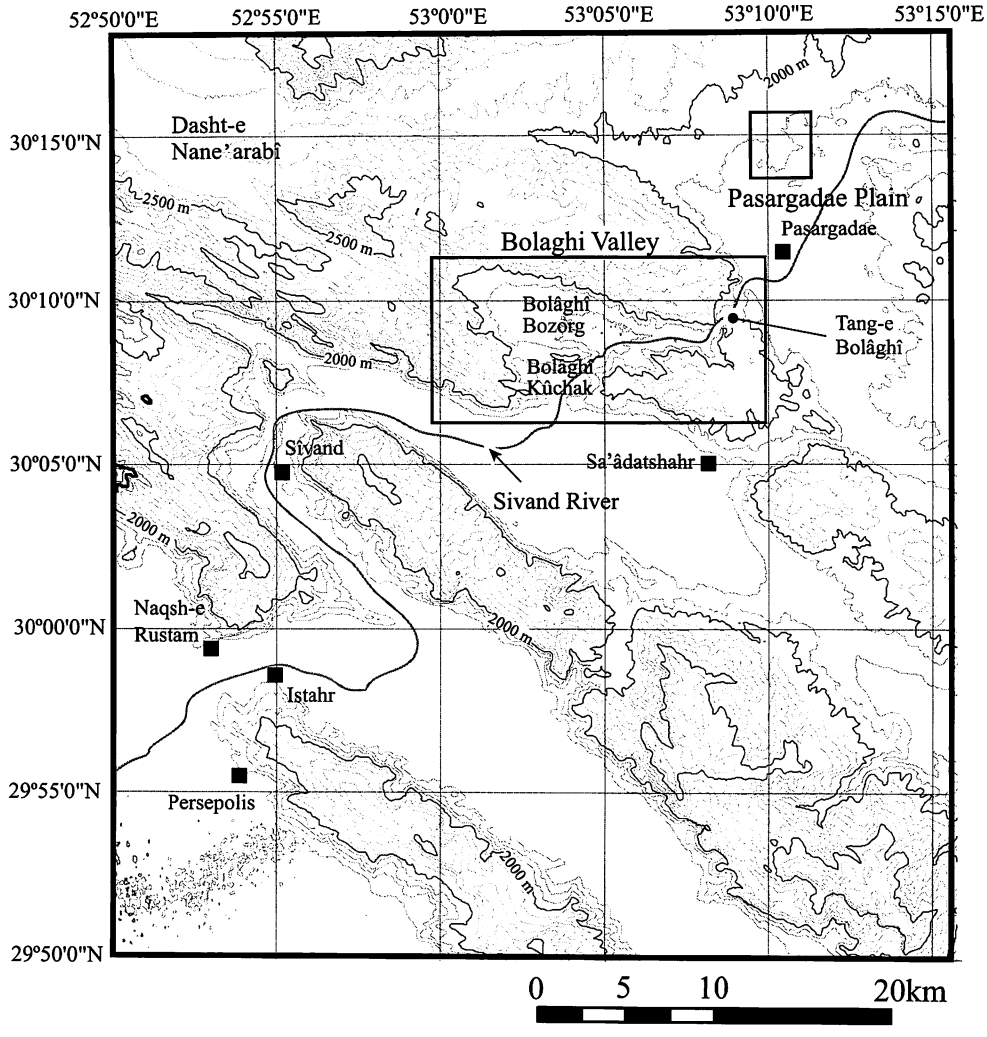


Fig.11.1 Vicinity of the Bolaghi Valley and the Pasargadae Plain with the main surveyed area.

To obtain sufficient results to fulfil the above goals, an intensive field walking survey was conducted in the study area (see below). Such survey methods have proved useful in identifying the remains of nomadic pastoralists and archaeological features located in mountainous areas.

The survey results show a wide range of archaeological remains in the Bolaghi Valley and Pasargadae Plain that can be interpreted from the transhumance routes of nomadic pastoralists. The large-scale construction works of the Achaemenid period inform us of the well-planned and systematic development of the vicinity of the Pasargadae Plain, including the Bolaghi Valley. As a whole, the survey results convey the importance of studying the past movement of people, mainly nomadic pastoralists, for understanding the wide range of human activities in Fars.

To avoid confusion with geographic names the following names are defined and used in this report. The *Bolaghi Valley* refers to the complex of *Tang-e Bolâghî*, *Bolâghî Bozorg*, and *Bolâghî Kûchak* (Fig.11.2). *Tang-e Bolâghî* refers to a narrow gorge in the northeastern part of the Bolaghi Valley (Pls.11.1-2). *Bolâghî Bozorg* refers to the main valley of the Bolaghi Valley including the so-called Dasht-e Bolâghî (Pls.11.3-4). *Bolâghî Kûchak* refers to a small valley extending to the south from the Bolâghî Bozorg (Pl.11.5). The southern part of the Bolâghî Kûchak connects to the Rahmatâbâd Plain. *Tang-e Khorkhore* refers to a valley

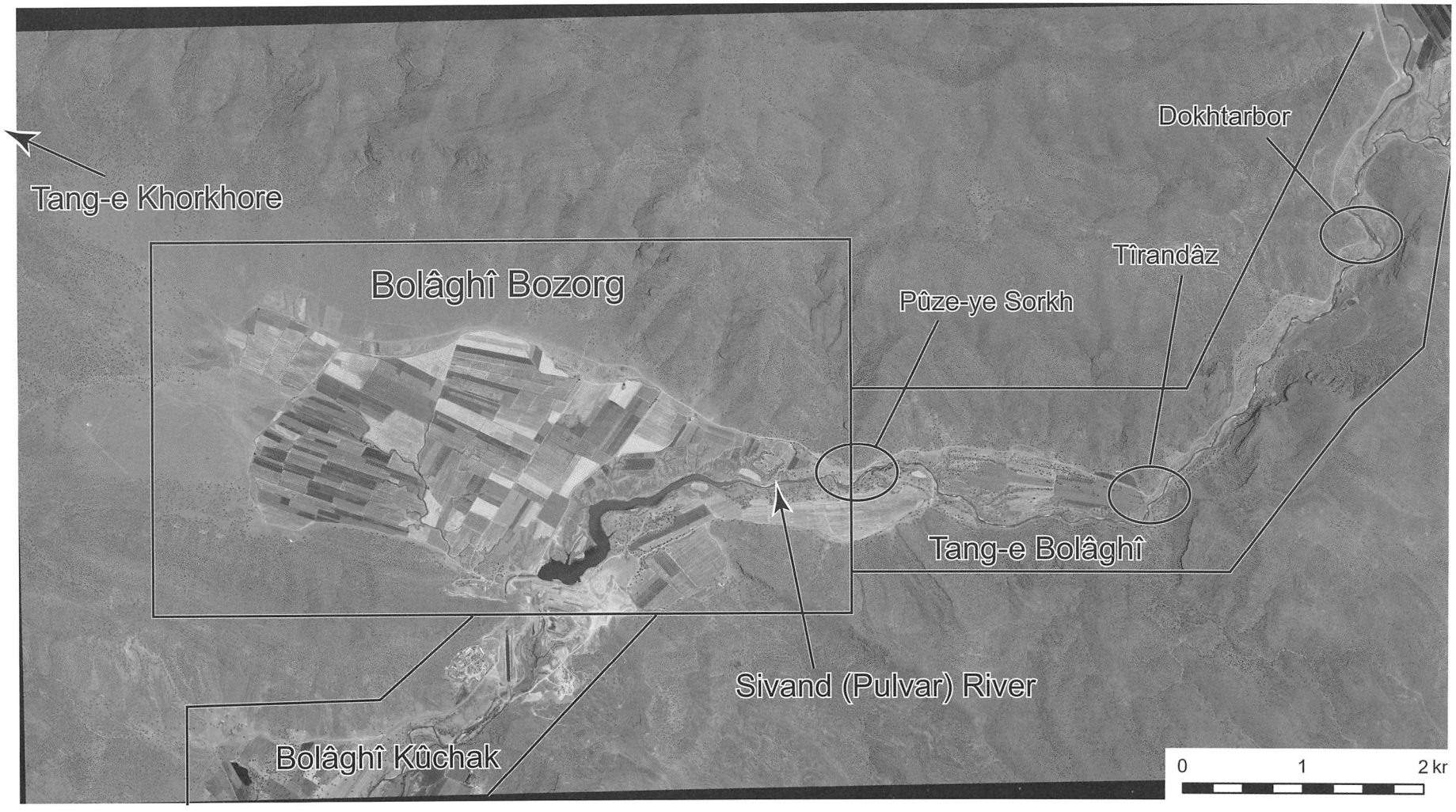


Fig.11.2 Bolaghi Valley: Major topographic features and the surveyed area (after QuickBird satellite image taken on 4 November 2004).

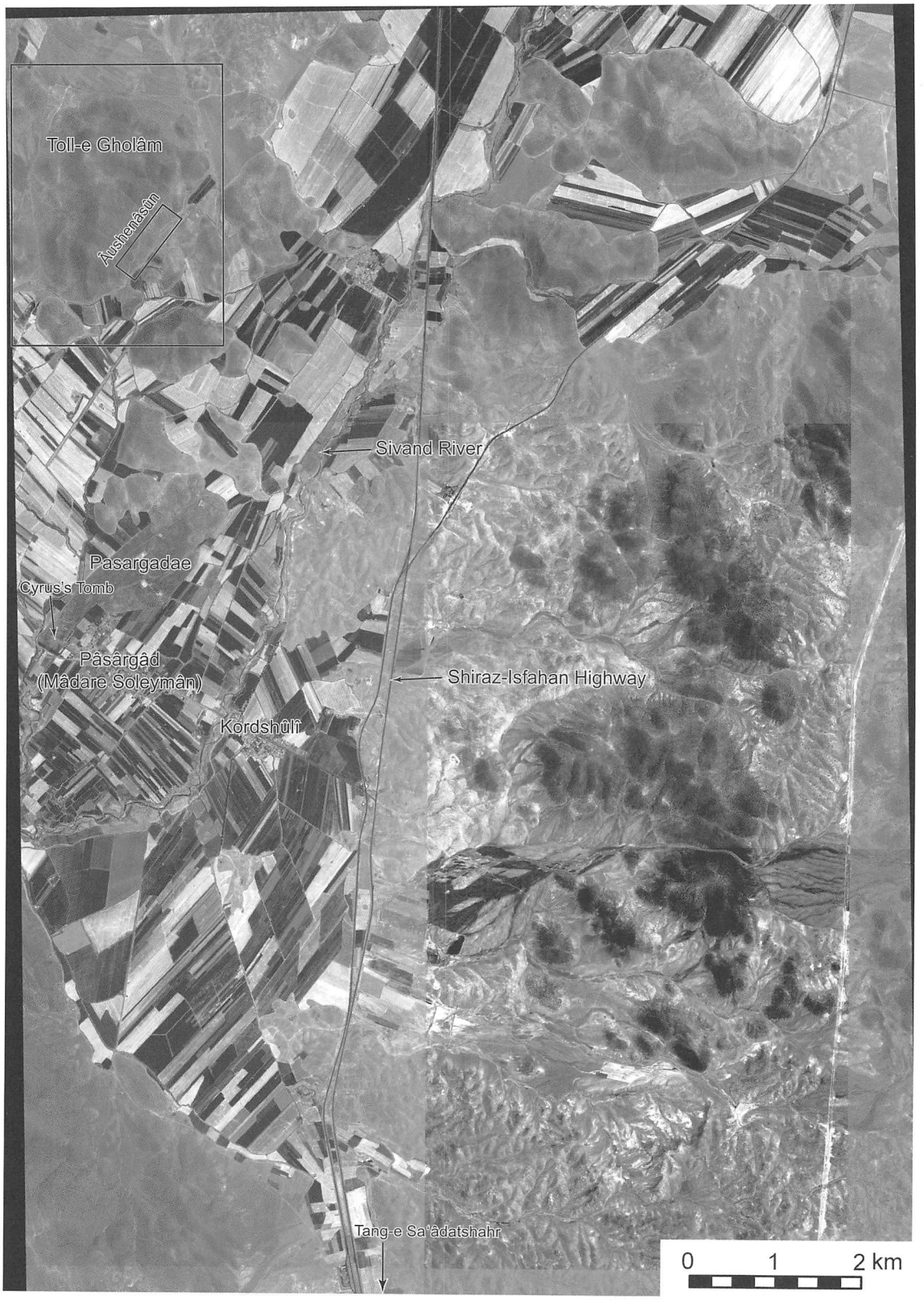


Fig.11.3 Pasargadae Plain: Major topographic features and the surveyed area (after QuickBird satellite image taken on 16 August 2004).

connecting to the east of the Bolâghî Bozorg (Pl.11.6). Finally, the Sivand River (fa. rûd-e sîvand) or the Pulvar River (fa. rûd-e pulvâr) refers to the main river running from north to south in the Bolaghi Valley (Pl.11.7).

## 2. Survey Aims

The aims of the survey are summarised as follows:

1) Record archaeological remains in the Bolaghi Valley to be submerged by the Sivand dam,

2) Investigate the past transhumance routes of nomadic pastoralists focusing on camp sites, cairns, and cemeteries, which are located in the foothills of small valleys which are distributed along the mountains/hills. This is to place the Bolaghi Valley within the larger spatial movement of people in Fars and to provide a new perspective on the historical significance of the Bolaghi Valley in southern Iran.

3) Investigate the large infrastructure works of the Archaemenid period, especially roads, water canals, and defence walls which are not only distributed in the valley floor, but also in the mountains/hills surrounding the Bolaghi Valley.

## 3. Survey Method and Areas

Prior to our survey around 130 archaeological sites in the Bolaghi Valley were already recorded and reported by M. 'Ata'i (2003; 2007). His report submitted to the ICAR (Iranian Centre for Archaeological Research) included a gazetteer of sites and a site distribution map which was made available to us. Thus, we avoided surveying the entire area of the valley and concentrated on archaeological remains along the transhumance routes of the valley as well as in the surrounding moutains which were previouly not investigated. In addition, the norhern part of the Pasargadae Plain was surveyd to obtain additional information about the transhumance routes which pass through the Bolaghi Valley.

The survey was carried out by intensive field walking and using high-resolution satellite images. The satellite images were taken by the QuickBird satellite of DigitalGlobe®: of the Bolaghi Valley on 4 November 2004, and the Pasargadae Plain on 16 August 2004. The archaeological remains were directly recorded on the satellite image magnified to a scale of 1:3000. A GPS was also used to confirm the location of the remains.

The main survey area (Figs.11.2-3) included the Bolaghi Valley and the Toll-e Gholâm area to the north of the Pasargadae Plain. Additonal surveys were carried out in the northwest, and south of the plain around Tang-e Sa'âdatshahr (before called Sa'âdatâbâd) (Appendices 1-7). A brief visit was conducted to the west of the plain around Dasht-e Nane'arabî and Cheshme-ye Khorkhore (Appendix 8).

The survey was conducted during two field seasons: the 2005 season between 29 July and 5 August 2005, and the 2007 season during 12-27 February 2007[2].

## 4. Transhumance Routes of Modern Nomadic Pastoralists around the Bolaghi Valley and the Pasargadae Plain

During fieldwork we conducted an ethnographic survey, interviewing the locals to gain information on the modern transhumance routes of nomadic pastoralists who transit the Bolaghi Valley and the Pasargadae Plain (Fig.11.4). The aim was to obtain supporting

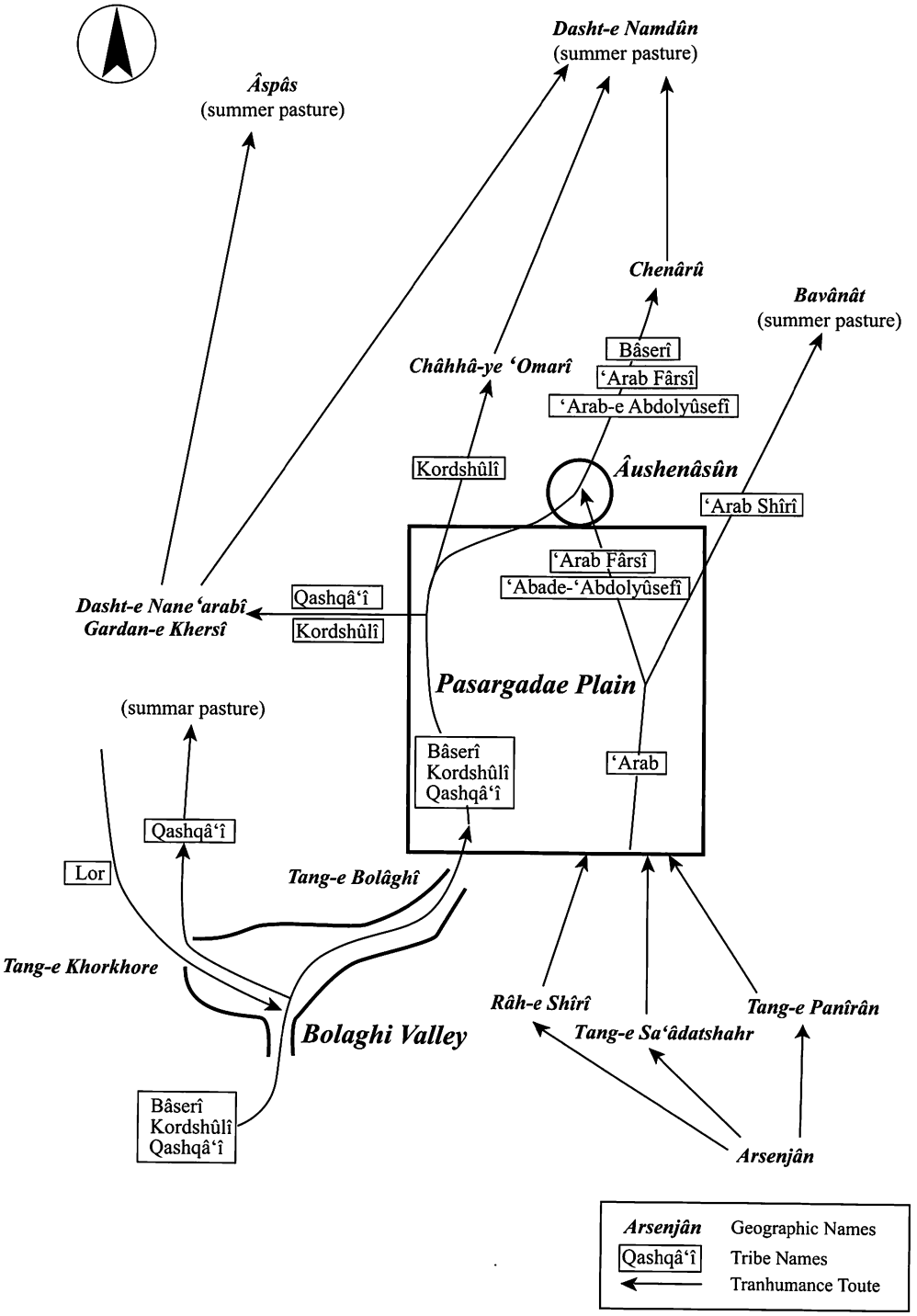


Fig.11.4 Schematic depiction of transhumance routes of nomadic pastoralists who transit the Bolaghi Valley and the Pasargadae Plain.

evidence of past transhumance routes and the historical importance of the Bolaghi Valley as a transit point of nomadic pastoralists. The interview was administered to the locals who now dwell in Pâsârgâd (Mâdar-e Soleymân).

Due to time constraints this ethnographic survey was very limited in nature and should be carried out in the future by proper ethnographers to obtain a more comprehensive

understanding of the nomads' movement and to increase the reliability of such survey information.

If we compare the transhumance routes according to tribes, clans, and families, the routes are more complex and contain various seasonal patterns of transhumance. Since it was difficult at that time to record these routes and patterns in detail, we focused on the main transhumance routes and the tribes who use those routes. To avoid confusion, we looked at the movement from winter pasture (fa. garmsîr) to summer pasture (fa. sarhadd).

### 4.1. Tribes of Nomadic Pastoralists

Major tribes of nomadic pastoralists who transit the Bolaghi Valley and the Pasargadae Plain are as follows: Kordshûlî, Bâserî, Qashqâ'î, 'Arab Shîrî, 'Arab Fârsî, 'Arab-e 'Abdolyûsefî, and Lor (locally known as Lor-e Esfahânî). Among them, the Kordshûlî and Bâserî are the major two with the other tribes being minor ones.

### 4.2. Bolaghi Valley

A transhumance route enters the Bolaghi Valley from the south through Bolâghî Kûchak and separates into two routes: the east route leads to the Pasargadae Plain through Tang-e Bolâghî, while the west route leads to Tang-e Khorkhore. The tribes of nomadic pastoralists who transit the Bolaghi Valley are the Kordshûlî, Bâserî, and Qashqâ'î (Fig.11.4).

#### 4.2.1. East route of the Bolaghi Valley

The tribes who use the east route of the Bolaghi Valley are the Kordshûlî, Bâserî, and part of the Qashqâ'î. After entering the Pasargadae Plain, these groups advance to the north along the foot of the mountains to the west of the plain. They camp along the foot of the mountains to the west of the village of Mobârakâbâd. From this point, different routes are taken by each tribe.

**Bâserî**

The Bâserî progress to the Âushenâsûn basin which lies to the north of the Pasargadae Plain, and through Chenârû and then head to the summer pastures located around the Dasht-e Namdûn Plain.

**Kordshûlî**

The Kordshûlî, on the other hand, after advancing north along the foot of the mountains, further separate into two groups heading to the north and west, respectively. The north group progresses to Châhhâ-ye 'Omarî and advances to the summer pastures around the Dasht-e Namdûn Plain. The west group advances to a wide valley which extends to the west of the Pasargadae plain and passes through the plains of Gardan-e Khersî and Dasht-e Nane'arabî. The group finally reaches the summer pastures located further to the north, such as the plains of Âspâs and Dasht-e Namdûn.

**Qashqâ'î**

Part of the Qashqâ'î also follows a similar route to the latter (west) group of Kordshûlî mentioned above.

#### 4.2.2. West Route of the Bolaghi Valley

**Qashqâ'î**

The Qashqâ'î who follow the west route of the Bolaghi Valley utilize the western part of the Bolaghi Valley for their camps. From this point, they head to the northwest passing through Tang-e Khorkhore and reach the summer pasture in the north.

**Lor**

The Lor move in a different direction from the tribes mentioned above. They move from north to south. Part of the Lor, who dwell around Isfahan (fa. Esfahân), do not pass through the Pasargadae Plain, but travel through Tang-e Khorkhore to reach the Bolaghi Valley. They use the Bolaghi Valley for their camps especially during the early spring. The majority of circular stone-built enclosure walls for tents and stone-built animal pens with a rectangular plan, both built using large stones and located in the small valleys along the foot of mountains surrounding the Bolaghi Valley belong to the Lor.

### 4.3. Pasargadae Plain

There are four gateways to enter the Pasargadae Plain from the south: from east to west, Tang-e Panîrân, Tang-e Sa'âdatshahr, Râh-e Shîrî, and Tang-e Bolâghî. The former three gateways are used by 'Arabs, namely 'Arab Shîrî, 'Arab Fârsî, and 'Arab-e 'Abdolyûsefî (Fig.11.4). After entering the Pasargadae Plain, these groups advance along the foot of the mountains in the east. The 'Arab Shîrî progresses to the northeast and reach a summer pasture around Bavânât. Tribes belonging to the 'Arab Fârsî and 'Arab-e 'Abdolyûsefî head to the northwest, and arrive at the Âushenâsûn basin and from this point, they follow the same route as the Bâserî (see above) and reach the summer pastures around Dasht-e Namdûn.

### 4.4. Summary

Although from a very limited survey, the above information suggests that the majority of nomadic pastoralists who move in north-south directions in the Bolaghi Valley and the Pasargadae Plain pass through the Bolaghi Valley, except the 'Arab. The importance of the Bolaghi Valley in the seasonal movement of nomadic pastoralists is further supported by the evidence of abundant camp sites and cemeteries recorded in the Bolaghi Valley (see below). It can be assumed that further ethnographic studies of nomadic pastoralists in northern Fars will highlight the importance of the Bolaghi Valley as one of the main transhumance routes in the region.

## 5. Survey Results

The survey results of the Bolaghi Valley are described according to three geographic sectors: (1) Tang-e Bolâghî and Bolâghî Bozorg, (2) Bolâghî Kûchak and (3) Pasargadae Plain. Within each section, we further grouped the description related to the survey aims, namely 1) archaeological remains related to transhumance movement, and 2) large infrastructure works apparently or possibly related to the Achaemenid period, including road, canal and defence systems.

### 5.1. Tang-e Bolaghi and Bolaghi Bozorg

Tang-e Bolâghî and Bolâghî Bozorg form the main part of the Bolaghi Valley, which is located southwest of the Pasargadae Plain. Tang-e Bolâghî has an L-shaped plan and the total length measures ca. 7 km. It consists of a gorge which runs in a northeast-southwest direction (ca. 4 km in length), and a valley which runs in an east-west direction (ca. 3 km in length). The average width of Tang-e Bolâghî is ca. 200-300 m$^3$. Tang-e Bolâghî can be separated by three major cliffs/bluffs standing at the west/north bank of the Sivand: from the north to south, Dokhtarbor, Tîrandâz, and Pûze-ye Sorkh (Fig.11.2). The altitude is ca. 1830 m asl (above sea level) at the northern entrance of Tang-e Bolâghî and ca. 1800 m asl around Pûze-

ye Sorkh.

Bolâghî Bozorg measures ca. 0.5-2 km (north-south) and ca. 6 km (east-west). The altitude is ca. 1800 m asl. The northern foot of the mountains measures ca. 1830-40 m asl.

The survey of Tang-e Bolâghî and Bolâghî Bozorg was carried out both in the 2005 and 2007 seasons. We recorded camp sites, cemeteries, building structures, cairns, stone linings (of roads, canals, and defence walls), settlements, and animal pens on the valley floor, in the small valleys, at the foot of the mounatins, and in the surrounding mountains. The following describes each category of remains.

### 5.1.1. Traces of Transhumance Movement

A "camp site" is defined here as the archaeological traces which include both ancient and modern remains of nomadic pastoralists. Some camp sites we recorded were used until quite recently. The usual camp sites include remains of post holes and stone walls for tents, hearths and sometimes stone-built enclosures (animal pens) for their herds (Pls.11.8-9). Since, at the moment, it is impossible to date those camp sites precisely, we use the term "camp sites" more in an ethnographic sense rather than in an archaeological one.

A "cairn" is defined as a burial mound which is deliberately constructed using piles of stones (Pls.11.10-11; see Stronach 1978: Pl. 145 for cairns in Tang-e Bolâghî). The cairns found in the Bolaghi Valley and in the north of the Pasargadae Plain usually contained a single rectangular burial chamber made of stones (Pl.11.12). Sometimes in a large cairn, double or triple burial chambers were observed. Similar cairns were also observed in the Toll-e Gholâm area (see below), Tappe-ye Hazrat-e Ya'qûb in the north of Pasargadae Plain, and in the Arsenjân area ca. 40 km southeast of the Bolaghi Valley. The cairn burial seems to be the common burial style of nomadic pastoralists in the northern Fars, however few detailed surveys or excavations have been conducted. If cairns are considered burial places particularly related to nomadic pastoralists, the structures have to be investigated in detail in the future to understand the nomadic aspects of history in Fars.

First, we would like to point out the following general characteristics in the relationship between camp sites and cemeteries. The majority of camp sites are found in small valleys, on the edge of alluvial fans and on the river terraces along Tang-e Bolâghî and along the north and south foot of the mountains of Bolâghî Bozorg (Figs.11.5-6, 8-17). These camp sites were obviously formed by nomadic pastoralists who moved along the small valleys. Cemeteries were often found in the middle part of the alluvial fans, on both ridges of the hills that rise from the valley floor, and at the foot of the mountains (Figs.11.5-6, 8-12, 14-17).

A wide variety of burial types were recorded during the survey: cairns, graves with quadrate, ellipse, or circular stone linings (Pls.11.13-15), graves with irregular clustering of large stones from human-head to slightly larger sizes (Pl.11.16-17), and graves formed beside a large standing stone (Pl.11.18). There were also graves with circular stone linings with paved stones inside the circular enclosure (probably the foundation of a cairn with the upper part totally destroyed) (Pl.11.19). Although further investigation is required, the majority of cemeteries were formed near the camp sites. The cairn burials however were not necessarily constructed near the camp sites.

#### 1) Tang-e Bolaghi

In Tang-e Bolâghî, camp sites and cemeteries are mainly located on the west bank of the Sivand. This is because the east bank of the Sivand is narrower in parts and difficult to pass. The major archaeological settlement site on the east bank appears only after ca. 1.4 km southwest of Dokhtarbor: around the site of TB 34. The camp sites on the west bank of the Sivand are mainly located on the alluvial fans of small valleys. In Tang-e Bolâghî the cemeteries are usually located away from the camp sites. The major cemetery is ca. 1.5 km

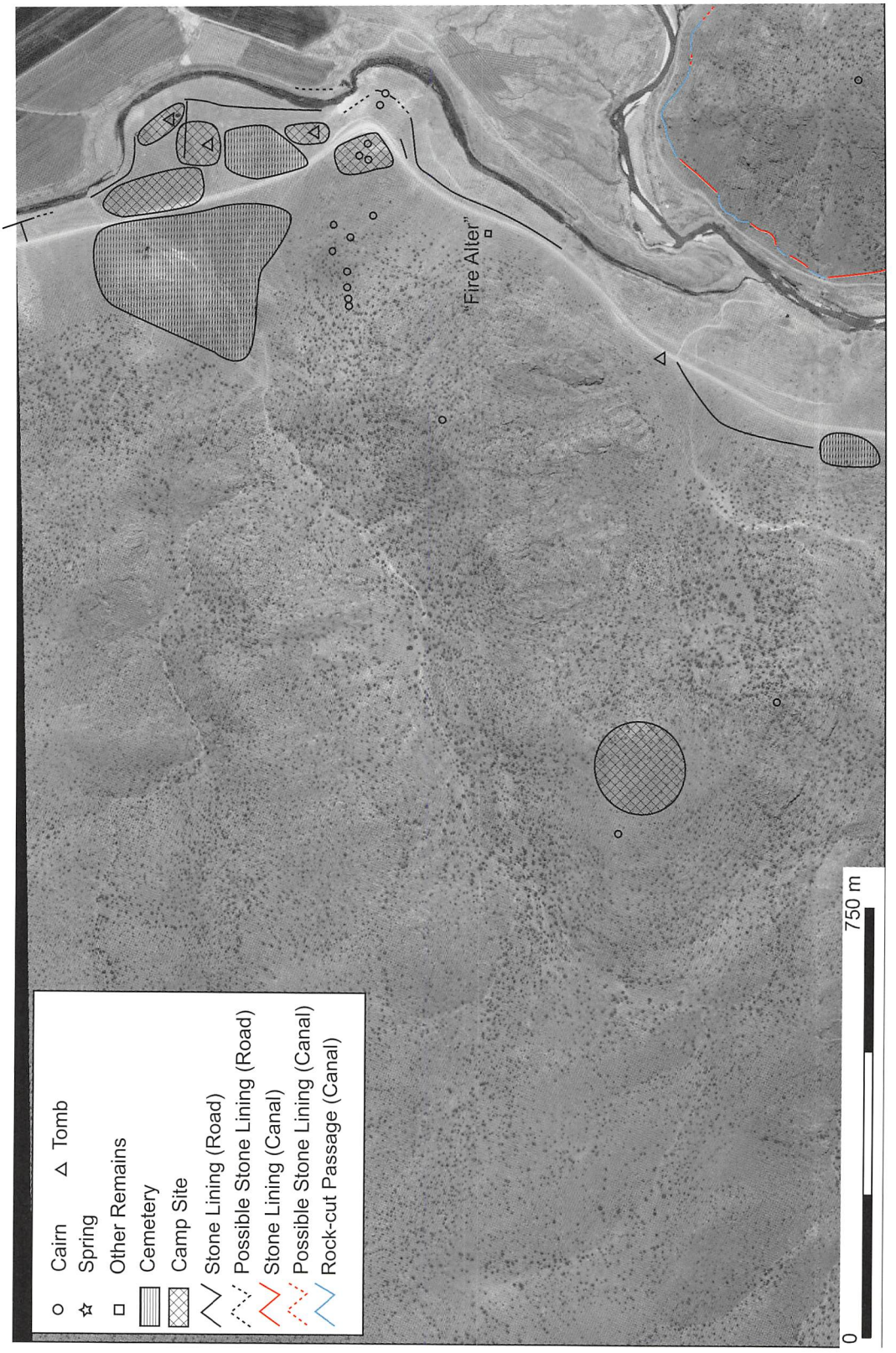


Fig.11.5 Tang-e Bolâghî (1): Surveyed archaeological remains to the west of and around the northern entrance (after QuickBird satellite image taken on 4 November 2004).

southwest of Dokhtarbor and ca. 1.3 km northeast of Tîrandâz (Fig.11.9). The cemetery consists of cairns and graves with stone linings and stone clustering. Other cemeteries were probably located on the ridge of the mountains around the small valleys or further up the

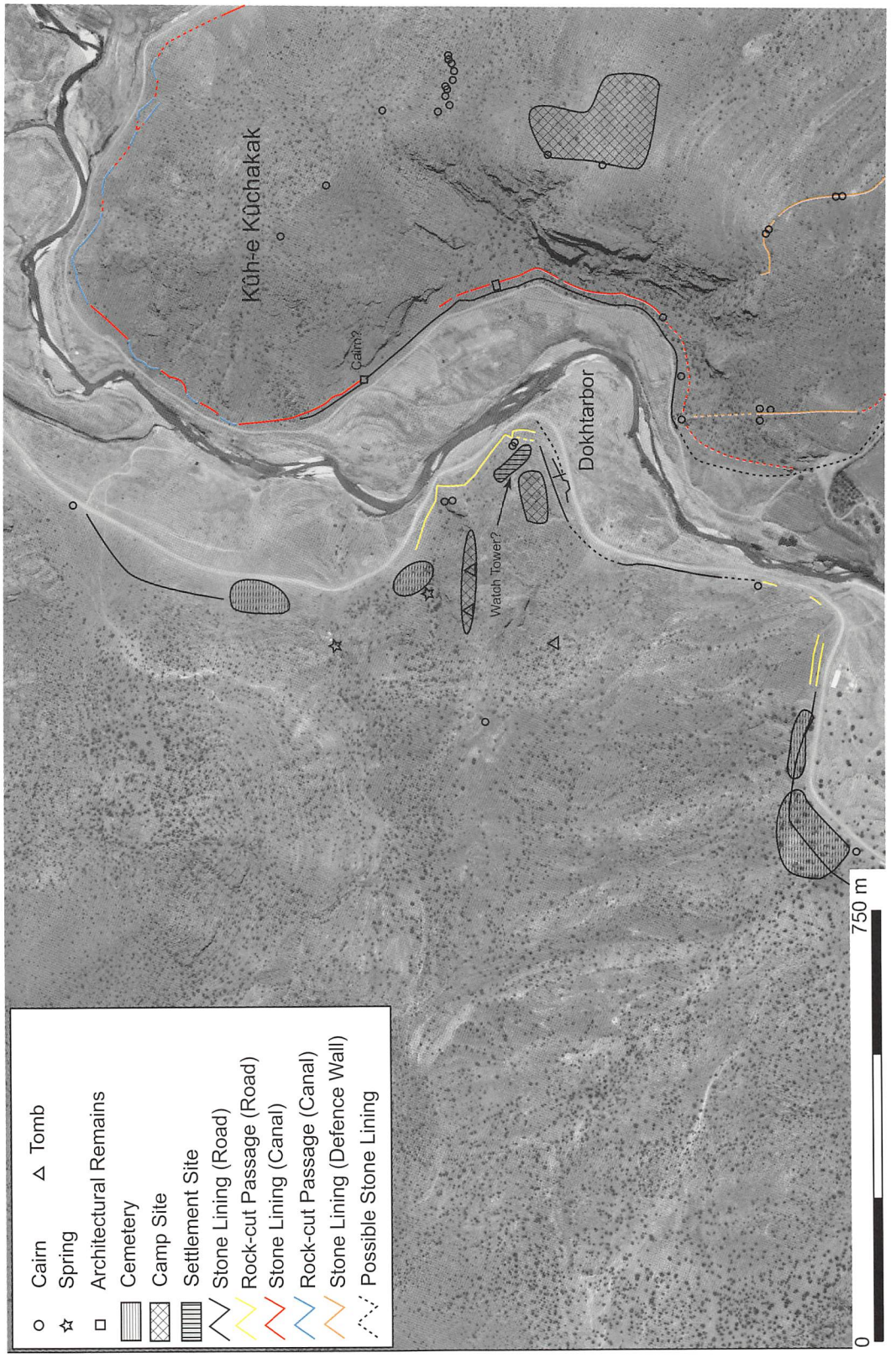


Fig.11.6 Tang-e Bolâghî (2): Surveyed archaeological remains from the northern entrance to the Dokhtarbor area (after QuickBird satellite image taken on 4 November 2004).

slope of the alluvial fans, though we were not able to confirm the locations due to time constraints.

Cairns in Tang-e Bolâghî were observed on both the west and east bank of the Sivand.

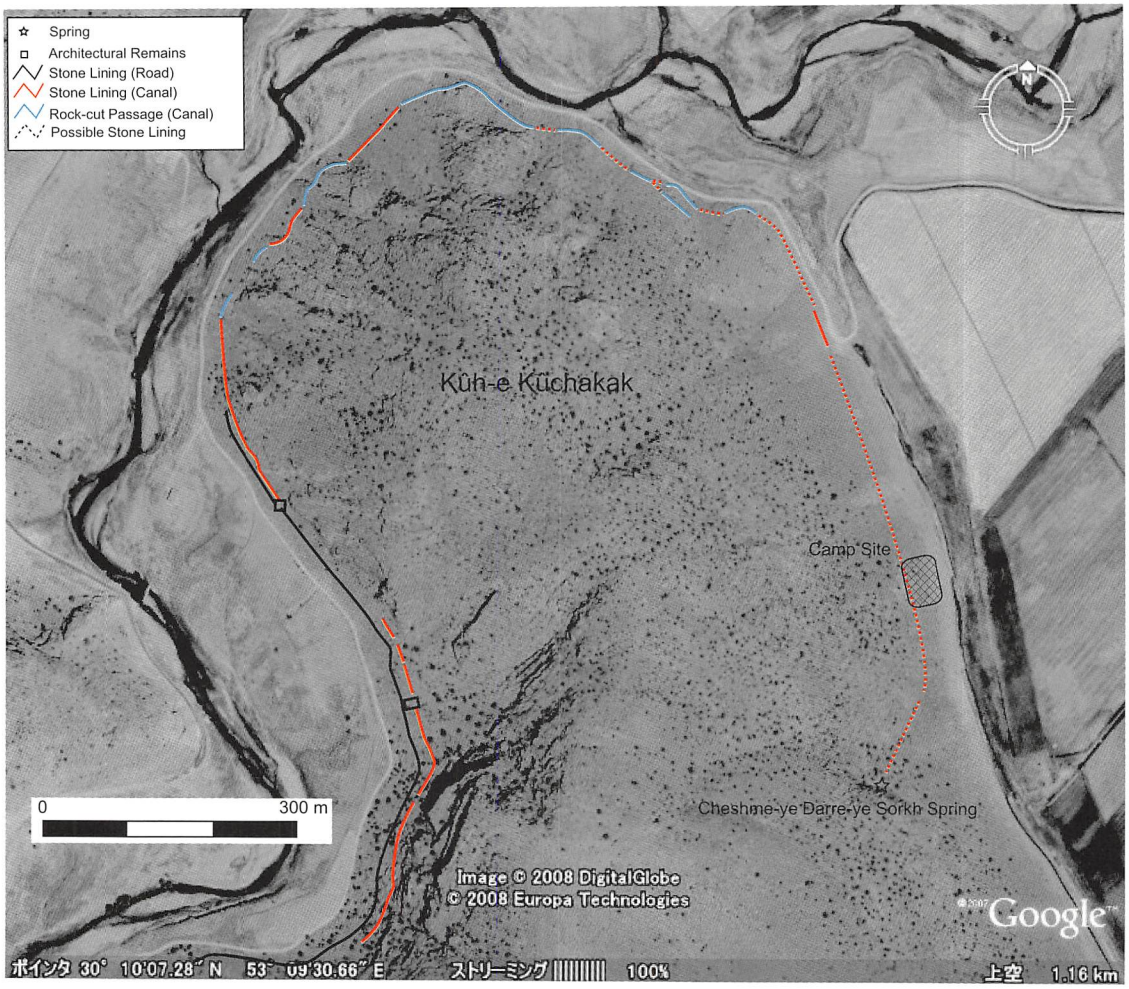


Fig.11.7 Tang-e Bolâghî (3): Canal system around the Kûh-e Kûchakak mountain at the northern entrance of Tang-e Bolâghî (after Google Earth 2007 ©).

They are normally constructed apart from the above mentioned cemeteries, except at Cemetery A where the cairns are mixed with other types of graves.

The cairns first appear on the east bank of the Sivand at the northern entrance of Tang-e Bolâghî (Fig.11.5). Almost all the cairns are located direcly on or near the stone linings which can be assumed to be the sidewalls of the road. On the east bank, the cairns are sparsely distributed from the northern entrance of Tang-e Bolâghî to the area around the site of TB 34, ca. 1.5 km southwest of Dokhtarbor (Figs.11.6 and 9).

On the west bank, the majority of cairns are located around Cemetery A to Tîrandâz. Here, similar to the east bank, several cairns are located directly on the stone linings which can be assumed to be sidewalls of the road (see below). This shows that the cairns were constructed using the stones of the stone linings after they were abandoned. If the majority of cairns were dated to the post-Achaemenid or the Parthian-Sasanina periods (see below), then the stone linings should be dated earlier than the cairns, namely to the Achameneid period.

The cairn burials have been widely identified in southern Iran from the Kerman to the Fars provinces (cf. Lamberg-Karlovsky and Humphries 1968: 271, Fig. 3)[4]. The dating of cairn burials has been in much dispute and seems to fall into a very wide time-span: from the first millennium BC to the Islamic period (Lamberg-Karlovsky and Humphries 1968: 271: 276; Whitcomb 1985: 211). Nevetheless, there are a number of excavated cairns which may provide a hint for the dating of cairn burials in Fars. The first example comes from a cairn

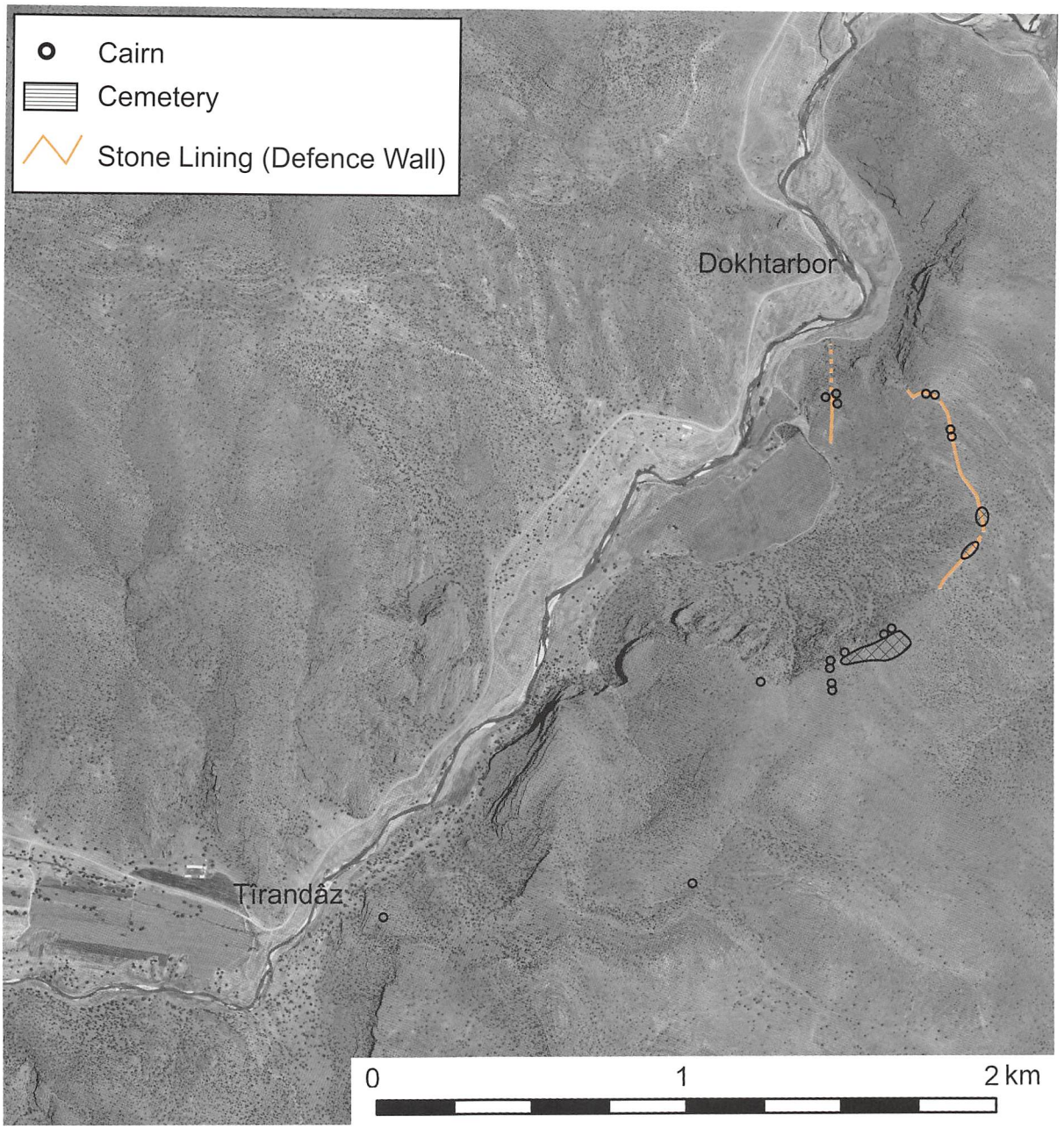


Fig.11.8 Tang-e Bolâghî (4): Surveyed archaeological remains on the eastern mountain of Tang-e Bolâghî between the Dokhtarbor and the Tîrandâz areas (after QuickBird satellite image taken on 4 November 2004).

located in Tang-e Bolâghî which was excavated by a British expedition in the 1960s. The excavators assumed the date of the cairn to the Parthian period based on a square-shoulderd, glazed pilgrim flask (Stronach 1978: 167, Pls. 145 a and b, Fig. 115, 8). Another example derives from the result of an American expedition which excavated several cairns on the ridge of mountains near Qasr-i Abu Nasr (old Shiraz) in the 1930s (Whitcomb 1985: 210-216, Pls. 55-59). Although the finds were poor, including some coins, pottery, beads, and metal objects (Whitcomb *op cit.* Fig. 76), the excavation result suggests the date from the late Parthian to the Sasanian period (Whitcomb *op cit.* 216). Therefore, at the moment, we may tentatively date the carin burials in the Bolaghi valley and the Pasargadae Plain from the Parthian/Sasanian to the early Islamic period.

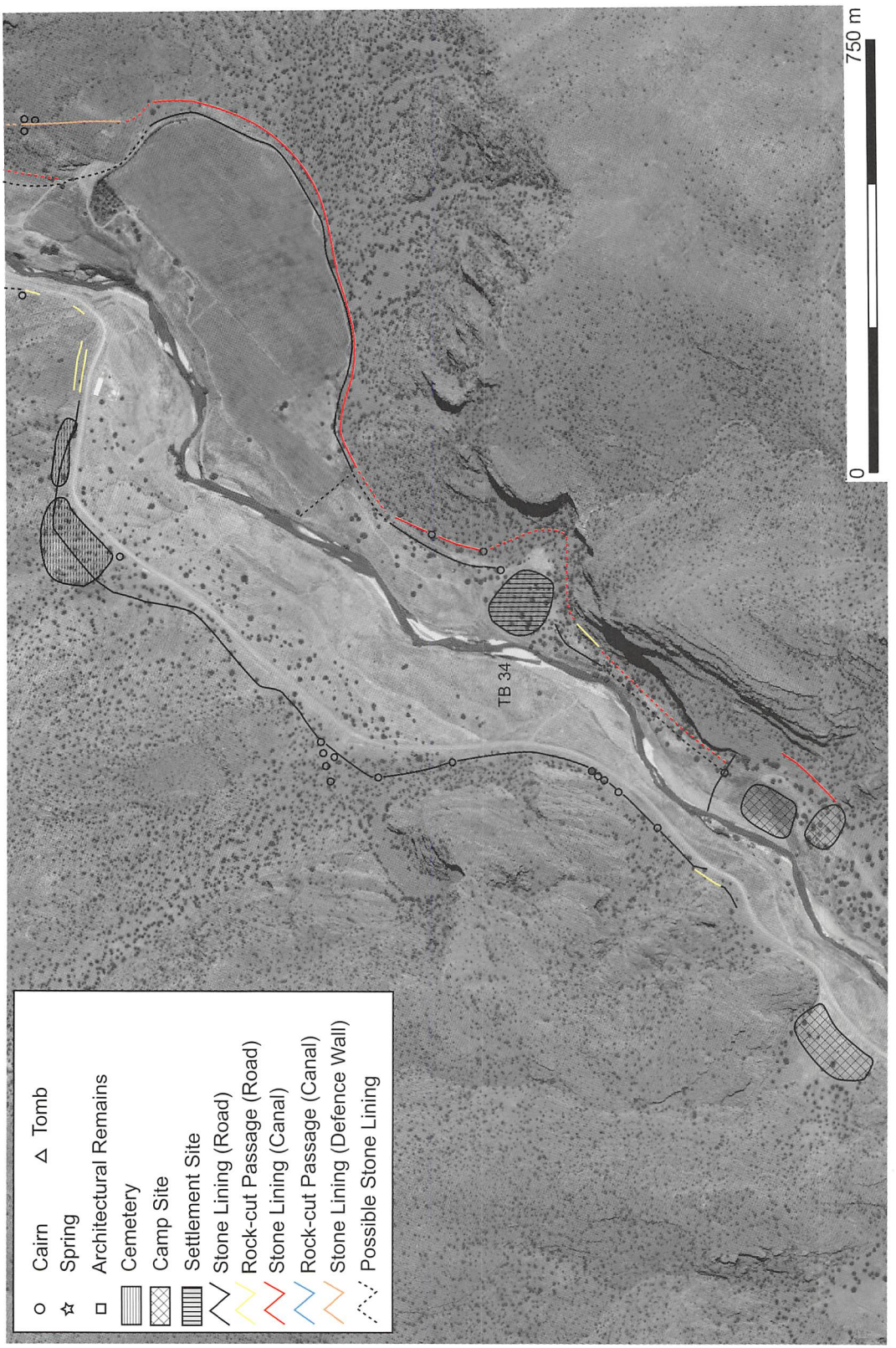


Fig.11.9 Tang-e Bolâghî (5): Surveyed archaeological remains between the Dokhtarbor and the Tîrandâz areas (after QuickBird satellite image taken on 4 November 2004).

Now, we describe the distribution of camp sites and cemteries in relation to Tang-e Bolâghî. First, a large complex of camp site and cemetery was located just to the west of the northern entrance of Tang-e Bolâghî (Fig.11.5; Pl.11.20). The site is located on the alluvial

fan and on the river terrace. The area of the site measured ca. 400 × 300 m and can be said to be one of the largest camp sites in the survey area. Remains of recently used walls for tents, animal pens, and hearths suggest that the site has been used until recent times. The cemetery of the site was located on the edge of the alluvial fan and on the river terrace. Obviously, the site was an important camp site just before entering or after leaving Tang-e Bolâghî.

Cairns and cemeteries were also distributed in the mountains to the east of the northern entrance of Tang-e Bolâghî and in the mountains which lie to the east of it (Figs.11.6 and 8). These cairns and cemeteries were formed to the northeast of the defence wall on the mountain to the south of Kûh-e Kûchakak (see below), and on the eastern foot of the mountains which extends to the southeast of Kûh-e Kûchakak (Fig.11.6; Pls.11.21-22). Thus, these cairns and cemeteries were obviously built by the nomadic pastoralists who moved towards the defence wall from the southeast and also along the foot of the mountains towards the northern entrance of Tang-e Bolâghî. The fact that the majority of these cairns and cemeteries were formed on the ridges visible from the transhumance routes which probably run along the foot of mountains to the east of Tang-e Bolâghî also supports the view that these remains were built by the nomadic pastoralists who pass through such routes. In addition, some camp sites were identified along the one of the route which leads to the northern entrance of Tang-e Bolâghî. The area is located ca. 2 km southeast from the northern entrance of Tang-e Bolâghî (Fig.11.27).

A cluster of cairns were also identified on the lower part of the ridge of a mountain which lies to the west of the northern entrance of Tang-e Bolâghî (Fig.11.5; Pl.11.23). Around the cairns, graves with stone clustering were also observed (Pl.11.24). As we climbed higher up the mountain, the cairns disappeared. These cairns were probably built by the nomadic pastoralists who took the westward route from the northern entrance of Tang-e Bolâghî. Although no cairns were found on the ridges of the mountains just to the west of Tang-e Bolâghî, the remains of cairns were visible on the mountains lying further to the west. Thus there is a possibility that another transhumance route lies further west of the northern entrance of Tang-e Bolâghî.

Finally, an animal pen was found to the west of a camp site which is located ca. 350 m northwest of Tîrandâz on the north bank of the Sivand. An animal pen is defined here as a rectangular structure built using various sizes of natural stones to store the livestock (mainly sheep and goats) of nomadic pastoralists. Usually dry masonry is applied.

**2) Bolaghi Bozorg**

In Bolâghî Bozorg, camp sites are located on the northern and southwestern foot of the mountains (Figs.11.14-16). They are generally located in the alluvial fans which were formed at the entrance of small valleys. Relatively large camp sites are located on both the north and south banks of the Sivand. The northern one is located ca. 500 m to the east of TB 91 and 92. The southern one is located ca. 1.2 km to the east of the Sivand dam and ca. 200 m to the south of TB 76, at the edge of the alluvial fan of a relatively large valley.

Cemeteries are either located at the back (i.e. closer to the mountains) of the sites, slightly down the slope from the sites, or at the edge of the alluvial fans. A large cluster of cemeteries were located at northern foot of the mountains from the north-central to the northwest part of Bolâghî Bozorg.

Two large cemeteries were located (Figs.11.15-16). One is a cluster of cemeteries located to the northwest of TB 92, including the cemeteries of TB 93 and 107. The other is located at the northwest corner of Bolâghî Bozorg with an area of ca. 500 (north-south) × 300 (east-west) m. Both cemeteries include cairns and graves with various styles of stone linings but the majority comprised the latter type of graves.

Cairns were sporadically found in the cemeteries in Bolâghî Bozorg, but particular

concentrations of cairns were observed in the northwestern as well as in the southwestern part of the valley (Figs.11.16-17). A cluster of cairns was also found around the eastern entrance of Tang-e Khorkhore (Pl.11.25).

Other than camp sites, cairns and cemeteries, clusters of animal pens which were constructed using large stones with dry mansory were located deep in the small valleys at the northwest part of Bolâghî Bozorg. Some structural remains and stone clusters which seem to be graves were also located around the animal pens. These structures were probably used by the Lor tribes (see Section 4).

As mentioned above, a large number of cairns and cemeteries were identified in Tang-e Bolâghî, Bolâghî Bozorg and its surrounding mountains. A large cluster of cairns and cemeteries were found in five locations: Tang-e Bolâghî, north-central, northwestern and southwestern parts of Bolâghî Bozorg, and at the eastern entrance of Tang-e Khorkhore. The camp sites were mainly found in the northern foothills of Bolâghî Bozorg and on the west bank of Tang-e Bolâghî. Fewer camp sites were located on the southwestern and southeastern foothills of Bolâghî Bozorg.

This suggests that the main transhumance routes in Tang-e Bolâghî and Bolâghî Bozorg were active in the northern sector. The southern sector was less used. The result also suggests that the transhumance routes from Bolâghî Bozorg were not only through Tang-e Bolâghî, but also the route through Tang-e Khorkhore was important. Large cemeteries located in the northwestern foothills of Bolâghî Bozorg suggest that the latter route was used until quite recently.

### 5.1.2. Roads, Canals, Defence Walls, and the "Royal Hunting Ground"

The archaeological remains which we consider apparently or possibly related to the Achaemenid period are described here. The remains mainly consist of stone linings and rock-cut passages which we estimated to function as roads, canals and defence walls. The stone linings were made of human-head sized stones or sometimes slightly larger stones. The stone linings were observed not only in the valley floors, but also on the ridges of the mountains. We classified them into four categories according to different functions:

(1a) Stone lining as the side wall of road,
(1b) Stone lining as the embankment of canal,
(1c) Stone lining as the defence wall,
(1d) Stone lining as an enclosure wall of the "royal hunting ground".

Along with the stone linings, rock-cut passages which are most noticeable on the west bank of the Sivand at Dokhtarbor in Tang-e Bolâghî (Stein 1936: 220; Sami 1971: 23-4; Stronach 1978: 166-67 and Pls. 142-43, 144a; Kleiss 1988a: 27-30, Abb. 6-7) should be considered here as well. Since the rock-cut passages, particularly those distributed in Tang-e Bolâghî, have a strong relationship with the stone linings. This is because the route of the stone linings and rock-cut passages interchange especially in the western part of Tang-e Bolâghî. The function of the rock-cut passages can be considered as follows:

(2a) Rock-cut passage as a road, and
(2b) Rock-cut passage as a canal.

We shall describe categories 1a to 1d below based on the survey results. Categories 2a and 2b are referred to when necessary.

#### 1) Category 1a: Stone Linings as the Sidewall of a Road

The stone linings belong to this category, i.e., stone linings as the sidewalls of a road, basically run at the foot of the mountains often winding into the small valleys which are

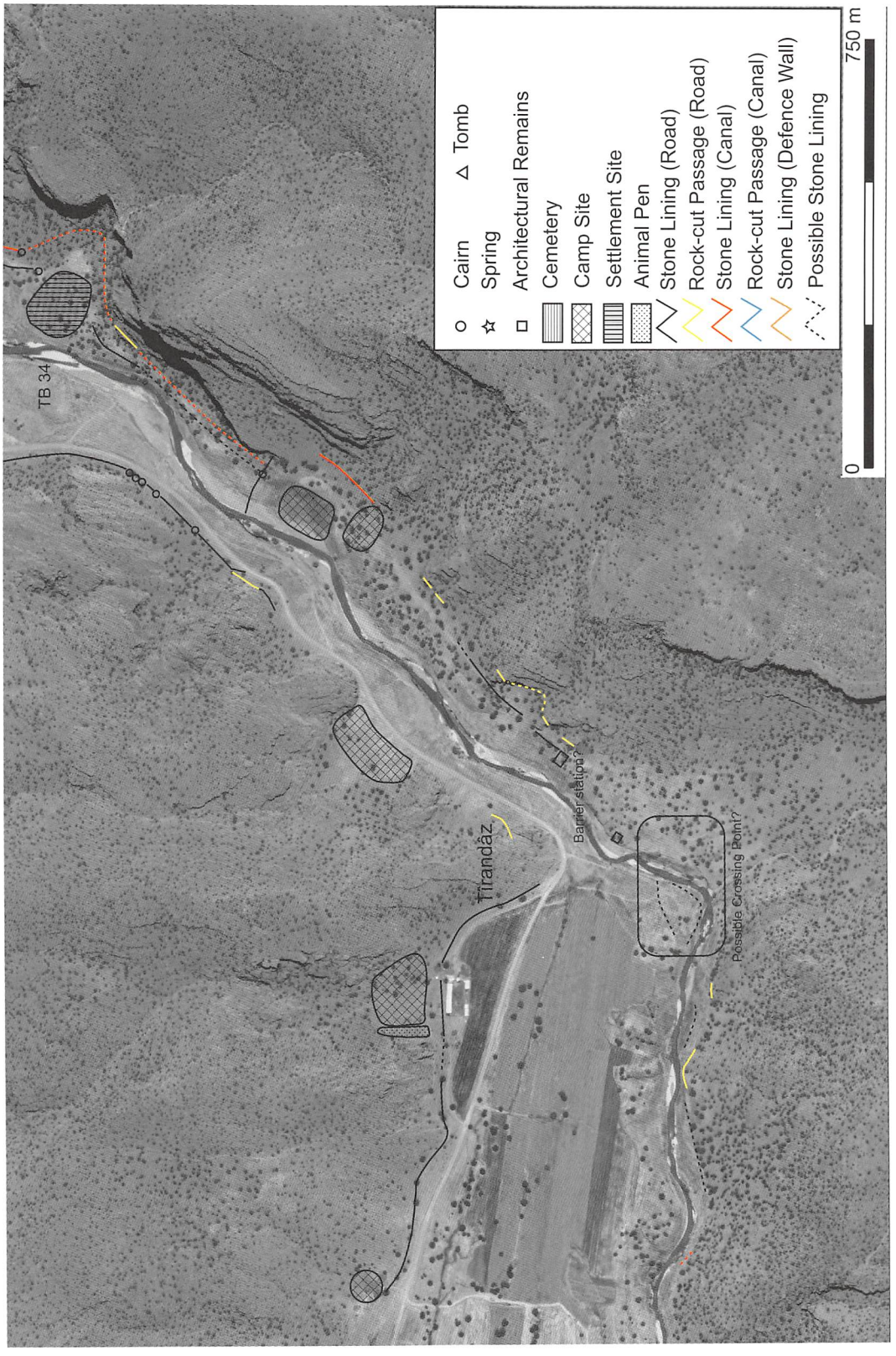


Fig.11.10 Tang-e Bolâghî (6): Surveyed archaeological remains around the Tirandâz area (after QuickBird satellite image taken on 4 November 2004).

located along the foothills of the mountain. The average width of the road seems to be ca. 1.5-2.0 m. Many of the stone linings observed in Tang-e Bolâghî to the eastern part of Bolâghî Bozorg are of this kind. The rock-cut passage at Dokhtarbor can be considered in

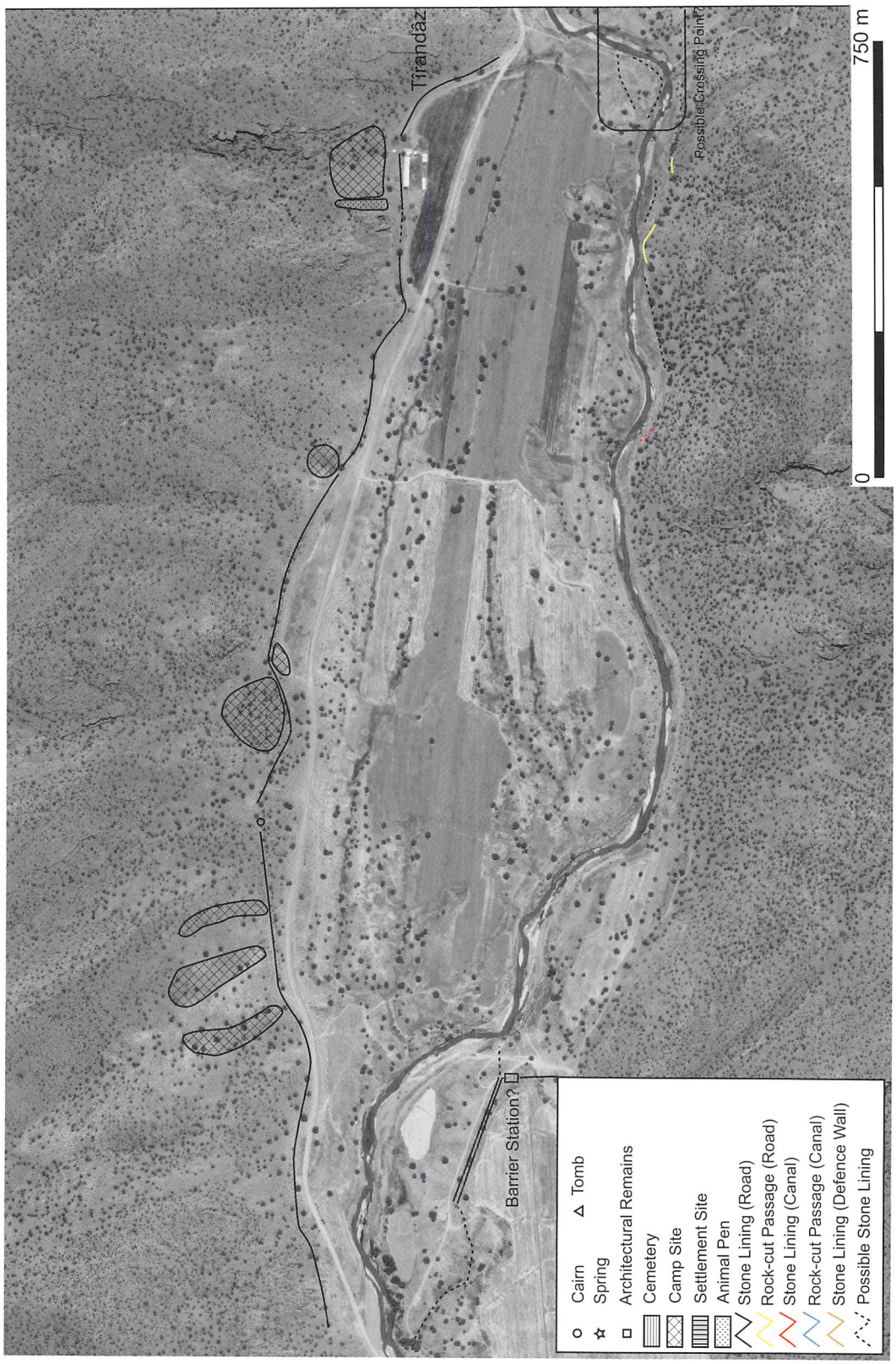


Fig.11.11 Tang-e Bolâghî (7): Surveyed archaeological remains between the Tîrandâz and the Pûze-ye Sorkh areas (after QuickBird satellite image taken on 4 November 2004).

category 2a[5]. This is because the width of the rock-cut passage, which measures ca. 150-170 cm, could more suitably be considered a road. This is apparent when we compared the stone-cut passages located in the eastern part of Tang-e Bolâghî which we considered canals (see

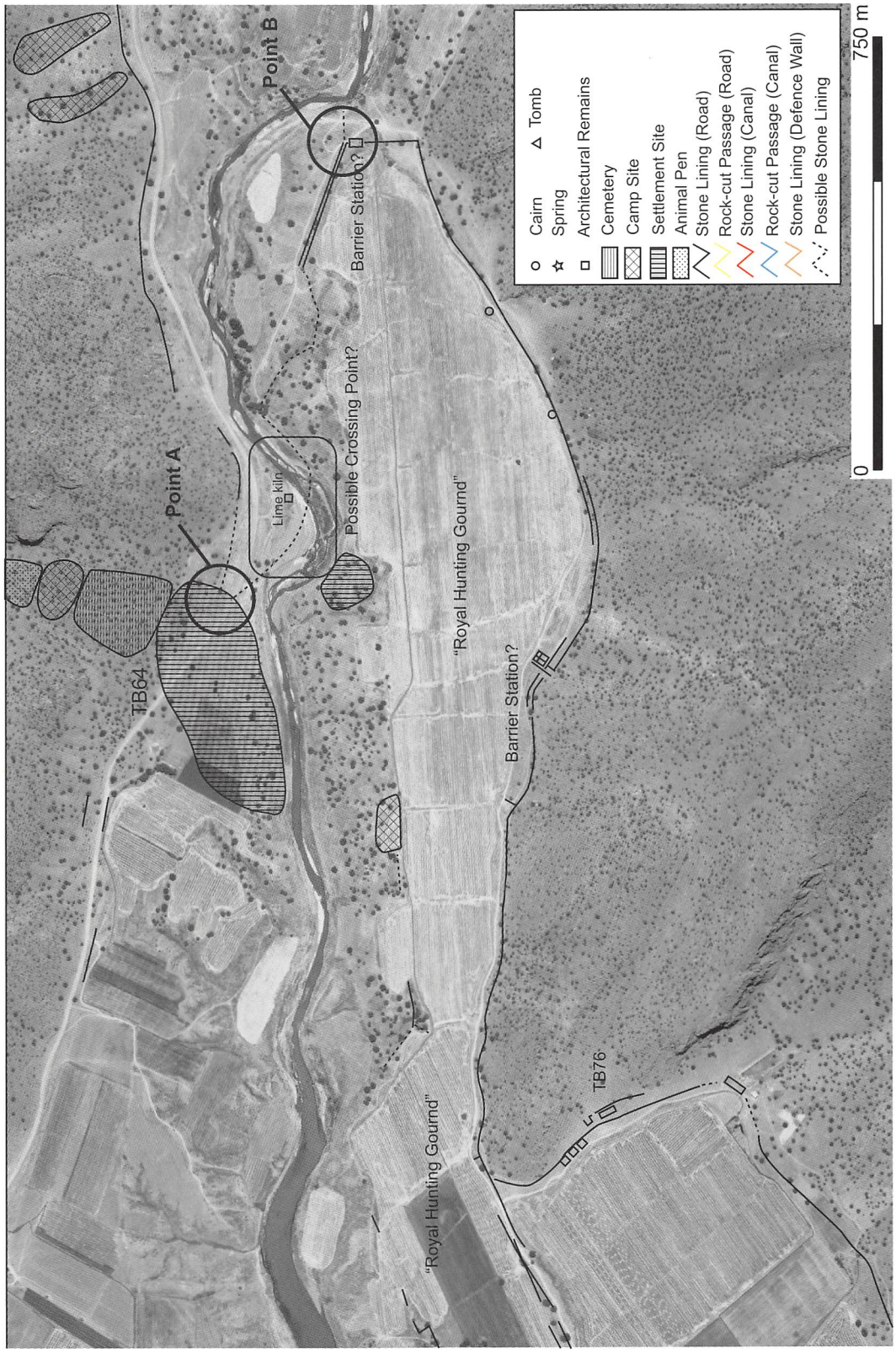


Fig.11.12 Tang-e Bolâghî (8): Surveyed archaeological remains around the Pûze-ye Sorkh area (after QuickBird satellite image taken on 4 November 2004).

below). This example measures only ca. 70-80 cm in width. Furthermore, the stone linings which represent the sidewall of the road can be observed on both ends of the rock-cut passage at Dokhtarbor. Therefore, it is more straightforward to consider the rock-cut passage

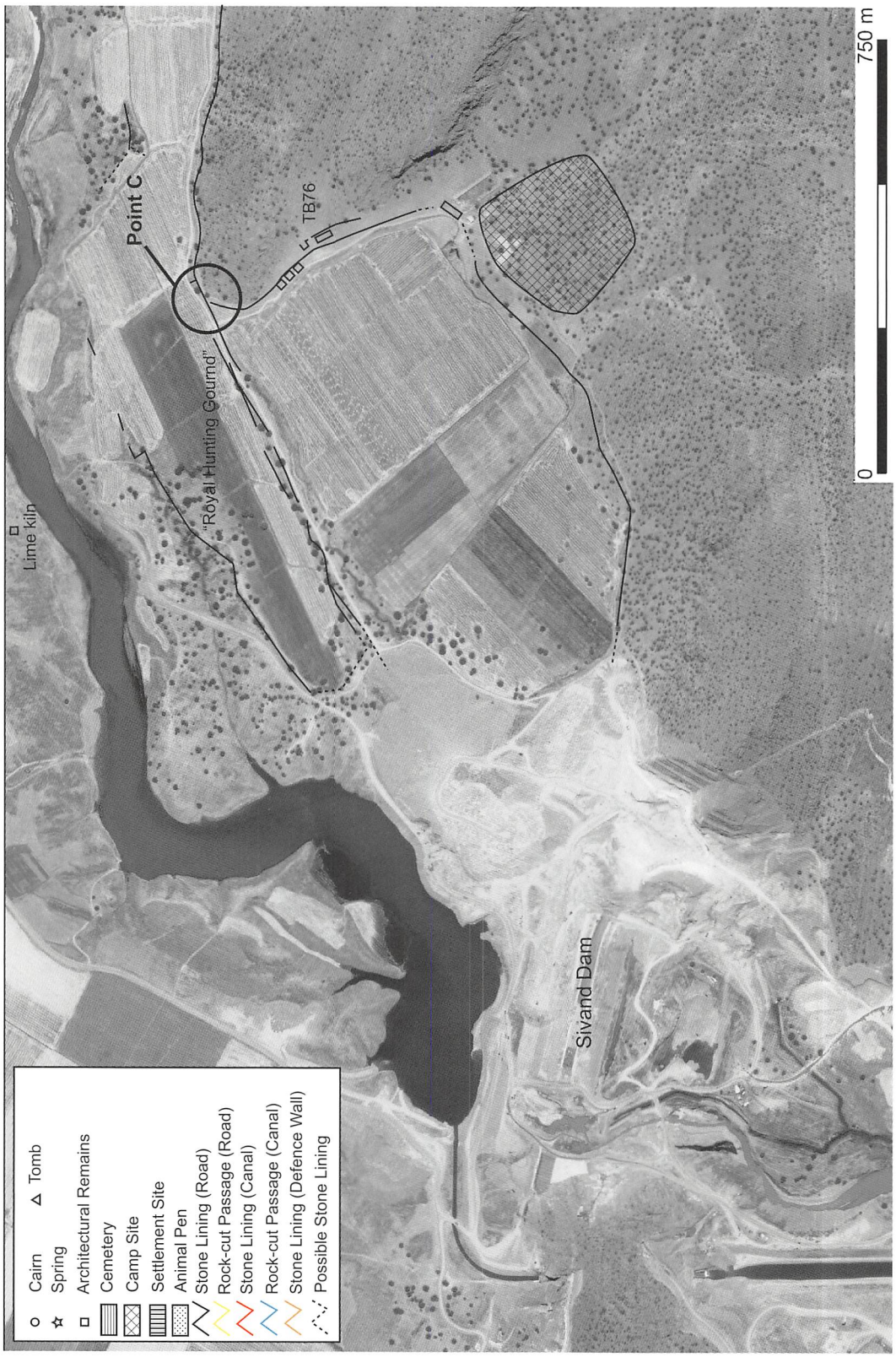


Fig.11.13 Bolâghî Bozorg (1): Surveyed archaeological remains in the northeast of the Sivand dam (after QuickBird satellite image taken on 4 November 2004).

as part of the road system.

The reasons why we considered the stone linings, especially in the western part of Tang-e Bolâghî, as sidewalls of the roads and assumed them inadequate for a canal or as the

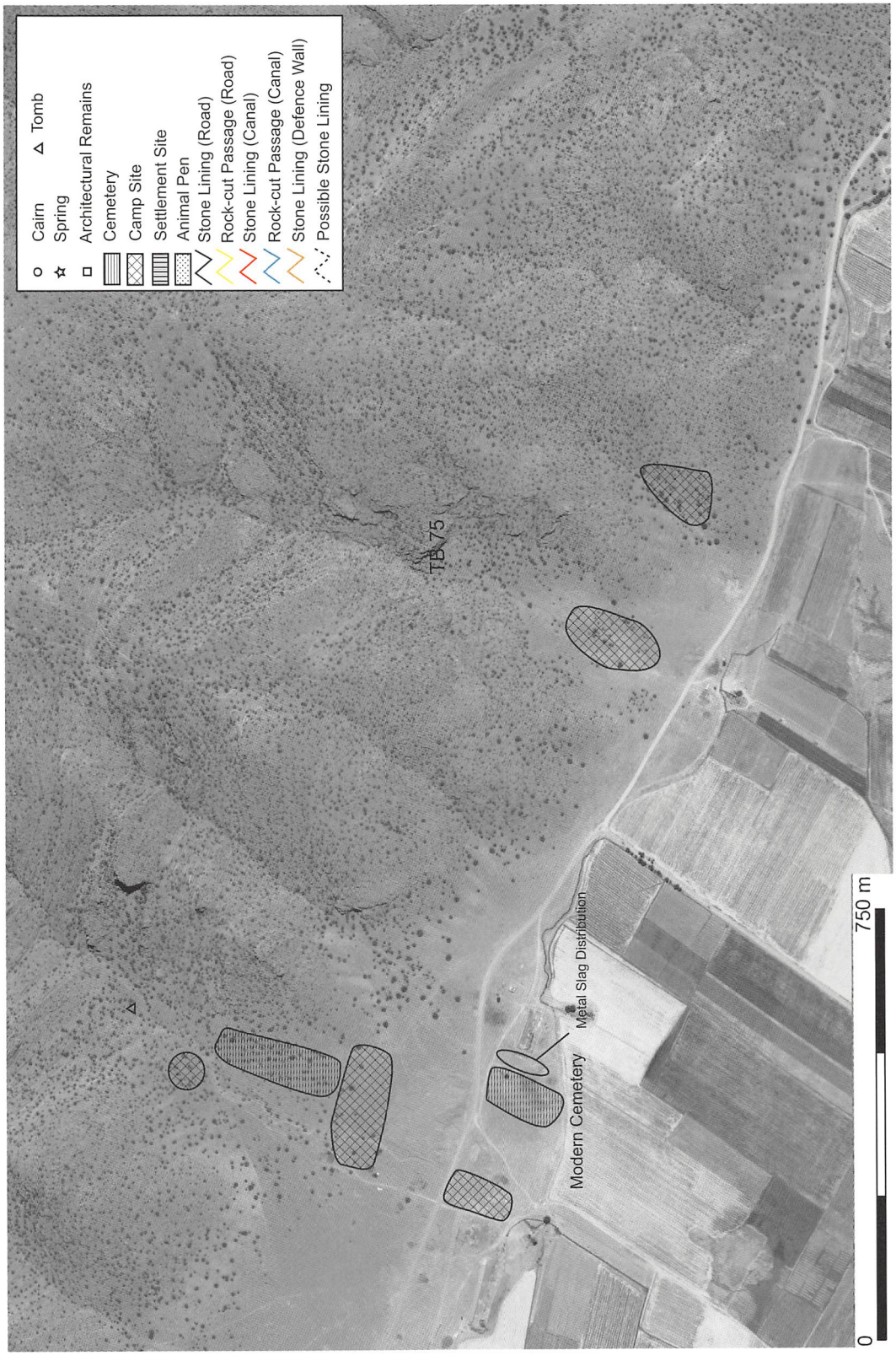


Fig.11.14 Bolâghî Bozorg (2): Surveyed archaeological remains in the north central part around TB 75 (after QuickBird satellite image taken on 4 November 2004).

sidewalls of canals are given as follows:

(1) Although the stone linings are in major parts constructed by following the contour

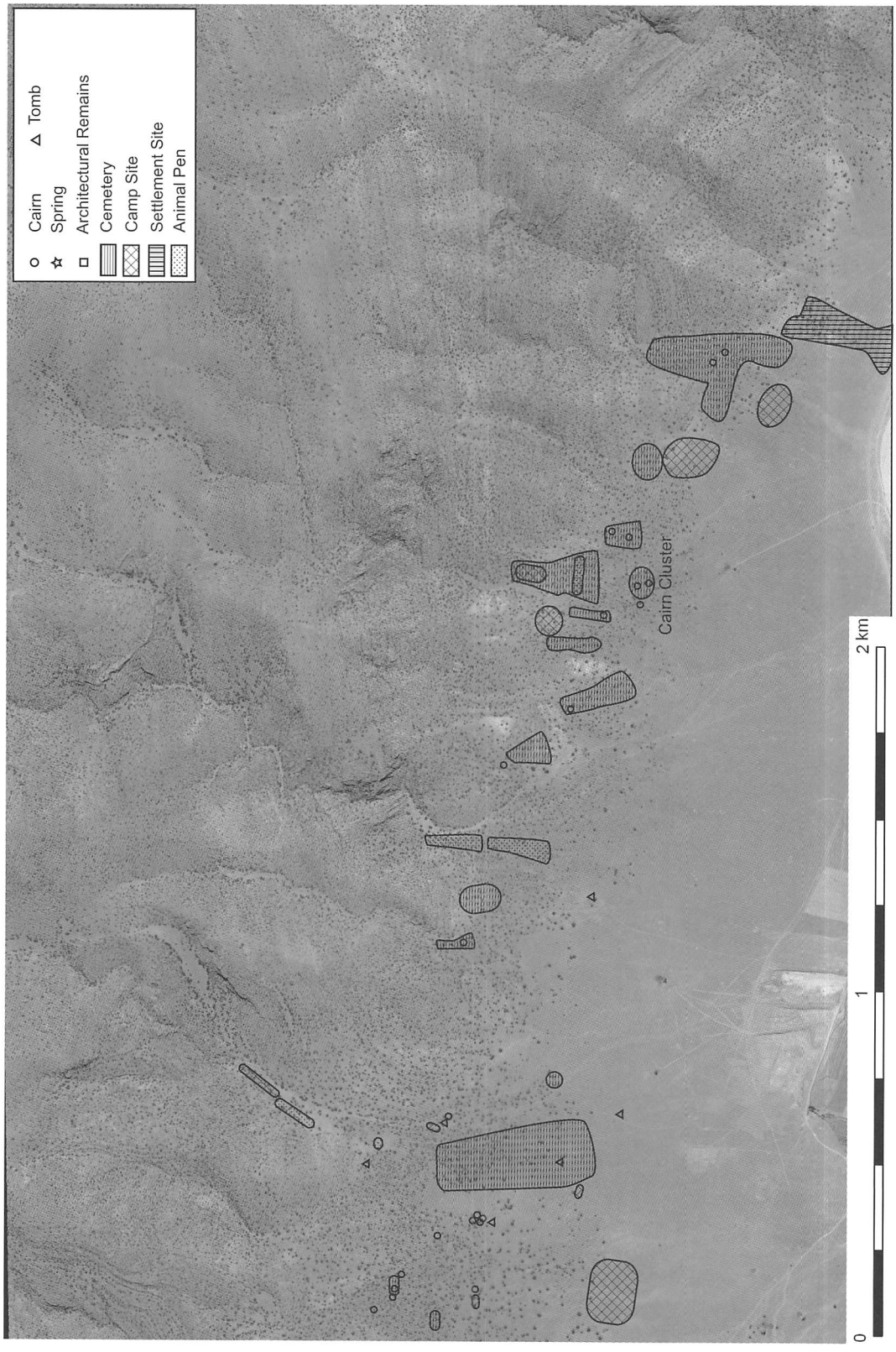


Fig.11.15 Bolâghî Bozorg (3): Surveyed archaeological remains in the northwestern part (after QuickBird satellite image taken on 4 November 2004).

lines, some parts contain redundant difference of evaluation. Thus, the water would not flow using such route.

(2) The stone linings are basically made of dry masonry without using mortar. Thus, the water would ooze out from the "canal".

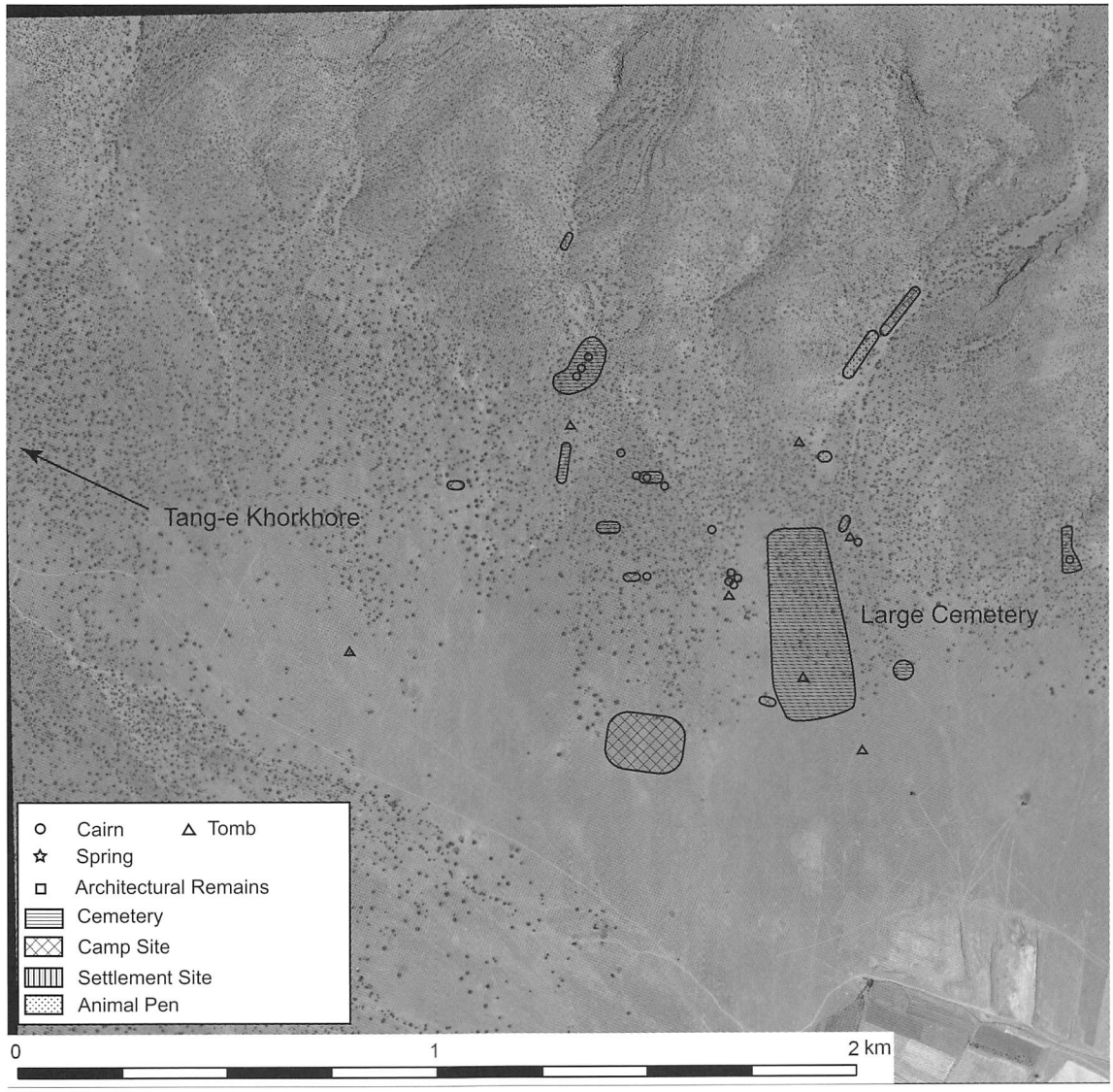


Fig.11.16 Bolâghî Bozorg (4): Surveyed archaeological remains in the northwestern corner (after QuickBird satellite image taken on 4 November 2004).

(3) By observing a number of trenches opened along the stone linings, the accumulation of soil is rather horizontal and no traces of running water were observed.

(4) Although the water source and the sluice gate of the canal located inthe eastern part of Tang-e Bolâghî has been identified (see below), the water source and the sluice gate of the "canal" in the eastern part of Tang-e Bolâghî has not been identified.

The Iranian-French joint expedition which surveyed the stone linings and rock-cut passages in the Bolaghi Valley has concluded that both structures found in the valley floor belong to a canal system ('Ata'i and Boucharlat 2006: 22). They also conducted small excavations along the stone linings. Although we do not totally agree with some of their observations and interpretations, it is highly possible that some part of the stone linings and rock-cut passages were used as canals (see below). What we are emphasizing is that not all of the structures can be interpreted as canals, but some were constructed as sidewalls of the road.

Just to the west of the rock-cut passage of Dokhtarbor, an unfinished engraving on the

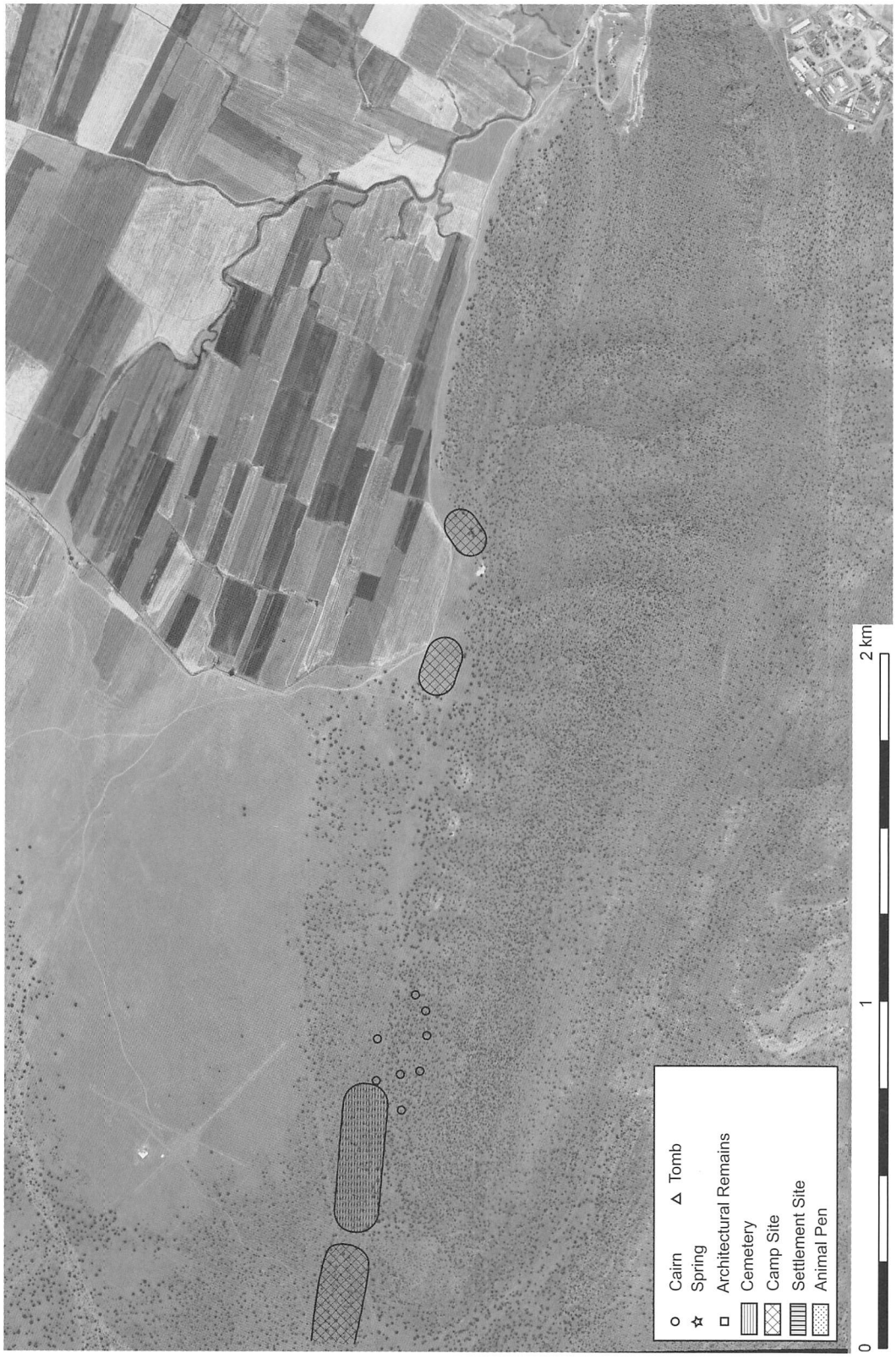


Fig.11.17 Bolâghî Bozorg (5): Surveyed archaeological remains in the southwestern part (after QuickBird satellite image taken on 4 November 2004).

rock surface was observed (Pl.11.26; Stronach 1978: Fig. 84b). As we can see from the examples of two paralleled rock-cut passages which are located between Dokhtarbor and Tîrandâz (Pls.11.27), this engraving was intended to create other rock-cut passages parallel

to the one in Dokhtarbor (cf. Stonach 1978: 166). Another possibility is that this engraving was intended to widen the rock-cut passage of Dokhtarbor further to the west.

Approaching from Pasargadae to the Bolaghi Valley, the stone linings of the sidewall of a road can be first encountered at the northern entrance of Tang-e Bolâghî (Fig.11.5). The road which lies in the western part of Tang-e Bolâghî leads to a rock-cut passage of Dokhtarbor (Pls.11.28-30). From this point on, the road continues into the eastern part of Bolâghî Bozorg (Fig.11.6, 9-12; Pls.11.31-32). Although it is difficult to trace the stone linings especially after entering Bolâghî Bozorg, the road at least reaches a settlement in the Darre-ye Hâjî Bahramî valley where the site of TB 64 is located (Fig.11.12)[6]. The site was excavated by the Iranian-Polish joint expedition and revealed occupation dated to the Achaemenid period (Asadi and Kaim 2007)[7].

As mentioned above, although there is poor evidence to provide dating for the road at the moment, if we rely on the presence of cairns constructed directly on the road structure, the road structure must be dated most likely to the Achaemenid period.

On the east and south banks of the Sivand, the stone linings of the sidewall of a road appear at ca. 700 m from the northern entrance of Tang-e Bolâghî. The road continues along the foot of the mountains to the site of TB 34, parallel to the canal which runs at a slightly higher elevation than the road (Figs.11.6-7, 9; Pls.11.33-34). The road becomes fragmentary after TB 34 and disappears around Tîrandâz. However, the road re-appears ca. 500 m east of Pûze-ye Sorkh. The road seems to continue from the area of TB 64 on the north bank of the Sivand. A crossing point of the Sivand was identified on the south bank of the river just ca. 150 m southwest of the cliff of Pûze-ye Sorkh (Fig.11.12; Pl.11.35). The remains of hard mortar, which were probably used to maintain the crossing point, were observed here. This crossing point where the river terrace becomes low and when the water level is low, it is an ideal crossing point. The re-appearance of the road structure on the south bank just after climbing to the river terrace supports such estimation. In addition, another possible corssing point was identified in Tîrandâz (Fig.11.10). Although no traces of mortar remains were found, stone scattered on the river bank and the narrow point of the river may suggest the possibility of crossing point.

The major intersections of the road within Bolâghî Bozorg can be summarised as follows:

(1) At Point A (see Fig.11.12), the road coming from the east along the north bank of the Sivand, advances to the southeast and to the west. The southeast branch leads to the river bank and arrives at the above mentioned crossing point of the Sivand. The west branch continues to the further west of TB 64, but disappears soon (ca. 500 m).

(2) At Point B (see Fig.11.12), the three roads intersect. One comes in from the northwest at the crossing of the Sivand. The second comes in from the east (This one is fairly short and cannot be followed further to the east). The third one comes in from the south. At this intersection, the foundation of a large structure, probably a barrier station was found. The third branch of the road derives from the west where the Sivand dam is now constructed. This road was probably connected to the road in Bolâghî Kûchak. However, between the western end of the third branch, and Bolâghî Kûchak, the road was completely destroyed by the Sivand dam and it was not possible to follow it through to Bolâghî Kûchak.

(3) At Point C (see Fig.11.13), the three roads intersect. One comes in from the east, the second comes in from the west, and the third branch comes in from the south.

An Achaemenid settlement (TB 76) is located near the three way intersection of Point C, just to the south of a "royal hunting ground" (see below) and has been excavated by the Iranian-Italian joint expedition (Askari Chaverdi and Callieri 2006; 2007). The site has been

interpreted as a rural settlement of ca. 1 ha in size. However, considering the location along the road system, it was not a simple rural settlement, but probably existed to support the royal activities which took place in the "royal hunting ground" as well as being an important way station on the south bank of the Sivand.

The road at the northern entrance of Tang-e Bolâghî continues to the north from Tang-e Bolâghî by turning southwest from the west bank of Sivand River. The road apparently continues from Tang-e Bolâghî and advances towards the west part of the Pasargadae Plain (Fig.11.5). We also looked for some crossing points of the Sivand towards the site of Pasargadae, but no clear evidence was discovered. We surveyed an area of ca. 1 × 1 km just to the north of the northern entrance of Tang-e Bolâghî. However, no major stone linings were identified. Probably the accumulation of alluvial soil carried by the Sivand as well as the destruction by human causes (e.g. cultivation and canal construction) have made the stone linings invisible on the present ground surface.

As mentioned above, to the west of the northern entrance of Tang-e Bolâghî, a large camp site and cemetery were recorded which is distributed to the north and south of the modern track. In the northern part of the camp site and cemetery, on the river terrace, some fragmentary remains of stone linings were identified. We assumed these remains as the road continuing from Tang-e Bolâghî. Although we did not find a road connecting Tang-e Bolâghî and Pasargadae, it is certain that one of the branches of the road from Tang-e Bolâghî continued to the west.

We also identified a stone lining perpendicular to the road structure, ca. 500 m north of the northern entrance of Tang-e Bolâghî. Such stone linings can be also observed at several places along the roads in Tang-e Bolâghî and Bolâghî Bozorg. The clear function of the structure is unknown, but we assume that due to its relationship with the road, it contributed to controlling the movement of people, especially nomadic pastoralists. The stone linings perpendicular to the road were often found just before reaching at an open space (e.g. alluvial plain, or riverbank). In some locations in Tang-e Bolâghî and Bolâghî Bozorg, structural remains assumed to be "barrier stations" were found adjacent to the above stone linings (e.g. Fig.11.12; Pl.11.36). Considering that the road leads to the capital city of Pasargadae, it is natural that a number of barrier stations were built along the road.

**2) Category 1b: Stone Linings as the Embankment of a Canal**

The stone linings which can be assumed as the embankment of canals were mainly observed in the eastern part of Tang-e Bolâghî and constructed in the lower part or on the edge of the foothills (Figs.11.6-7, 9-10). The stone linings of this category sometimes run in parallel with category 1a and probably functioned to connect the rock-cut passages of category 2b.

Canals with similar construction have been reported in north Fars, particularly in the Kur River basin or the Persepolis Plain. For example, Sumner (1986: 14) describes the huge canal (ca. 50 km in length) derived from Band-e Dokhtar. The canal runs along the foot of the mountains and consists of rock-cut passage ("a ditch dug into the talus") and more typically a stone lining type. This type he describes that "form of an embankment following the lower contours of the mountain" and the core strcucture is made of cobble stones "covered by a thin mantle of earth" (Sumner *ibid.*). He assumed that water probably flowed between the mountain and the embankment. Probably this was the case with the canal we encountered in the Bolaghi Valley and in the Toll-e Gholâm area in the Pasargadae Plain (see below). If the stone masonry is covered by thin earth, no mortar was needed, and indeed the embankments of the canal which we encountered in the survey area were constructed by dry masonry. Probably the earthen mantle was completely destroyed due to natural causes as well as humans who reused the stones of the embankment for other purposes.

A major canal system was encountered in the northeast part of Tang-e Bolâghî (Fig.11.6; Pls.11.37-38). The canal system consists of a mixture of stone linings and rock-cut passages. Slightly below the canal, a road runs in parallel to the canal. The rock-cut passages were often found where a rock ridge extends towards the Sivand River. An average width of the rock-cut passage was ca. 50-70 cm and was not suitable for numbers of people or animals to pass through. The canal seems to flow following the contour line and leads to the area where the site of TB 34 is located. The site has been excavated by the Iranian-French joint expedition and unearthed the Achaemenid structural remains with Achaemenid-style stone column bases ('Ata'i and Boucharlat 2007). Although the remains of the canal seem to continue further to TB 34 and some remains of rock-cut passages were found further to the south of the site, the final destination of the canal was not identified.

The water source of the above canal was confirmed to be located outside the Bolaghi Valley. Following the remains of rock-cut passage and stone linings continuing to the southeast from the northern entrance of Tang-e Bolâghî, we identified the old spring of Cheshme-ye Darre-ye Sorkh located halfway up the hill ca. 1 km southeast from the northern entrance of Tang-e Bolâghî (Fig.11.7; Pl.11.39). Although the stone linings disappear around the spring, considering the location and possible extent of the canal, we assumed that the Cheshme-ye Darre-ye Sorkh (or Cheshme-ye Qermez) is most likely to be the water source of the canal.

Another water source, not related to the above canal was also found ca. 2.5 km southeast of the Cheshme-ye Darre-ye Sorkh spring. This spring (Cheshme-ye Mourî) is located in the foot hills and presumably one of the main springs which watered the Pasargadae Plain (Fig.11.28). To the northwest of Cheshme-ye Mourî, a stone-built causeway-dam of Sadd-e Domdariyâ (Sadd-e Dom-e Dariyâ) (see Fig.11.26 and Appendix 2) was recorded and to the southwest of the spring, the old route of Râh-e Shîrî which leads to Qasr-e Dokhtar (see Appendix 7:5) is located.

**3) Category 1c: Stone Lining as the Defence Wall**

The stone linings of category 1c, which is a defence wall, were recorded mainly on the ridges of the mountains on the east bank of the Sivand. The defence wall is constructed of large sized stone linings and sometimes the wall was preserved to ca. 1-2 m in height.

A defence wall was discovered to the southeast of Kûh-e Kûchakak at the northern entrance to Tang-e Bolâghî (Fig.11.8; Pls.11.40-41). The wall measured ca. 800 m in length and ca. 1.5-1.8 m in thickness. Only the foundation of the wall was visible on the ground surface. The wall is located on a mountain ridge and probably had an opening to the southeast. To the east of the wall, there exists an easy access route from the southeast passing through a low mountain ridge. Around the possible opening of the wall, the stone-built foundation of a building was identified. The building might be a "gate structure" of the defence wall. The northwestern end of the defence wall is located on the cliff which projects towards the east bank of the Sivand. The defence wall was constructed by connecting the cliffs located to the northwest and southeast respectively to restrict access to Tang-e Bolâghî from the east. Considering the scale of the structure and the style of masonry, the defence wall probably dated to the Achaemenid period. No potsherds were observed around the stone linings.

Another defence wall was identified on the slope of the mountain on the east bank of the Sivand in Tang-e Bolâghî (Fig.11.8; Pls.11.42-43). The previously mentioned defence wall is located ca. 350 m northeast of this defence wall. Thus, it can be suggested that the northeast part of Tang-e Bolâghî was protected by a double defence wall system.

The defence wall runs in an approximately north-south direction on a cliff located at the foot of the mountain. The wall was extremely well preserved and had ca. 1.5-2 m in width,

ca. 400-500 m in length and maximum of ca. 2 m in remaining height. The wall was constructed as if crossing the cliff. The northern end of the wall seems to be connected to a stone lining of the road which surrounds the cliff. On top of the cliff, three cairns were built on the wall. It is highly possible that the cairns were constructed using the stones of the wall. Among the three cairns, one of them was the largest cairn (ca. 16 m in diameter) we had encountered during the survey. The amount of stones used in this large cairn suggests that there might have been a watch tower or other structures on top of the cliff and that the cairn was built using stone remains of stones from those buildings.

This defence wall was probably preventing the movement of people from the mountains to the east of Tang-e Bolâghî. Immediately to the south of the defence wall, a flat alluvial terrace (ca. 650 × 320 m) is located. The defence wall was probably constructed to protect the alluvial terrace and the road and canal running at the edge of the alluvial terrace.

Furthermore, we assumed that the stone linings of category 1a, which we considered to be roads, had another different function as a part of defence system. Although we do not know how high the sidewalls of the road were, it was certainly some sort of obstacle to those approaching from the mountain slope and at the same time, functioned as a protection wall for those moving along the road. In addition, a number of barrier stations which were located at some points on the road (see above) may also function as watch stations facing the mountain side. Therefore, the sidewalls of the road system probably also functioned as a part of a defence system mainly preventing or controlling the access from the mountains around Bolaghi Valley to the valley floor.

**4) Category 1d: Stone Lining as the Enclosure Wall of a "Royal Hunting Ground"**

The stone linings of category 1d were found in the east central part of Bolâghî Bozorg on the south bank of the Sivand River (Figs.11.12-13; Pls.11.44-45). The walls constructed using boulder stones were found along the edge of a flat river terrace. The stone linings seem to enclose a rectangular area of ca. 2.5 × 0.3-0.18 km. The stone linings of the wall remain in better preservation in the south, east and west sides of the enclosure. The north side which faces the Sivand is poorly preserved. The stones used in the western part of the enclosure were much larger than the ones in other parts and the the walls were much thicker.

According to the locals, there was once a mound (fa. tappe) in the west part of the enclosure. We also observed scatters of Achaemenid and Islamic potsherds within the enclosure, suggesting the presence of some structural remains. The scatter of potsherds gradually fades as we moved from the west to the central part of the enclosure. No potsherds were observed in the eastern part. This may confirm the past presence of a mound in the western part of the enclosure. The thickness of the surrounding walls measured ca. 2.5-3.2 m in the east and west sides. Compared to the thickness of normal stone linings, which is ca. 1.5-1.8 m, the walls surrounding the enclosure are extremely thick.

Considering the above factors, if this was built during the Achaemenid period, the enclosure surrounded by a thick wall should have been an important structure for the Achaemenid Empire. Thus, at the moment, considering that the structure is located in the central part of the Bolaghi Valley and close to a river channel, this enclosure may have functioned as a "royal hunting ground" (Gk. *paradeisos*: a "walled garden or hunting grounds") (cf. Sumner 1986: 10; Boucharlat 2003: 265 as "royal hunting park and garden") which was utilized by Achaemenid kings dwelling in Pasargadae. The *tappe* or possible presence of structural remains can be interpreted as a royal structure for the hunting ground. The thick and large stone walls to the west of this area were to protect the royal structure and the east part of the area was probably used more as a hunting ground.

In addition it is already known that the Achaemenid palace complex at Pasargadae contained a royal garden consisting of stone-lined water channels, small pools and a square

pavilion (Stronach 1978: 107-112). Thus, it is not peculiar that the Empire constructed similar recreation places for royal and elite personnel near Pasargadae.

**5) Summary**

The survey has confirmed that the rock-cut passages and stone linings located on the west bank of the Sivand River in Tang-e Bolâghî were a road system. On the other hand, the rock-cut passage and stone linings located on the east bank of the Sivand include canals, roads, and defence walls.

As mentioned above each stone lining has various functions, excepting the stone linings as canals, the stone linings were part of the defence system of Bolaghi Valley and eventually that of Pasargadae Plain. The survey of transhumance routes of modern nomadic pastoralist informs us that the Bolaghi Valley located to the southwest of Pasargadae is a strategically important location for the Achaemenid Empire as well as the main transhumance route around Pasargadae. Therefore, it was crucial to control the movement of nomadic pastoralists in and around the Bolaghi Valley. The presence of stone linings perpendicular to the road structure, and as possible barrier stations adjacent to the road (see above) can be understood as the installations which control or limit the movement of people along the roads. The defence walls on the mountain ridges also acted to prevent enemies entering the important imperial route. Along the Sivand, the construction of a road system together with its defensive sidewalls also controlled the movement of people. Therefore, the so-called "royal road" seems to be built on the transhumance route itself. We can further assume that the road system found in Bolâghî Bozorg was obviously part of the "royal road" which connects Pasargadae and Persepolis.

Although the distribution of stone linings and rock-cut passages in the Bolaghi Valley has already been reported by 'Ata'i (2003; 2007), no detailed studies have been undertaken yet. Our attempt to consider different functions for the stone linings and rock-cut passages by following the structures in detail hopes to bring a new challenge to interpret such structures which are distributed in the much wider area of Fars.

### 5.1.3. Other Finds

**1) Lime Kilns**

Two kiln remains possibly lime/gypsum kilns were located (Figs.11.12-13). One is situtated at Pûze-ye Sorkh, ca. 300 m southeast of TB 64. Another example is located ca. 1 km southwest of TB 75. Both were on the north bank of the Sivand. The dating of the kilns is unknown, but due to the condition of the kilns, they were probably used during the the Islamic period.

**2) Seasonal Springs**

Few springs are located in Tang-e Bolâghî and Bolâghî Bozorg. Nevertheless, in ancient times, more seasonal springs were available in the small valleys, especially in the northern foothills of Bolâghî Bozorg where the main transhumance route lay. Seasonal springs usually gushed water only during the winter and spring. Two seasonal springs were located on the west bank of the Sivand in Tang-e Bolâghî (Fig.11.6). The first spring is located in a small valley ca. 1 km southwest from the northern entrance of Tang-e Bolâghî. The second spring is located ca. 200 m southeast of the first spring.

**3) Rock-Cut "Fire Altar"**

According to D. Stronach (1978: Fig. 3) a "fire altar" is located at the northern entrance of Tang-e Bolâghî, on the west bank of the Sivand (Fig.11.5). We have reexamined the location and found a limestone rock ca. 30 m from the northern entrance of Tang-e Bolâghî,

just to the west of the modern track. On top of the rock, a hole of ca. 25 cm in diameter and ca. 20 cm in depth was perforated (Pl.11.46).

The rock-cut "fire altar" is usually represented by a circular indentation in the rock surface. Such structures were found not only around Pasargadae, but also at Istakhr and Naqsh-e Rustam (cf. Trümpelmann 1984: 323-26; Huff 1998: 74-5). The structures are assumed to be dated to the late Sasanian period and various interpretations have been made on the function of such structures including mortars, funeral-cists/ossuaries, fire-holes/fire bowls, column bases, and support of an urn. More recently, R. Boucharlat agrees with the use of either column bases or ossuaries dated probably to the post-Achaemenid period (Boucharlat 2003: 264), though the dispute of their function is not yet conclusive.

### 5.2. Bolaghi Kuchak

Bolâghî Kûchak is located to the southwest of Bolâghî Bozorg (Figs.11.1-2). The valley is the main southern entrance as well as an important strategic point of the Bolaghi Valley. The valley measures ca. 3.8 km (northeast to southwest) in length and 0.5-2 km (east-west) in width with the altitude of ca. 1780 m asl. Both the east and west sides are surrounded by mountains and the Sivand runs close to the eastern foothills of the mounatins. The valley consists of narrow gorges at the north and south ends with an alluvial plain (ca. 1.5 × 2 km) located to the south. The survey of the valley was carried out in the 2007 season.

#### 5.2.1. Traces of Transhumance Movement

Bolâghî Kûchak is an important gateway for nomadic pastoralists who pass through Bolâghî Bozorg and Tang-e Bolâghî (see Section 4). However, in Bolâghî Kûchak few camp sites were identified compared to those of Bolâghî Bozorg and Tang-e Bolâghî. In addition cairns and cemeteries were rarely found in the valley floor and on the ridge of mountains. This was because Bolâghî Kûchak was mainly used as a traverse point rather than a camping location for nomadic pastoralists.

**1) Camp Site and Settlement**

The only major camp site was found at the foot of the mountain to the west of Bolâghî Kûchak (Fig.11.19; Pl.11.47). The site seems to contain a long-term occupation since both potsherds from the Bakun/Lapui periods (late 5th to 4th millennium BC) and the Achaemenid period were observed on the site (Pl.11.48). On the south edge of the site, a stone lining of the road (see below) was identified, suggesting that the camp site was not only on the transhumance route, but most likely on the road system of the Achaemenid period. Since this site seems to be the largest camp site in Bolâghî Kûchak, it was probably used by the nomadic pastoralists since ancient times.

Just to the southwest of the camp site, a settlement site was found between the foothills of the mountain to the north and the alluvial plain to the south (Fig.11.19; Pl.11.49). The settlement, which extends to the east-west, has an area of ca. 100 m (north-south) × ca. 350 m (east-west). In the area of the site, several stone linings considered to be the foundations of the walls were observed. Abundant potsherds probably dated to the Achaemenid period were also observed on the surface, especially to the west of the site. A circular stone-built well was located in the west of the site. Considering its size, the site was probably the main settlement in Bolâghî Kûchak.

**2) Carins and Cemeteries**

Hardly any cairns or cemeteries were identified at the foot and on the ridges of the east and west hills of Bolâghî Kûchak. A possible cemetery is located just to the west of the above mentioned settlement site (Fig.11.19). The scarcity of cairns and cemeteries is

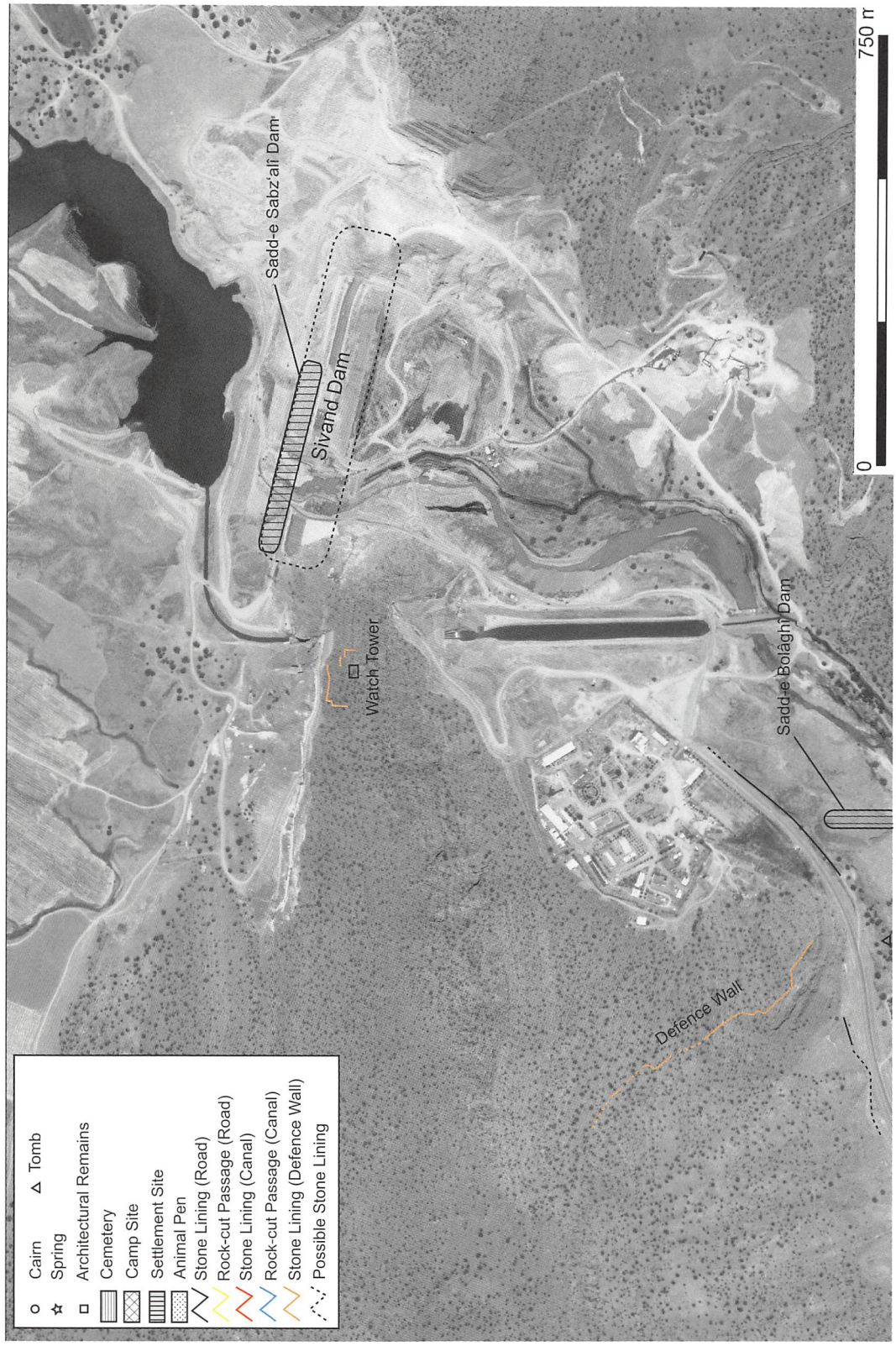


Fig.11.18 Bolâghî Kûchak (1): Surveyed archaeological remains in the northern part (after QuickBird satellite image taken on 4 November 2004).

obviously related to the scarcity of camp sites. As we saw above, the number of carins and cemeteries increases once entering Bolâghî Bozorg.

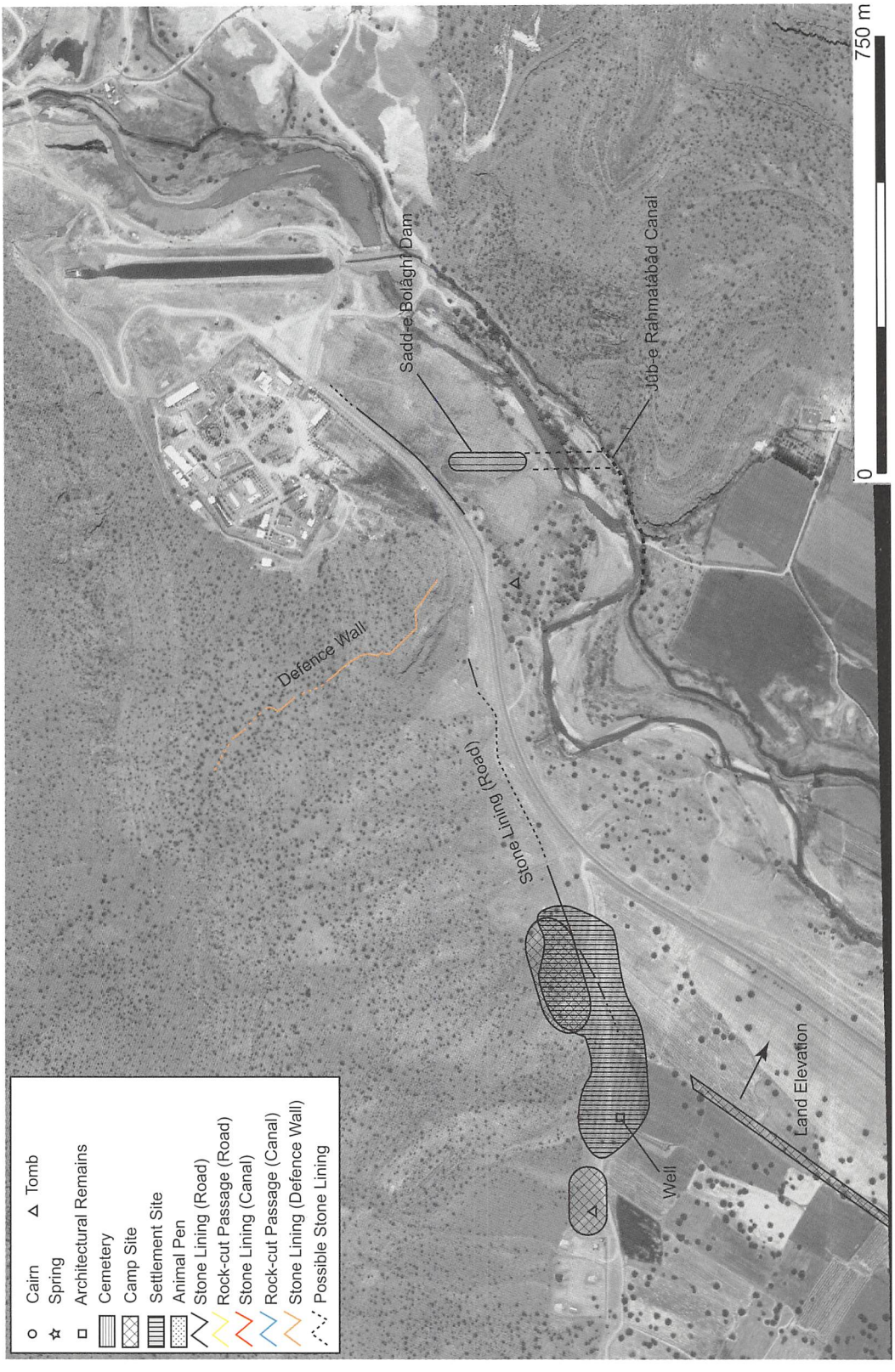


Fig.11.19 Bolâghî Kûchak (2): Surveyed archaeological remains in the southwestern part (1) (after QuickBird satellite image taken on 4 November 2004).

### 5.2.2. Road System

Stone linings which resemble the ones in Tang-e Bolâghî and Bolâghî Bozorg were also identified in some parts of Bolâghî Kûchak. However, the condition was much more


Fig.11.20 Bolâghî Kûchak (3): Surveyed archaeological remains in the southwestern part (2) (after Google Earth 2007 ©).

fragmentary than those in the first two areas.

Since the northern gorge of Bolâghî Kûchak is completely destroyed by the Sivand dam, we were not able to identify any stone linings. The stone linings start to appear, ca. 1 km southwest from the northern entrance of Bolâghî Kûchak, on the west bank of the Sivand. A stone lining (ca. 1-1.5 m in width) was found to the east of the modern road which leads to the Sivand dam. Then, the stone lining disappers after ca. 250-300 m and re-appears at the foot of the mountain further to the southwest (Figs.11.18-19; Pl.11.50). From this point, fragmentary stone linings continue to the camp site and settlement mentioned above following the foot of the mountain.

Considering the relationship with the camp site and settlement, the stone linings mentioned above are most likely to be the sidewalls of a road structrure. In addition, a stone lining perpendicular to the road structure was identified in the central part of the settelement site.

We were not able to follow the road structure from the settlement site to the west. However, some fragmentary stone linings probably the sidewalls of the road were identified in the foothills of the mountain to the southwest of Bolâghî Kûchak (Fig.11.20; Pl.11.51). If this is part of the road structure the road continued from the northern entrance of Bolâghî Kûchak ran along the foothills and then, crossing somewhere on the alluvial plain and lead to the road at the southwest of Bolâghî Kûchak. Neverthless, due to the fragmentary state of the stone linings, the above hypothesis is difficult to prove.

### 5.2.3. Water Management System

Our survey identified two ancient dams and a canal in Bolâghî Kûchak. One is Sadd-e Sabz'alî located at the point where the newly built Sivand dam (Sadd-e Makhzanî-ye Sîvand) now stands. Another dam, Sadd-e Bolâghî, was recorded further down the channel of Sivand. A canal probably connected to the two dams was identified in the eastern foothills of Bolâghî Kûchak.

#### 1) Sadd-e Sabz'alî Dam

According to the locals, at the point where the Sivand dam is located, there was an ancient dam called Sadd-e Sabz'alî (Fig.11.18). Considering the presence of the Jûb-e Rahmatâbâd canal (see below), it is highly possible that such a dam was located there in the past. The presence of such a dam should be examined by satellite images or aerial photographs taken before the construction of Sivand dam. Although it is impossible to give the date of the dam at this moment, if we consider the planning and execution of such a large construction project, we temporally assume that the dam is dated to the Achaemenid period.

#### 2) Sadd-e Bolâghî Dam

Slightly down the channel of the Sivand from the Sivand dam, an ancient dam was discovered on the west bank of the Sivand (Fig.11.19; Pl.11.52). The area is where the cliffs from the east and west mountains, respectively hang over the valley and form a narrow point. The dam was consructed using earth and has a large earthen rampart shape. The structure measures ca. 40 m in width, ca. 60 m in length and ca. 10 m in height from the current river surface. The upper part of the rampart, especially on the eastern side is covered by cobble stones. The dam seems to run in a northeast and southwest direction: the northeast end is buried beneath the soils of land elevation, while the southwest end is cut by the Sivand. Although we have little evidence to date the structure, considering the size and construction method, it can be temporarily dated to the Achaemenid period.

#### 3) Jûb-e Rahmatâbâd (Canal of Sadd-e Bolâghî Dam)

The canal of Sadd-e Bolâghî is located at the foothills of the mountain to the east of Bolâghî Kûchak, and slightly down the channel of the Sivand from the Sivand dam (Fig.11.19; Pl.11.53). According to the locals, before the construction of the Sivand dam, the sluice gate of the canal was located around the Sadd-e Sabz'alî dam, just to the north of the Sivand dam.

For water to flow in the canal the presence of a dam structure is neccesary. Thus, two ancient dams (Sadd-e Sabz'alî and Sadd-e Bolâghî) were constructed. However, it is rather strange that only one canal was found. This was probably the original canal that was built when Sadd-e Sabz'alî was constructed. When this dam was abandoned, the second dam (Sadd-e Bolâghî) was built and utilized the same canal to deliver water.

The date of this canal is also unknown, but considering its relationship with the dams, the Achaemenid period is most likely.

The presence of dams and the canal indicates that Bolâghî Kûchak was not only important as a transhumance route, but also a crucial water source for the alluvial plain to the south of Bolâghî Kûchak and moreover for the Rahmatâbâd plain. If the above dams and the canal were dated to the Achaemenid period, the Empire intended the systematic irrigation and cultivation of the the Rahmatâbâd plain. Although the dams were destroyed, the canal was renovated and still irrigates the plain around Rahmatâbâd and Qavâmâbâd.

### 5.2.4. Defence System

Compared to Bolâghî Bozorg, Bolâghî Kûchak was less used for camps by nomadic

pastoralists and the canal system was rather limited. However, the defence system was relatively well organized in Bolâghî Kûchak. On the ridges of hills to the west of Bolâghî Kûchak, we identified two new defence walls and a watchtower.

**1) Defence Walls**

The first defence wall was discovered on a cliff overhanging the west bank of the Sivand (Fig.11.19; Pl.11.54). It is located ca. 1 km southwest of the Sivand dam. The defence wall runs approximately north-north-west to south-south-east. The south end of the wall is located near the end of the cliff top and continues north along the steep ridge of the hill towards the area ca. 10 m below the top of the hill. The total remaining length of the wall measures ca. 500 m as the crow flies and the wall wound slightly towards the northeast and thus to some degree off from the ridge of the hill. The wall was ca. 1.5-2 m in average thickness.

The second defence wall was found to the northwest of a watchtower (see below). The wall is located on a steep slope of the hill and continues down the slope to the north (Fig.11.18; Pls.11.55-56). The wall continues for ca. 50 m and turns at a right angle to the east. Then the wall continues for ca. 10 m and ends. The thickness of the wall measures ca. 2.5 m, but after turning to the east, the thickness was slightly reduced.

**2) Watchtower**

A watchtower was found on the ridge of a cliff projecting just to the west of the Sivand dam (Fig.11.18; Pl.11.57). The location overlooks both Bolâghî Bozorg and Bolâghî Kûchak, and is suitable for guarding the routes which pass the valley floor. The watchtower was built by human-head size stones but the south part utilized natural rock. The plan of the watchtower seems to be a triangular one with stone-built walls in the west and north. The west wall has a thickness of ca. 3 m and three rectangular rooms (probably tombs) were attached to the inner side. These rooms (or tombs) were probably built later after the watchtower was abandoned. The watchtower was built slightly offset to the north side of the cliff ridge. This is probably because the access route to this structure was easier from the north rather than from the south. Several potsherds were observed around the watchtower. Although the dating of potsherds was difficult, it seems that they resemble those of the Achaemenid period.

The above observation indicates to us that the defence walls and the watchtower were constructed on the cliffs to the west of Bolâghî Kûchak. The location of these structures commands a fine view of Bolâghî Kûchak and offered an advantage to control the movement of people along the valley floor. Although the evidence is weak, if these structures are dated to the Achaemenid period, the two defence walls and a watchtower must be part of the defence system to protect the Pasargadae Plain (see below).

In comparison with the west side of Bolâghî Kûchak, no defence walls or watchtowers were discovered to the east of Bolâghî Kûchak, although several cliffs are located there. One of the reasons for such a lack is probably due to the presence of the Sivand close to the eastern foothills of Bolâghî Kûchak and was therefore difficult to utilize as the main route. The presence of a canal here might also prevent the construction of a road. In any case, the road system ran to the west of Bolâghî Kûchak and thus one had to put emphasis on protecting and controlling the west part of the valley. The lesser utilization of the east part of Bolâghî Kûchak is also evidenced by the lack of any cairns and cemeteries. In other words, even the nomadic pastoralists seem to use the west part of Bolâghî Kûchak as their transhumance route. Such movement of the nomadic pastoralists contributed fundamentally contributed to the necessity of establishing a secure defence system in this part of valley.

Finally, considering the presence of the above mentioned defence walls, watchtower, roads, and the natural defence barriers of the Sivand and canal, we can say that the movement of people was fairly well controlled in Bolâghî Kûchak.

#### 5.2.5. Other Finds

**1) Land Elevation**

A large tract of elevated land (ca. 1.2 km in length and ca. 15 m in width at present) was observed on the west bank of the Sivand, in the west central part of Bolâghî Kûchak (Fig.11.20). The elevated land runs from northeast to southwest and the surface was in some parts covered by cobble stones.

Although the function and the date of the elevated land is unknown, we can provide an hypothesis which suggests it as a part of the road system which connects the stone linings in the north, and the fragmentary one in the southwest of Bolâghî Kûchak; since in the western part of Bolâghî Kûchak where the modern road is located, the land seems to slide eastward toward the Sivand. Probably the elevated land was intended to be used to construct a flat surface to lay a road within Bolâghî Kûchak.

The area around the elevated land is now used as cultivated fields since the establishment of the Islamic Republic. If we were to observe the satellite images or aerial photographs prior to cultivation, we may observe the better preserved state of land evelation and other structures which may have been located in the vicinity.

### 5.3. Pasargadae Plain

The Pasargadae Plain is located to the northeast of Bolaghi Valley and measures approximately 11 km (north-south) × 4.5 km (east-west) with the altitude of ca. 1860 m asl (Fig.11.3). The survey of the plain was conducted in the 2007 season. The result of the survey can be summarised as follows.

#### 5.3.1. Toll-e Gholam Area

Toll-e Gholâm is a cluster of natural hills located ca. 4 km north of the Pasargadae palace complex (Fig.11.3; Pl.11.58). Just to the east of Toll-e Gholâm, a small basin called Âushenâsûn is located. Âushenâsûn has been an important transhumance route for nomadic pastoralists moving between the Bolaghi Valley and the summer pastures to the north of the Pasargadae Plain (see Section 4). The remains of transhumance can be seen in camp sites, cairns and cemeteries. In particular, abundant cairns were observed in the area.

In the Achaemenid period, the area around the Âushenâsûn basin was obviously one of the crucial areas for protecting the northern hinterland of Pasargadae. We have identified some archaeological remains possibly dated to the Achaemenid period that relate to the protection and exploitation of the plain. These remains closely resemble those found in the Bolaghi Valley and can be classified into road, canal and defence systems.

##### 5.3.1.1. Trances of Transhumance Movement

**1) Camp Sites**

Abundant small camp sites can be found in the small basins or at the foot of small valleys (fa. darband) which are located around the foot of natural hills at Toll-e Gholâm area (Figs.11.21-23). The camp sites were recorded in a small valley located to the east of the hills located at the southern end of Toll-e Gholâm, and to the west of a small basin located in the north of the same hills at the southern end of Toll-e Gholâm. At Âushenâsûn, the camp sites are distributed in the flat plain to the east of the basin or in the small valleys to the west.

Among many camp sites, the noteworthy ones are the following two. First is the camp site located in the east foot of a hill where a caravanserai (see Section 5.3.2) is situated to its

south (Fig.11.23; Pl.11.59). We observed lithic fragments and Bakun type painted wares. Just to the east of the site, an Achaemenid road structure (stone lining) runs north-south. Thus the site was not only along the transhumance route, but also along the ancient road.

Another camp site is located in a small valley to the east side of the eastern hill of Âushenâsûn (Fig.11.22; Pl.11.60). An Islamic building with a square plan, probably a small caravanserai, was recorded. On the surface, some potsherds dated to the Bakun /Laupi periods were observed together with the abundant Islamic sherds. On a hill located to the west of the site, a large number of cairns were located. This suggests that the plain lying to the east of the above hill was part of a transhumance route. In other words, this camp site was formed on the ancient transhumance route.

The survey evidence shows that some camp sites were used from the prehistoric period to the Achaemenid period or even to the Islamic period (see also the case of another caravanserai in Section 5.3.2). The transhumance routes around Âushenâsûn were apparently used since the ancient times up to recent times by the nomadic pastoralists.

**2) Cairns and Cemeteries**

Around the Âushenâsûn area, numerous cairns and cemeteries were found on the ridges of hills, slopes of low hills, and deep in the small valleys. Cairns are the one of the most distinctive archaeological remains that we encountered at Toll-e Gholâm (Figs.11.21-22). The location of the cairns can be classified into three groups as follows:

(a) Located on the ridge of a hill/mountain (Pls.11.61-62)
(b) Located on a point slightly below the ridge (Pl.11.63), and
(c) Located on the lower slope of a hill/mountain (Pl.11.64).

The characteristics concerning the location of the cairns can be summarised as follows:

(a) Cairns located on the ridge of a hill/mountain are constructed in roughly equal distances.
(b) Apart from the cairns located on the ridge of a hill/mountain, the cairns are located on similar contours with similar distances to one another.
(c) Cairns located on the lower part of the slope and on the ridge of a hill/mountain often accompany a cemetery in the vicinity.
(d) Cairns located on the lower part of the slope and on the ridge of a hill/mountain are normally visible from the transhumance routes around the hill/mountain.
(e) Cairns located on the lower part of the slope are often formed on a small cliff projecting to the transhumance route.

The above observation suggests that the cairns are formed along the transhumance routes and the cairns and cemeteries around them were obviously formed by nomadic pastoralist who used the above mentioned camp sites. The cairns and cemeteries were located along the modern transhumance routes and especially intriguing is that they were constructed on the points which are visible from the transhumance routes, such as on the ridge or slope of the mountains. Whatever meanings are there for the locations of cairns and cemeteries, it shows that these remains can be used as markers to identify past transhumance routes, i.e. if there is a series of cairns and cemeteries, for example, along a certain ridge of the mountain, a route which can view such structures is a transhumance route of the nomadic pastoralists who constructed the structures.

Almost all the cairns were looted and few had the complete remains of stone-built rectangular burial chambers. The size of cairns can be classified into three groups: (1) small (2-3 m in diameter), (2) medium (ca. 5-8 m in diameter), and (3) large (ca. 10-15 m or larger in diameter). The cairns group belonging to (2) were most frequently encountered. The

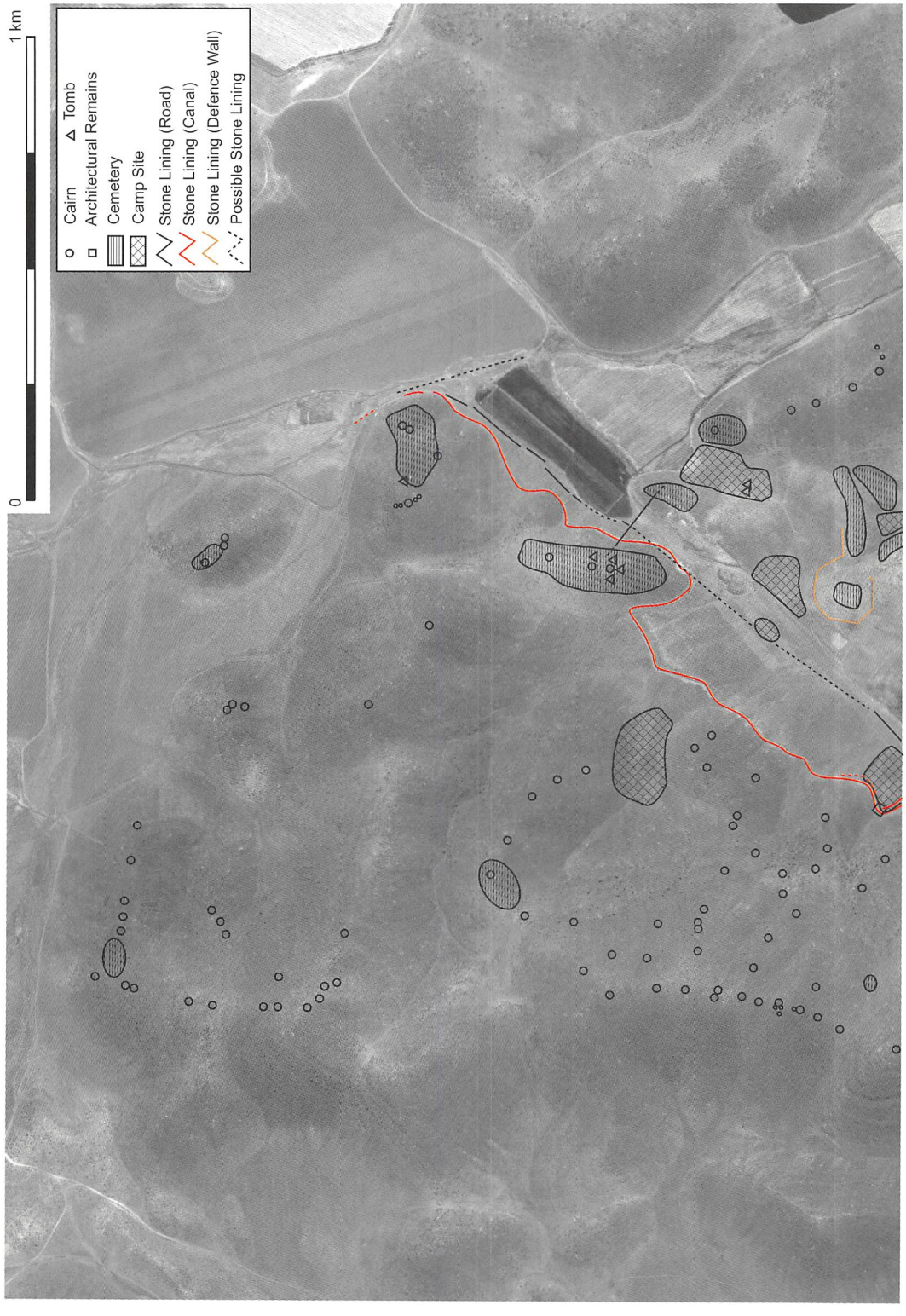


Fig.11.21 Toll-e Gholâm (1): North part of the area (after QuickBird satellite image taken on 16 August 2004).

average size of the burial chamber was ca. 130-150 cm in length and ca. 50-60 cm in width. The main axis of the burial camber was classified into two groups: north-south and east-west axes. Some cairns, especially the smaller sized ones, had a circular burial chamber (ca. 1 m in diameter). Such small sized circular chambers probably belong to a child burial. Finally the cairns normally had a single burial chamber, but especially for the large size ones, double

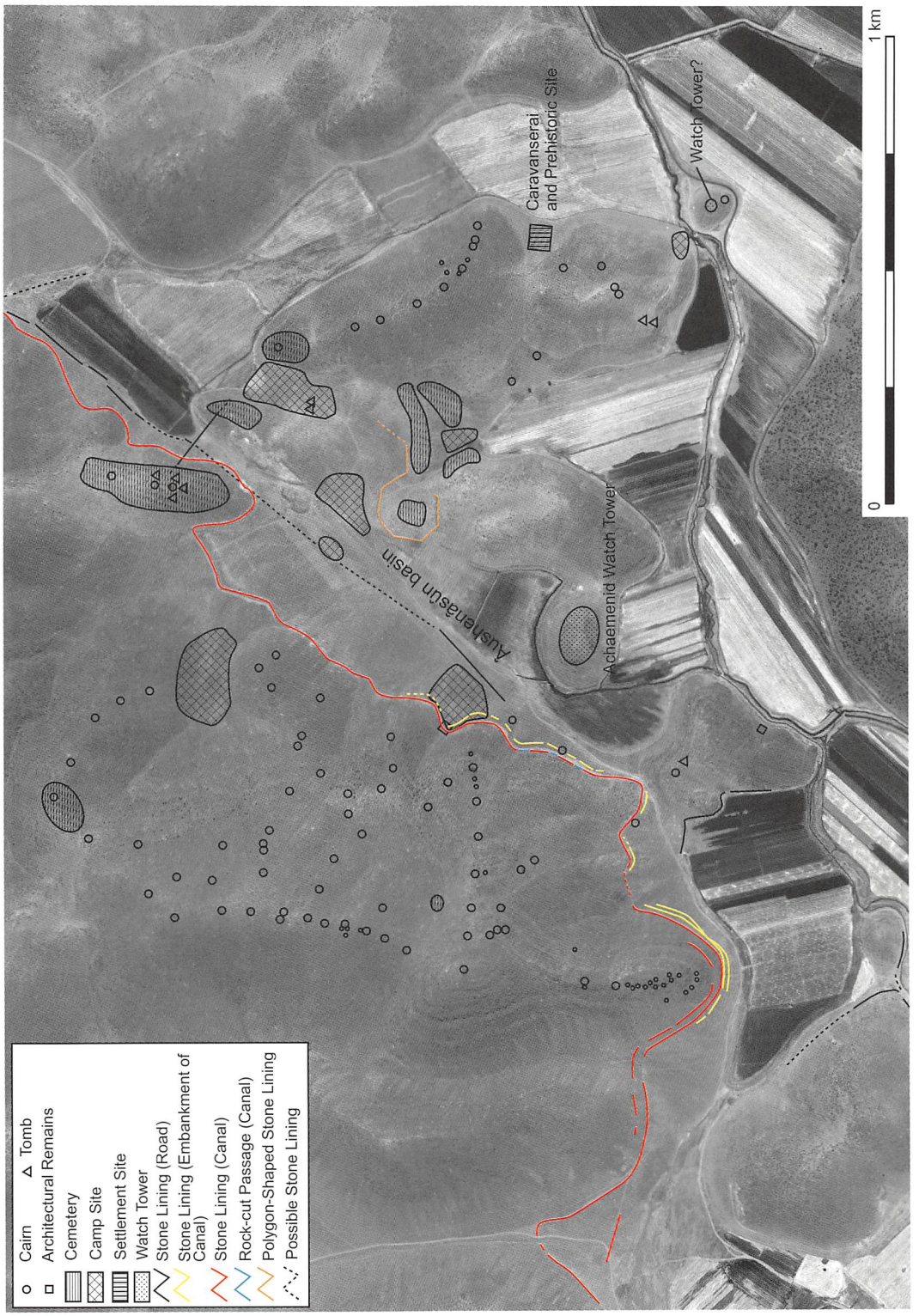


Fig.11.22 Toll-e Gholâm (2): South part of the area (after QuickBird satellite image taken on 16 August 2004).

or triple burial chambers were observed sometimes accompanying small burial chambers at the edge of cairns.

One of the best preserved cairns is located on a cliff located to the west of Âushenâsûn basin (Pl.11.65). According to this cairn, the stones covering the structure seem to have originally formed a cylindrical shape. Thus, the cairns we see now are the remains which do


Fig.11.23 Toll-e Gholâm (3): Southern end of the area and the northwest part of the Pasargadae site (after QuickBird satellite image taken on 16 August 2004).

not show their original condition due to later looting.

As mentioned above, the cairns often accompany various sizes of cemeteries in their vicinity. The graves of these cemeteries are formed by using surrounding stones. The different styles of graves can be summarised as follows:

(a) Placing the stones in a circular form (Pl.11.66)
(b) Paving the stones in a circular form (possibly a destroyed cairn?) (Pl.11.67)
(c) Cluster of several stones (Pl.11.68)
(d) Circular or semi-circular stone linings placed in front of a rock (Pl.11.69), and
(e) Using space between the rocks (Pl.11.70).

The cemeteries are often formed on the ridge of hill/mountain in between the cairns, on top of a low hill, or on the slope at the foot of hill/mountain. Graves of such cemeteries are considered to be those of nomadic pastoralists and reflect the distribution of transhumance routes as mentioned above. The size of the cemetery may represent the lifestyle and size of camps of nomadic pastoralists.

At the moment, due to time constraints, it was not possible to observe the location and form of each grave in detail. However, if we have to obtain more detailed information concerning the movement of nomadic pastoralists, such research should be carried out in the future.

The above result suggests that Toll-e Gholâm centering on the Âushenâsûn basin was utilized by pastoral nomads from the ancient times to the present and it is highly possible that the camp sites, cairns and cemeteries in Toll-e Gholâm have a strong relationship with those of the Bolaghi Valley and the Pasargadae Plain.

#### 5.3.1.2. Road System

A similar type of stone lining to the sidewalls of the road, which we observed in the Bolaghi Valley, was identified in Toll-e Gholâm. The stone lining was clearly visible from the Âushenâsûn to the north (Figs.11.21-22; Pls.11.71-72). Some fragmentary remains of stone lining were also identified to the east of the southern end of the hills of Toll-e Gholâm. Since the stone lining was constructed without concern to the contour line, we consider the structure as a sidewall of the road system. The road structure continues parallel to the below mentioned canal until the northeast area of Toll-e Gholâm. A stone lining perpendicular to the road was also identified just to the north of Âushenâsûn (Figs.11.21-22; Pl.11.73).

#### 5.3.1.3. Canal System

The canal with a stone lining embankment was found at the southern end of Toll-e Gholâm, in the northern foothill of a small valley which runs east-west (Figs.11.21-22). Although some parts of the canal were rebuilt recently, it had a firmly built stone lining embankment. This canal continues to the west of Âushenâsûn where we identified a rock-cut passage. The embankment of the canal consists of at least two steps (Fig.11.22; Pl.11.74). Since the canal was constructed on the slope, it aimed to reinforce the embankment to prevent collapse. The stones used for the canal were quite large in size (ca. 50-60 cm) and were carefully constructed.

After passing through the Âushenâsûn basin, the canal continues to the slope of hills located to the east of the Toll-e Gholâm area following the contour line. Unfortunately we did not identify the water source of the canal which is located somewhere to the north of Âushenâsûn (according to the locals there was once a spring near Âushenâsûn). Although the dating of the canal is not clear, observing the construction method in stone lining as well as that of rock-cut passage, it is highly possible that the canal dates back to the Achaemenid period. If so, the structure delivered water to the cultivated fields to the west of the Pasagrdagae Plain and was an important structure for the systematic development around Pasargadae.

#### 5.3.1.4. Defence System

**1) Watchtower**

A watchtower is located to the southeast of Âushenâsûn on a hill projecting towards the basin from the east (Fig.11.22; Pls.11.75-76). On top of the hill, abundant human-head sized stones and potsherds dated to the Achaemenid period (including those storage jars with projected horizontal bands, see Adachi this volume) were observed. There were two looting holes (ca. 3 m in depth) opened at the central part of the site. The location of the site is at a strategic point where one can overlook the transhumance route crossing the Âushenâsûn basin from north to south or vice versa. Based on the above evidence, we assumed that the site was a watchtower constructed during the Achaemenid period.

**2) Polygon-Shaped Stone Lining**

From the northeast hill of Âushenâsûn to the northeast of the Âushenâsûn basin, we recorded a large polygon-shaped stone lining (Figs.11.21-22, ca. 120 × 180 m). Although the original use of it is unknown, the stone lining was constructed using larger stone than the stone linings of the road structure and there is a possibility that it is related to a defence system. The stone lining has an opening to the southeast.

The presence of the road system and the watchtower indicate that the Âushenâsûn was one of the main gateways to the Pasargadae Plain facing north and probably needed to be carefully controlled by the Achaemenid Empire. The presence of canals here together with some remains in the heart of Pasargadae Plain (see below) implies that water was systematically delivered from the north area to the west of the Pasargadae Plain, probably due to an imperial cultivation scheme delivered by the Empire.

### 5.3.2. Other Finds in the Pasargadae Plain

**1) Caravanserai**

The site is located on the southern slope of a hill and the adjacent plain located to the southern end of Toll-e Gholâm (Fig.11.23; Pls.11.77-78). Abundant fragments of earthen and glazed wares, porcelain and baked bricks were scattered on the surface to the west of the site. A structure considered to be the caravanserai and a water reservoir (fa. âbanbâr) are located to the east of the site (Pl.11.79). Considering the above distribution of artefacts, some related structures of caravanserai were located to the east of the site. In addition, fragments of Achaemenid large storage jars and Bakun type painted wares were also observed on the site surface, we can assume that the site was occupied from the prehistoric times. Thus, the site was along an important transhumance and transport route connecting Toll-e Gholâm and Pasargadae.

**2) Rock-Cut "Fire Altar"**

In the southeast corner of the hill where the above mentioned caravanserai is located to the south, a top-flat grayish limestone rock with a hole perforated on the top was observed (Fig.11.23; Pl.11.80). Since this artificial hole was perforated on the top, we assumed it to be a "fire altar" of the late Sasanian period (see Section 5.1.3). The hole measures ca. 45 cm in diameter and ca. 25 cm in depth.

**3) Old Canal near the Sacred Precinct**

Near the Sacred Precinct, which lies ca. 1.4 km northwest of the Pasargadae palace complex, an old canal with stone covered side walls was observed (Fig.11.24). Since the new canal was recently built just next to the old one, the walls of the old canal were revealed. The soil dug out by the new canal contained numerous stones which were probably derived from the old canal. Both old and new canals run in a north-south direction, but unfortunately the


Fig.11.24 Pasargadae Plain (1): North part of the Pasargadae site (after QuickBird satellite image taken on 16 August 2004).

new canal has heavily destroyed the old one (Pls.11.81-82). By examining satellite imagery, the old canal seems to run in a straight line in a northest-southwest direction (Fig.11.24). If this old canal was constructed during the Achaemenid, it provides other evidence of a canal system to systematically develop the Pasargadae Plain.

## 6. Discussion

### 6.1. Relationship between the Transhumance Route and the Distribution of Archaeological Remains

As mentioned in Section 4, the transhumance routes of the modern nomadic pastoralists seem to locate mainly in the Bolaghi Valley which leads to the Pasargadae Plain. Neverthless, there are tribes who use Tang-e Khorkhore which lies to the west of Bolâghî Bozorg. The presence of abundant cemteries and camp sites at the northwest of Bolâghî Bozorg indicates the importance of this route. Keeping such movement of pastoral nomads in mind, a following hypothesis for the relationship between the transhumance routes and the distribution of archaeological remains in the Bolaghi Valley is given.

According to the locals, the modern nomadic pastoralists who enter Bolâghî Bozorg through Bolâghî Kûchak in the spring, move either towards the west along the southwestrn foot of the mountains or to the north and then to the west along the northern foot of the mountains. The latter route leads to Tang-e Khorkhore, then to Toll-e Qorbângolî and Dasht-e Nane'arabî. Obviously the reserve route was taken in autumn. Such transhumance routes must have been in use for a long period of time which is supported by the presence of Bakun period remains (e.g. TB 91) as well as the large settlements (TB 92) and surrounding cemeteries in the north-central area of Bolâghî Bozorg.

Probably just before the Achaemenid period, the east route which traversed the Bolaghi Valley from Bolâghî Kûchak to Tang-e Bolâghî gradually became important. The importance of the route was dramatically increased during the Achaemenid period due to the construction of the "royal road" which connects Pasargadae and Persepolis. Along with the road, a canal system was introduced to systematically deliver water into Tang-e Bolâghî.

After the collapse of the Achaemenid Empire, i.e. during the post-Achaemenid or Parthian-Sasanian periods, the "royal road" presumably lost its importance and was abandoned. This is supported by the presence of cairns which were constructed directly on the road structures or by dismantling the stones from the road structures. The abandonment of the "royal road" probably led to the revival of the above west route as the main traverse route of the Bolaghi Valley.

Although the main route shifted to the west, the route which passed through Tang-e Bolâghî probably continued to be used by nomadic pastoralists. This is evidenced by the presence of camp sites, cairns, and cemeteries in Tang-e Bolâghî.

The west route as the main route in the Bolaghi Valley must have continued in use to the present through the Islamic period. An Islamic cemetery at the north-central area of Bolâghî Bozorg, which was in use until quite recent times, and an Islamic period settlement (TB 89) provides evidence of this.

### 6.2. Road system of the Bolaghi Valley and the Pasargadae Plain

The road structures found in the Bolaghi Valley and around the Pasargadae Plain indicate the careful and systematic exploitation of the area (Fig.11.35). If these structures were dated to the Achaemenid period, the road system in the Bolaghi Valley can be assumed to be part of the "royal road" which must have been established and maintained by the Achaemenid Empire. Unfortunately there is no clear textual evidence which shows the itinerary between Pasargadae and Persepolis, if we carefully surveyed the foothills of the mountains between the two areas the remains of a road structure should be located.

The importance of the road connecting Pasargadae and Persepolis can be referred to some extent by the description of Plutarch. He noted that after Darius I, the Achaemenid

kings were inaugurated at Pasargadae (*Lives*, *Life of king Artaxerxes*, § 3.1). Although this may not reflect historical facts, it at least indicates the importance of Pasargadae as the first capital of the Empire.

The road system was arranged to not only pass through the Bolaghi Valley, but probably also used by royal families for their recreation. The site of TB 34 which revealed a small but royal camp site and a possible "royal hunting ground" indicate that the road was maintained to access these places.

On the other hand, the road was considered an important factor in the defence system (see below). The road seems to have many barrier stations and related structures such as stone linings perpendicular to the road structure. Controlling the movement of goods and people including nomadic pastoralists brought security eventually to the Pasargadae Plain.

Although the road system in the Pasargadae Plain was not surveyed in detail, the presence of road in Toll-e Gholâm suggests that a similar road system was also available to the north of Pasargadae. Since the road found here is also located along important transhumance routes like the ones in the Bolaghi Valley, it can be assumed that the "royal roads" were principally constructed along the major transhumance routes. Thus, the important way stations or barrier stations during the Achaemenid period were probably constructed around or on top of the camp sites of nomadic pastoralists as we saw the long-term use of camp sites from the prehistoric period to the Achaemenid or Islamic periods elsewhere in Toll-e Gholâm and Bolaghi Valley.

Finally, comparing the "royal roads" reported in other areas of north Fars, the scale of the road seems to have been much larger. The "royal road" located in the Persepolis Plain, for example, had a width of ca. 5-7 m and was paved with cobble stones or made of rock-cut passages (Sumner 1986: 17). Although the dating of such roads should be re-examined with fresh evidence (cf. Boucharlat 2003: 264), the difference in scale seems to be probably related to the location and the importance of the road. Probably the Persepolis Plain became much more important for transportation, especially with the Susa area to the west the roads were probably constructed in large scale. The road system which runs in the Bolaghi Valley and in the north of Pasargadae Plain was fundamentally based on transhumance routes and probably not so important for the Empire compared to the road system in the Persepolis Plain, particularly after the Empire's capital moved there.

### 6.3. Water Management System of the Bolaghi Valley and the Pasargadae Plain

During the survey, we were able to collect information related to water management in the Bolaghi Valley and the Pasargadae Plain based on interviews with local informants, observation of satellite images, and brief visits to the locations. Although it requires more detailed study by specialists in hydrology, hydrogeology, and hydraulic engineering, we shall provide preliminary consideration of the survey results in brief.

In addition, during these few decades, the Pasargadae Plain seems to alter rapidly due to expanding cultivation fields, and the development of infrastructure including the construction of roads and railways. Thus, the study of the past water management system should utilise the past satellite images and aerial photographs as much as possible. Since the structures related to water management, such as canals, dams, and canals are due to its large scale often over looked by archaeological investigation and may rapidly be destroyed by local development. Thus, future study of the water management system around the Pasargadae Plain requires a preservation scheme along with archaeological investigation.

The water management system of the Bolaghi Valley and the Pasargadae Plain largely consists of canals and dams (Fig.11.35). Due to its scale and construction, it is most likely that the remains are dated to the Achaemenid period, though additional evidence is required to evaluate the dating.

We shall list below the major remains which are important for the water management system in the surveyed area.

**1) Canal System in Tang-e Bolâghî**

A well-developed canal system is located in Tang-e Bolâghî on the east bank of the Sivand. The canal collects water from the spring of Cheshme-ye Darre-ye Sorkh located outside Tang-e Bolâghî. The canal is probably related to watering the site of TB 34 and possibly to the "royal hunting ground".

**2) Dams and Canal in Bolâghî Kûchak**

Two dams are located near the Siavnd dam. One is Sadd-e Sabz'alî and the other is Sadd-e Bolâghî. The Canal of Jûb-e Rahmatâbâd was probably connected to the above two dams and ran along the foothills of the mountain to the east of Bolâghî Kûchak.

**3) Irrigation Canals in the Pasargade Plain**

During the Achaemenid period, irrigation water of the Pasargadae Plain was probably taken from the upper stream of the Sivand and numerous canals constructed in the plain must have delivered water to the cultivated fields. One of them is the old canal identified near the Sacred Precinct by the modern canal construction (see Appendix 1). In addition, some stream channels around the plain which have unsually straight channel lines can be assumed to be the old canals.

**4) Canal to the North of Pasargadae Plain**

In Toll-e Gholâm, a canal runs along the foothills of the mountains to the east and south. The water source of the canal is unknown, but probably located further north. Although we did not identify the related canal in the plain area, the above canal must have provided water to the west part of the Pasargadae Plain.

**5) Canal and Dam in the Southwest of Pasargadae Plain**

In the southwest of the Pasargadae Plain, just to the north of Tang-e Sa'âdatshahr, the large canal of Jû-ye Dokhtar is located in the foothills of the mountains (see Appendix 7). The canal is probably connected to the earthen dam of Sadd-e of Jû-ye Dokhtar (see Appendix 7). From the dam, another canal of Jû-ye Tang-e Sa'âdatshahr (see Appendix 7) extends to the south towards the district of Sa'âdatshahr where the town of Sa'âdatshahr is now located.

Although above mentioned dam and canals around Tang-e Sa'âdatshahr were used to irrigate the Pasargadae Plain, they were probably more important for irrigating the district of Sa'âdatshahr. This is because, the southwest part of Sa'âdatshahr plain can be irrigated by the Sivand which passes through the Bolaghi Valley, but the northeast part is poor in water sources. Therefore, construction of canal form a dam extending to the south was necessary to irrigate the northeast part of Sa'âdatshahr plain with the water of Sivand. It is possible that the Achaemenid Empire which successfully irrigated and expanded the cultivation fields in the Pasargadae Plain aimed next to develop the fields in the Sa'âdatshahr plain. For this reason, it was necessary to set up a water management system around Tang-e Sa'âdatshahr.

After successfully irrigating the northeastern part of Sa'âdatshahr plain, the Empire not only expanded the fields to the south but by obtaining new water resources, reinforced the direct control of one of the important southern gateways to the Pasargadae Plain.

Furthermore, such successful irrigation of the area around Tang-e Sa'âdatshahr must have increased the importance of the transhumance route. Originally the area around Tang-e

Sa'âdatshahr has been located along at one of the important transhumance routes which pass through the Pasargadae Plain. However scarcity in water sources must have made it difficult for the majority of nomadic pastoralists to pass through. Once the irrigation scheme was completed, probably the route became more suitable for nomadic pastoralists to pass and thus the importance of the transhumance route was enhanced. It can be assumed that controlling such a route was also beneficial for the Empire both economically and militarily.

If all the above series of remains can be certainly dated to the Achaemenid period, then the water management system of the Bolaghi Valley and the Pasargadae Plain was carefully planned and maintained by the Empire to give maximum benefit from the fruitful water sources in the surveyed area as the water management system around Tang-e Sa'âdatshahr indicates.

In addition, W. Kleiss has reported several irrigation works and dams to the northeast of the Pasargadae Plain around Dîdgan and Qâderâbâd (Kleiss 1987:99-101; 1988a; 1998b; 1992) His survey informs us that abundant dams and irrigation works are located ca. 10-15 km northeast of Pasargadae Plain, which was constructed on the tributaries of the Sivand (see Kleiss 1992: Abb. 1 and 7b). Moreover, two dams were reported further to the north from Toll-e Gholâm (Kleiss 1988a: 25-27, Abb. 4-5; 1992: 134-136, Abb. 6-7, Taf. 32.3 and 33.1). The evidence provides another example for the well-organized water management system around the Pasargadae Plain.

### 6.4. Defence System of the Bolaghi Valley and the Pasargadae Plain

The defence system probably dated to the Achaemenid period was found in a wide geographical area including the Bolaghi Valley and the Pasargadae Plain. The main components of the defence system were 1) defence walls and watchtowers, and 2) roads with sidewalls and related structures (Fig.11.35).

#### 6.4.1. Defence Wall and Watchtowers

The stone linings which can be considered as defence walls were identified not only on the ridges of mountains or hills which surround the Bolaghi Valley and Pasargadae Plain, but also as far as the plain of Dasht-e Nane'arabî, which is located ca. 30 km west of Pasargadae. Defence walls were identified in the following areas (Fig.11.35):

(a) On the ridge of the hills to the northeast of the Pasargadae Plain (see Appendix 6),
(b) On the ridge of the mountains to the east of Tang-e Sa'âdatshahr (see Appendix 7-4),
(c) In the Kûh-e Domdariyâ mountain to the southeast of Pasardage Plain,
(d) On the ridge of a mountain to east of the northern entrance of Tang-e Bolâghî,
(e) On the ridge of the mountain to the west of Bolâghî Kûchak,
(f) In the Dasht-e Nane'arabî plain to the northwest of Pasargadae Plain (see Appendix 8), and
(g) In the valley of Tang-e Khorkhore, to the east of Cheshme-ye Khorkhore (see Appendix 8. This wall may be the same group of walls as mentioned in f).

The watchtowers were found on a hill in the Âushenâsûn basin, and on a cliff in the northwest of Bolâghî Kûchak.

In addition there is local information that similar defence walls are located in Gardan-e Panîrân, and in Râh-e Shîrî to the southeast and the south of Pasargadae Plain, respectively (see Appendix 5).

The defence walls are constructed at strategic points along the transhumance routes (a and e), or at points in the mountains where approach is relatively easy (b to d). Defence walls of (f) and (g) are constructed at a location which divides the summer pasture of Dasht-e

Nane'arabî and the area to the west of Pasargadae Plain from Bolaghi Valley and Pasargadae Plain. The defence wall of (e) is accompanied by a watchtower.

It is apparent that the above mentioned defence walls were constructed to protect the Pasargadae Plain. The large-scale of defence walls and their strategic distribution must have been not only symbolized the powerful imperial authority of the Achaemenid Empire, but also had an important military function to prevent advance of enemies and control the movement of nomadic pastoralists. In other words, the movement of people which included the transhumance of nomadic pastoralists was a crucial factor for maintaining economic, political and social infrastructures of the Empire.

### 6.4.2. Roads with Sidewalls and related Structures

The roads with the sidewalls, stone linings perpendicular to the road structure, and buildings adjacent to the road (probably barrier points) were identified in Bolâghî Bozorg, Bolâghî Kûchak and in the northern part of Âushenâsûn.

The roads with sidewalls are identified in the Bolaghi Valley as well as to the north of Toll-e Gholâm. At various points along the roads, the stone linings perpendicular to the road structure and some building structures adjacent to the road were observed. In addition, as we saw in Âushenâsûn, a watchtower was constructed on the hill overlooking the road structure.

These roads with sidewalls probably not only functioned as the so-called "royal road" during the Achaemenid period, but also played a crucial role for nomadic pastoralists and other travellers (e.g merchants, messengers, and tribute bearers). The stone linings perpendicular to the road and building structures adjacent to the road probably functioned as facilities to control the movement of people along the road.

### 6.4.3. Strategic Importance of the Bolaghi Valley

Not only the above mentioned defence walls and watch towers are distributed in the Bolaghi Valley but also the roads with sidewalls. In addition, at the western end of Tang-e Khorkhore, a large defence wall crossing the Dasht-e Nane'arabî plain is located. It is obvious that the Bolaghi Valley was on the "royal road" connecting Pasargadae and Persepolis, and located at the strategic point for the protection of the Pasargadae Plain. Also important royal structures, including the site TB 34 and the "royal hunting ground" (see above) was located in the Bolaghi Valley. Moreover, the Bolaghi Valley was utilized by many nomadic pastoralists who moved between the summer and winter pastures. Therefore, it is crucial to protect and control the Bolaghi Valley for the Achaemenids in Pasargadae. The highly developed defence system in the Bolaghi Valley and its vicinity apparently shows the strategic importance of the Bolaghi Valley.

## 7. Conclusion

The survey has confirmed that the Bolaghi Valley has been an important transhumance route for nomadic pastoralists since ancient times. The importance of the routes within the valley may have shifted from period to period. Nevertheless similar routes were used for a long period of time which was evidenced by the distribution of camp sites, cairns, and cemeteries. Similar types of archaeological remains were observed also in the northern part of the Pasargadae Plain, and some of them have been used from the prehistoric to the Islamic periods. Thus, the tranhumance routes in the Bolaghi Valley and Persepolis Plain have been the main pipeline for human activities in the region.

Although Alizadeh (2003) and others (e.g. Sumner 1986: 30-31; Boucharlat 2003: 264-265) have emphasised the important role of nomadic pastoralists in archaeological research

in Fars, the focus of archaeologists had been largely fixed on settlement sites, especially artificial mounds (*tappe*). Although it is normally difficult to identify the past remains of nomadic pastoralists, we have to challenge them to understand and interpret the unique history of Fars. In our survey, we placed emphasis on surveying the foothills of small valleys where remains of camp sites and cemeteries are most likely to be found. Although the dating of these remains is a large issue, we hope that our non-site (here meaning non-*tappe*) approach has proven it can collect much information concerning the past transhumance movement.

Concerning the Achaemenid period remains, we have shown that road, water management, and defence systems are strongly related to the transhumance movement of nomadic pastoralists. Although there were other categories of people, such as merchants and travellers moving along the routes or roads constructed by the Empire, it seems that controlling the seasonal movement of nomadic pastoralists was much more cruciall to maintain the sovergnity of the Achaemenids. Thus, probably vast amounts of labour and budget were devoted to contruct those systems. We hope that future investigation of the establishment and development of such systems will shed new light on the emergence of the Achaemenid Empire in Pasargadae.

In addition, imperial exploitation of the Bolaghi Valley and Pasargadae Plain shows an example of how imperial power can exploit the vicinity of a capital city. The evidence collected from the Bolaghi Valley and Pasargadae Plain suggests that probably soon after the Empire was established the systematic and extensive development of the vicinity of the capital city started. Further study in the vicinity of Pasargadae Plain including the Bolaghi Valley will, we hope, provide not only a model of imperial exploitation of the capital city, but also the development of imperial structure in southern Iran.

## 8. Appendices

The following are additional results we collected during our survey. The majority of these are simply derived form brief visits to the locations. Thus, the information is limited and should be re-examined or re-evaluated in the future.

### Appendix 1: Vicinity of the Pasargadae Palace Complex and the Do Tollûn Area

We made a brief visit around the palace complex of the Pasargadae site and its vicinity including the Do Tollûn area along the Sivand River. This visit was intended to confirm the site distribution of Pasargadae published as Fig. 3 of Stronach 1978 (hereafter mentioned as the Stronach report).

**1) Artificial Mounds and Distribution of Artifacts**

We visited a hill which is located to the south of 'Abôlvardî village. The Stronach report mentions that there is a scatter of Achaemenid period potsherds. Nevertheless, due to heavy constraints of modern houses, it was not possible to investigate the surface scatter of potsherds. The hill itself is a natural mound and does not contain archaeological remains.

Next, we observed the Sacred Precinct of Pasargadae. The south altar was recently destroyed partly by treasure seeking looters (Pl.11.83). To the northwest of the two altars, the Stronach report mentions a prehistoric mound. However, our investigation revealed that it was dated to the Achaemenid period or later. In addition, several small artificial mounds were located around the above mound (Fig.11.24; Pl.11.84). The surface collections from these mounds all include Achaemenid period potsherds. In one mound, a scatter of Bakun type painted wares was observed. These mounds are now in danger of destruction by

cultivation progressing in the surrounding area.

To the east of the Pahlavi inscribed rock (see below), on the west bank of the Sivand, a mound which is mentioned by the Stronach report (Stronach 1978: Fig. 3) as a prehistoric mound is located (Fig.11.24). The site is locally known as Tall-e Se Asiyâb[8]. On the surface of the mound, potsherds of the Bakun/Lapui periods along with the Achaemenid period sherds are scattered. Thus, the mound was also occupied during the Achaemenid period.

On the east bank of the Sivand, to the southeast of the Pasargadae palace complex, two mounds called Do Tollûn (Do Tallûn) are located (Fig.11.25; Pl.11.85). The larger east mound (Do Tollun A) has been examined by Sir M. Aurel Stein (1936). We observed the potsherds of the Bakun/Lapui periods as well as those of the Achaemenid period. At the smaller west mound (Do Tollun B), abundant Islamic earthen and glazed wares were observed. The main occupation of this mound seems to be during the Islamic period.

Around 300 m to the southeast of Do Tollûn, two low mounds were identified by examining the satellite image (Fig.11.25). On the north mound (ca. 50 m in diameter) abundant Islamic earthen and glazed wares were observed. On the south mound (ca. 40 m in diameter), potsherds belonging to the Achaemenid and post-Achaemenid periods were observed together with some worked stone fragments. Several looting holes were also found on the mound (Pl.11.86).

**2) Sasaninan "Fire Bowl" on Mound B of Pasargadae**

According to the Stronach report, a Sasanian "fire bowl" is located on Mound B of Pasargadae. When we reexamined the location, the structure, which we believe to be the one identified by Stronach, was located further the northeast of the place mentioned in the report (Fig.11.24; Pl.11.87). On the mound which the structure is located, numerous natural rocks were exposed on the surface and a cluster of stones which can be assumed to be graves were observed. Currently Mound B is in the fenced area together with the palace complex.

**3) Pahlavi Inscribed Rock and a Sasanian "Fire Bowl"**

According to the Stronach report, on the foot of the northeast hill of Pasargadae, several Pahlavi inscriptions were engraved on the rock surface and four "fire bowls" were located around the inscribed rock (Stronach 1978: 163-65, Pls. 137-40).

Our visit to the site showed that the inscribed rock is now located ca. 1 m from the modern canal and one set of inscription (Inscriptions A-C) was found more worn than the photograph published in the Stronach report (Pl.11.88). The area of the inscribed rock is now outside of the fenced area of Pasargadae and the possibility of destruction is relatively high at the moment.

Around 1.5 m north of the inscribed rock, a "fire bowl" engraved on the rock was identified (Pl.11.89). This structure was apparently one of the four "fire bowls" mentioned in the Stronach report (Stronach 1978: Pl. 137). Unfortunately it was not possible to identify other three during our visit. A scatter of potsherds was observed around the inscribed rock and the "fire bowl", suggesting that the surrounding area of these remains can be identified as a site.

## Appendix 2: Sadd-e Domdariyâ Causeway-Dam

To the southwest of the Pasargadae Plain, in the place called domdariyâ (edge of a lake or marshland) by the locals, a dam called Sadd-e Domdariyâ is located (Figs.11.25-28; Pl.11.90). It is an earthen dam covered by stones and measures ca. 10-15 m in width. The dam extends in straight line in a north-south direction. The earthen structure of Sadd-e Domdariyâ extends from Toll-e Domdariyâ, which is located at the southwestern end of domdariyâ, and the northern entrance of Râh-e Shîrî, which is the old route connecting

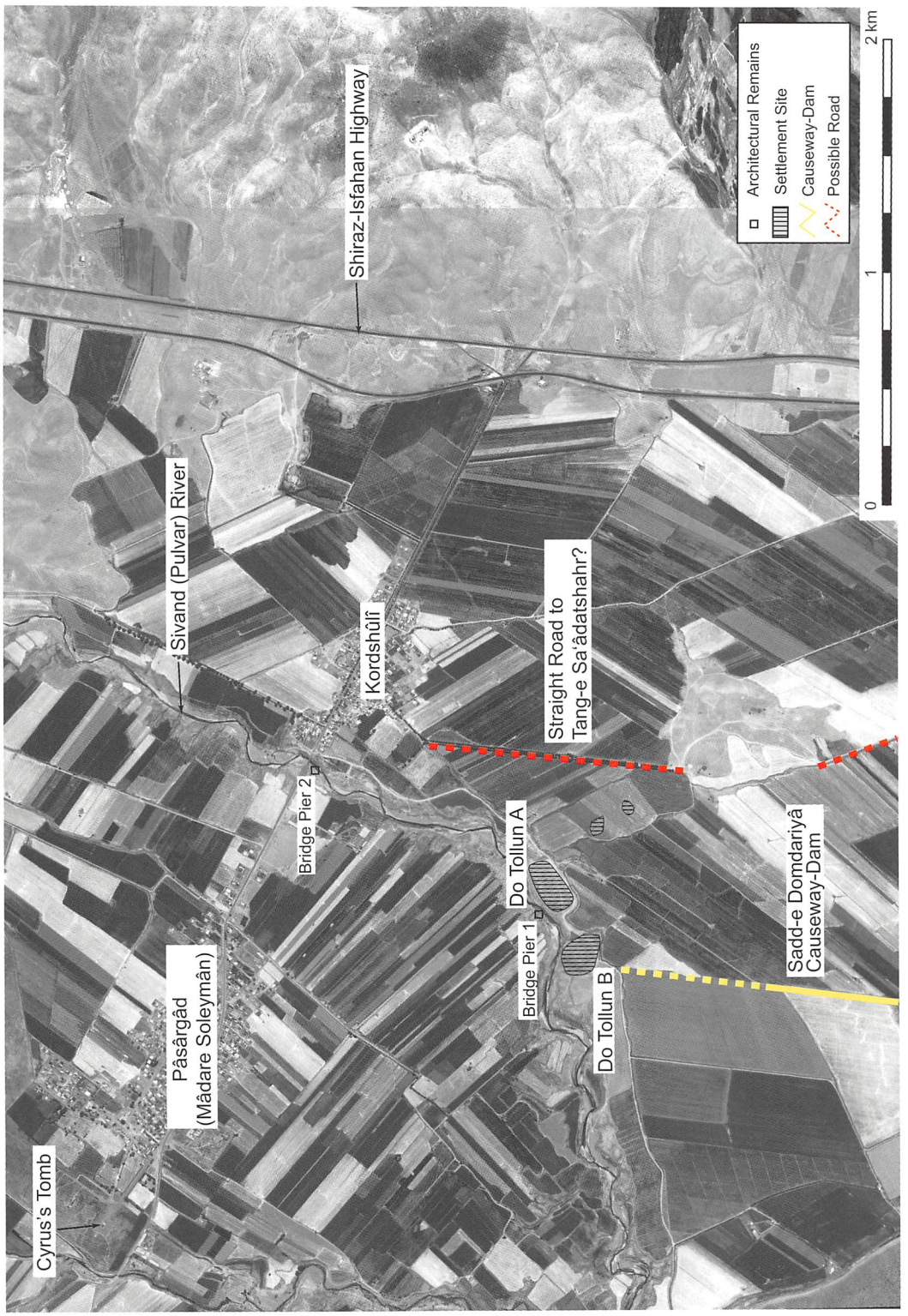


Fig.11.25 Pasargadae Plain (2): Central part of the plain (after QuickBird satellite image taken on 16 August 2004).

Pasargadae and Sa'âdatshahr, to the north at ca. 1.9 km (Fig.11.28).

Although the northern end of Sadd-e Domdariyâ is buried under the present soil surface, according to the locals, this earthen structure extends to the west mound of Do Tollûn (Do Tollun B) (Fig.11.26). If this is correct the total length of the structure is ca. 2.6 km.

The locals informed us that this earthen structure is called "sadd" ("dam" in Persian)


Fig.11.26 Pasargadae plain (3): Sadd-e Domdariyâ Causeway-Dam (Appendix 2), the road from Kordshûlî to Tang-e Sa'âdatshahr (Appendix 4), and the Northeast defence wall (Appendix 6) (after QuickBird satellite image taken on 16 August 2004).


Fig.11.27 Pasargadae Plain (4): The causeway-dam and camp sites along the foot of mountains to the southwest of Pasargadae Plain (after QuickBird satellite image taken on 16 August 2004).

and prevents the water, which accumulated in the domdariyâ area after the heavy rain, to flood the land to the west of domdariyâ. In fact the area of domdariyâ is said to be like a marshland before the drainage channel (fa. zehkesh) was constructed at the foothills of the mountain to the west of domdariyâ. It is possible that such a situation has left a local legend concerning Sadd-e Domdariyâ.

However, considering that Râh-e Shîrî was the old route connecting Pasargadae Plain and the Sa'âdatshahr area, the earthen structure probably not only functioned as a dam but was also used as a causeway connecting the northern entrance of Râh-e Shîrî and the central part of Pasargadae (at least to the south bank of the Sivand). Since it had to build a straight passage crossing the marshland of domdariyâ, the causeway had to be levelled by soil and covered by stones.

At the moment, no evidence is available to date the earthen structure. However, comparing it with other monumental structures, the structure can be considered to belong to the Achaemenid period.

If this is a causeway-dam, we have to consider the crossing point of the Sivand from the south to the north bank. Although no clear evidence is available, two remains of bridge piers were recorded along the Sivand (see Appendix 3), such locations can be possible locations

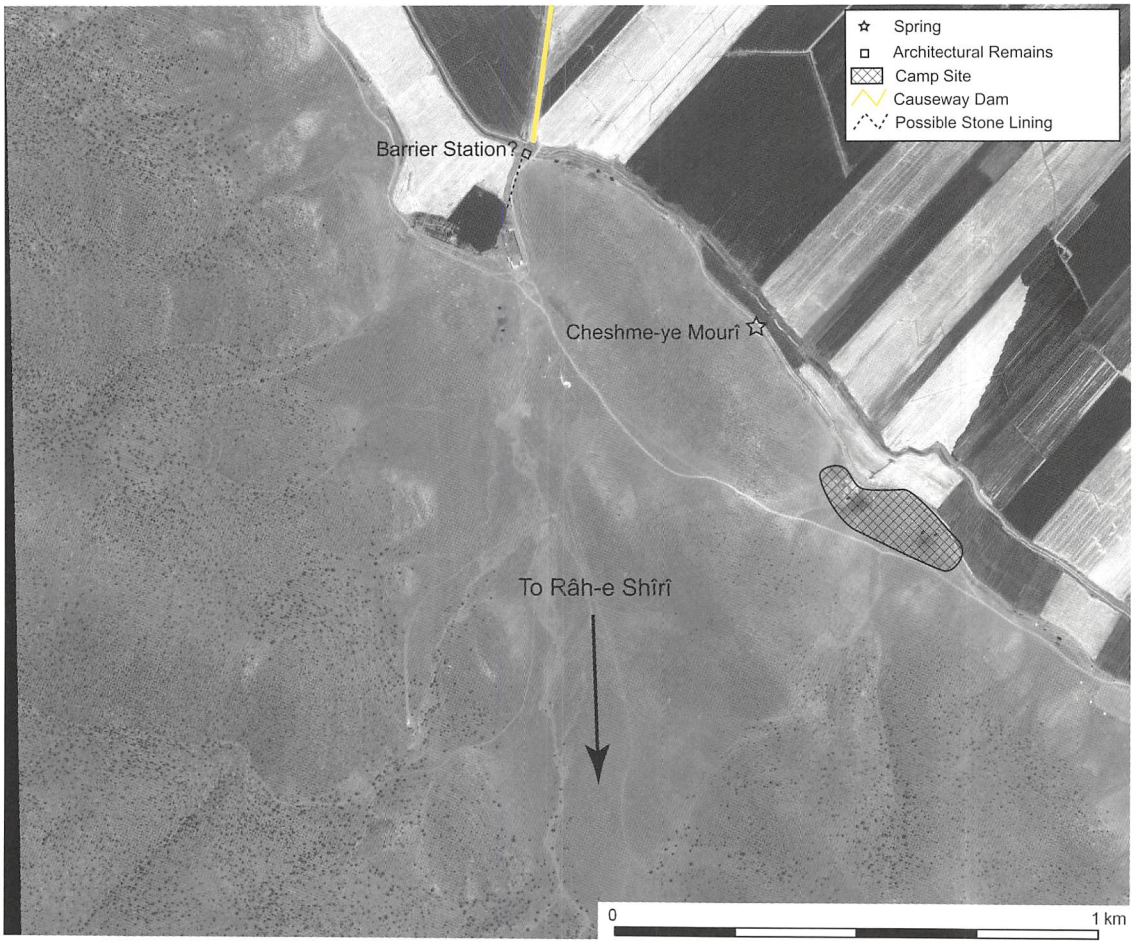


Fig.11.28 Pasargadae Plain (5): The southern end of the causeway-dam (after QuickBird satellite image taken on 16 August 2004).

for a crossing point.

## Appendix 3: Bridge Piers along the Sivand

### 1) Bridge Pier 1

The trace of a bridge pier is located to the north of the east mound of Do Tollûn (Do Tollun A) (Fig.11.25; Pl.11.91). It is constructed of human-head sized stones and mortar. Some fragments of baked bricks were also used. Due to heavy destruction, estimation of its structural form was difficult. The construction method suggests a date of the Archaemenid period or later.

### 2) Bridge Pier 2

The second bridge pier is located just to the south of present bridge which connects the villages of Kordshûlî and Pâsârgâd (Fig.11.25; Pl.11.92). According to the locals, recent flooding has revealed the bridge pier which consists of two piers: on in the middle of the river and the other on the west bank.

The bridge pier was made of white dressed limestone blocks and no traces of mortar were observed. Based on the one pier left in the middle of the river, the shape seems to be an ellipse in cross-section. The dating of the bridge pier is not certain. Nevertheless, considering the use of dressed limestone blocks and absence of mortar, there is a possibility that the structure is dated to the Achaemenid period.

### Appendix 4: Road from Kordshûlî to Tang-e Sa'âdatshahr

A straight road extending between the village of Kordshûlî to the Tang-e Sa'âdatshahr was recorded (Figs.11.25-26; Pl.11.93). The road starts from the south of Kordshûlî and reaches a low hill. Then the road emerged from the west of the low hill and heads to the south-south-east straight towards Tang-e Sa'âdatshahr. The southern end has been destroyed by the modern cultivation and the new Shiraz-Isfahan highway. According to the locals, the road continues to a checkpoint (fa. toroqkhâne) which was destroyed by the newly built highway. It is said that the road was the main route connecting the Pasargadae Plain and Sa'âdatshahr. The date of the road is unknown at the moment.

### Appendix 5: Defence Wall on the Mountain to the Southwest of the Pasargadae Plain

A defence wall was found on the ridge of the mountain (Reshte-ye Kûh-e Kûchakak) to the southwest of Pasargadae (Fig.11.30; Pl.11.94). The wall is on the northern side of the ridge and is constructed of natural stones. Based on the observation of the wall at a small valley where the wall crosses over the valley (N 30° 07′ 21"; E 53° 11′ 02"), the wall measures ca. 2-2.5 m in width. Although it was not possible during the survey to identify the whole length of the defence wall, it is possibly located between Tang-e Sa'âdatshahr and Râh-e Shîrî. In addition, the eastern end of the wall may connect to the defence wall observed to the east of Tang-e Sa'âdatshahr.

### Appendix 6: Defence Wall on the Mountains to the Northeast of the Pasargadae Plain

To the northeast of the Pasargadae Plain and to the east of the new Shiraz-Isfahan highway, a defence wall (ca. 1.6 km in length and ca. 7-8 m in width) is located on three hills: the first hill to the northwest, the second hill to the southeast, and the third hill to the south (Fig.11.29; Pl.11.95). The hills are just to the east of the Sivand River. The stone lining of the defence wall starts from the western foothill of the first and continues to the northeast up to the summit. From the summit, the wall extends to the southeast towards the second hill. Then passing two shallow valleys which lie between the first and the second hills, and the second and the third hill, the wall reaches the northeastern foothill of the third hill. The wall climbs the ridge of the third hill towards southwest and seems to disappear just over the summit. The entire shape of the defence wall has an elongated U-shape with the southwestern part lacking. Considering the location and its shape, the wall must have been part of the defence system protecting the northeast part of the Pasargadae Plain.

In addition, abundant cairns were located along the above or in the vicinity of the defence wall. This indicates that the cairns were built after the wall was abandoned and stones which constructed the wall were used to build cairns.

### Appendix 7: Sites around Tang-e Sa'âdatshahr

**1) Sadd-e Jû-ye Dokhtar Dam**

An earthen structure which extends in straight line ca. 450 m (northwest to southeast) with ca. 15 m in width is located to the southeast of Pasargadae Plain and to the north of the northern entrance of Tang-e Sa'âdatshahr (Fig.11.30-31). The structure was heavily damaged by the Shiraz-Isfahan highway to the west and the southeastern end disappears before reaching the mountain located to the east of Tang-e Sa'âdatshahr. The structure has been widely known to the locals for some time, but its characteristic, function, and date have been unknown.

The earthen structure is made of hard-beaten light brown soil which does not contain large stones or gravel (Pl.11.96-97). The northeastern face of the structure is covered by human-head sized stones. Considering the construction method and its location, as well as

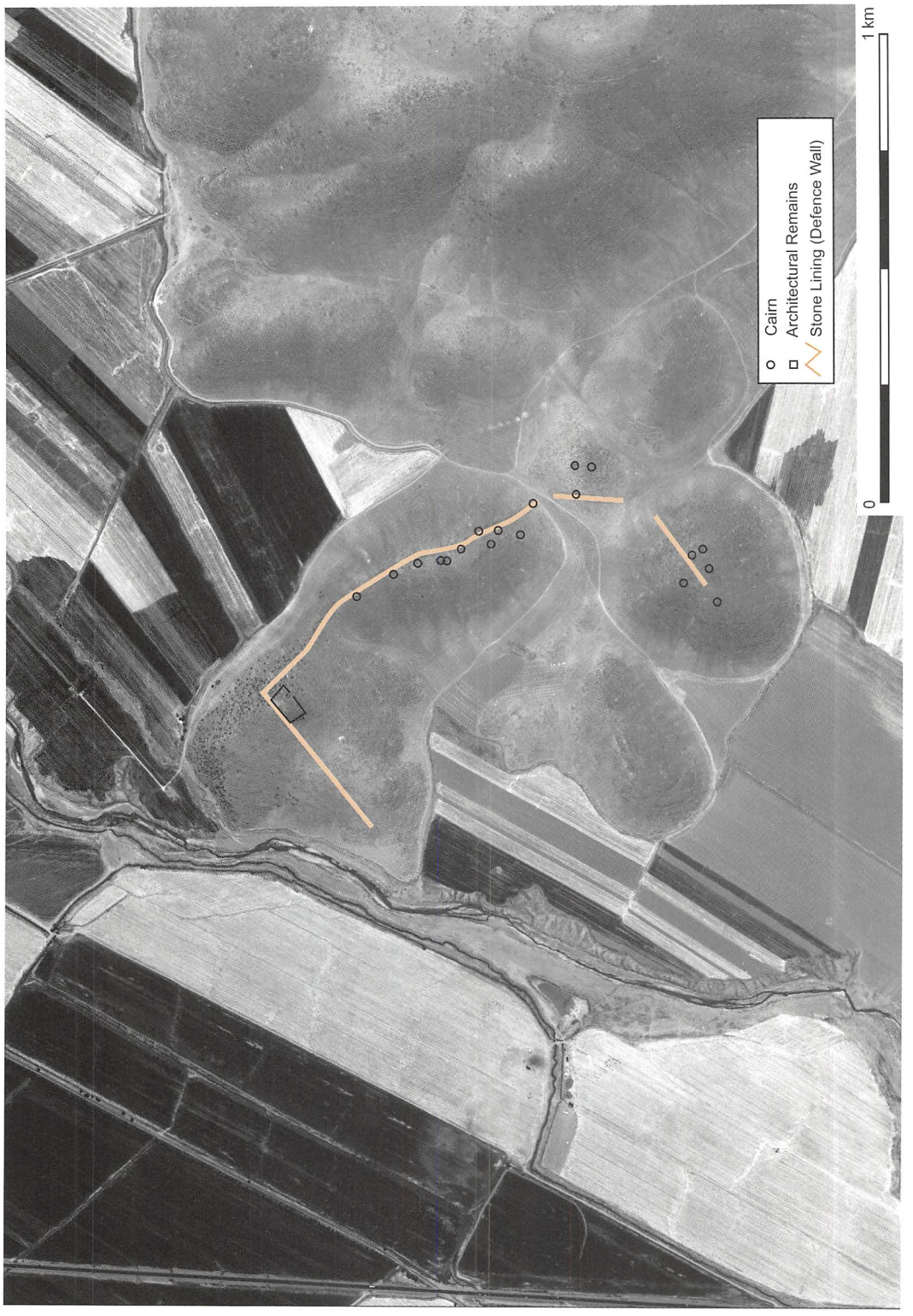


Fig.11.29 Pasargadae Plain (6): The northeast defence wall of the Pasargadae Plain (after QuickBird satellite image taken on 16 August 2004).

the presence of a huge ditch of Sadd-e Jû-ye Dokhtar (see below) to the north, the earthen structure can be assumed to be an ancient dam.

We have observed a cairn, which can be dated to the Parthian-Sasanian period, located on the earthen structure, suggesting that the dam was dated earlier than the Parthian-Sasanian period. Since the dam is located in an important sector of Pasargadae Plain, an imperial

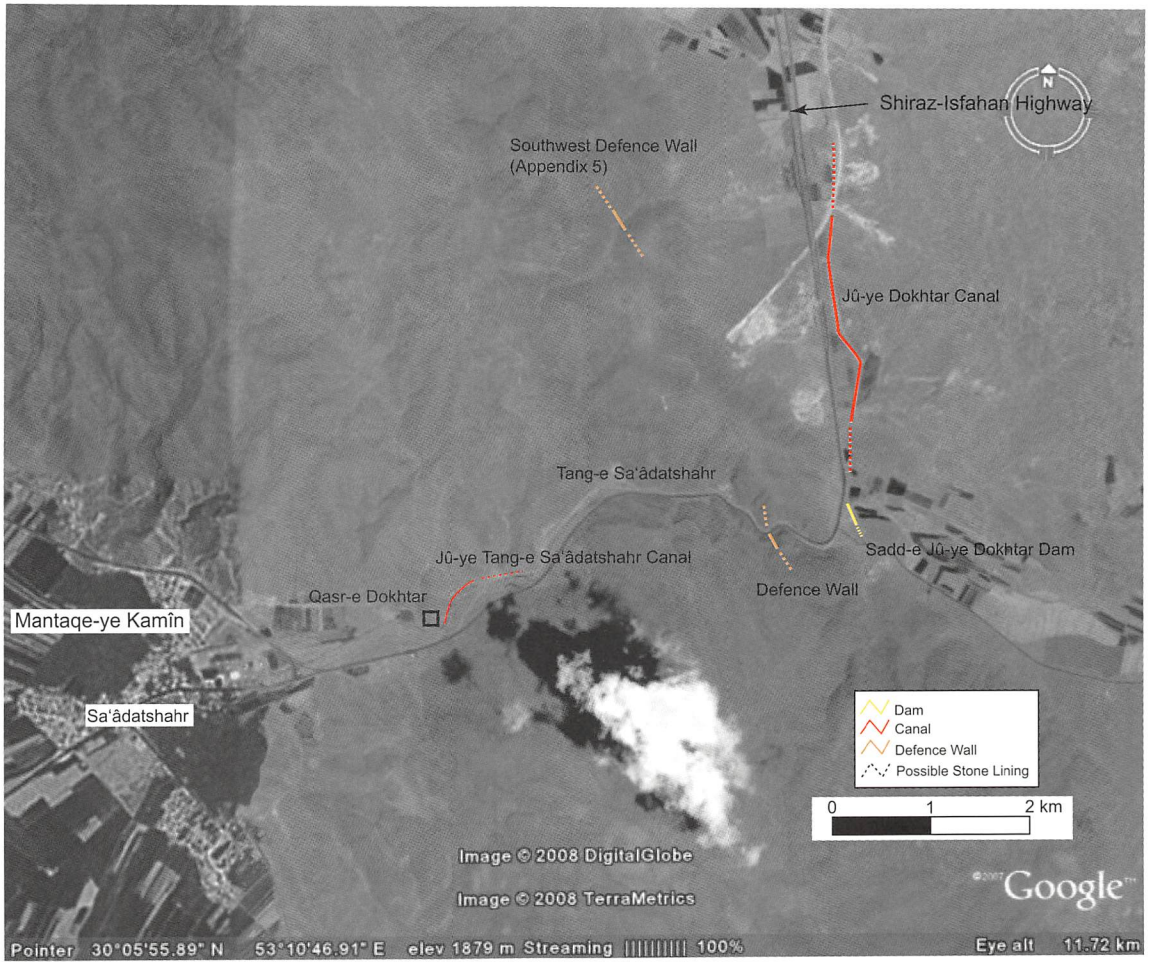


Fig.11.30 Surveyed archaeological remains in the southern end of the Pasargadae Plain and around Tang-e Sa'âdatshahr (after Google Earth 2007 ©).

capital of the Achaemenid period, we can assume that the dam was originally constructed in the Achaemenid period.

The soil of the dam is now rapidly removed by road and other construction works. If we do not conduct some preservation schemes for the structure, the dam may disappear in the near future.

The dam was previously reported by W. Kleiss (Kleiss 1982: 361-62, Abb. 1; 1988b: 65-66, Abb. 4) who surveyed the dams and related structures in the north of Pasargadae Plain. He surveyed the dam in 1973 and again in 1987 and mentioned that it had ca. 560 m in length, ca. 45 m in width and ca. 8 m in height (Kleiss 1982: 361-62, Abb. 1; 1988b: 65). He also considers the structure to be dated to the Achaemenid period.

**2) Jû-ye Dokhtar Canal**

A huge ditch is located ca. 1 km to the north of the above mentioned Sadd-e Jû-ye Dokhtar dam at the foothills of mountains to the east of the Pasargadae Plain, just to the east of Shiraz-Isfahan highway (Figs.11.30, 32; Pls.11.98-99). The ditch follows the contour line and continues meandering slightly to the north for ca. 2 km. Unfortunately, the northern end of the ditch is covered by the elevated land of the currently progressing Shiraz-Isfahan railway construction, and the southern end is damaged by the Shiraz-Isfahan highway At one point (N 30° 06′ 52"; E 53° 12′ 23"), the entire width is ca. 70-80 m with the ditch width of


Fig.11.31 Sadd-e Jû-ye Dokhtar Dam in the southern end of the Pasargadae Plain (after Google Earth 2007 ©).

ca. 40-45 m. The ditch is located in between an earthen rampart which measures ca. 5-6 m in height from the surrounding ground surface. The depth of the ditch is ca. 10 m from the top of earthen rampart. The ditch is now abandoned and not in use.

Considering the location to the above mentioned Sadd-e Jû-ye Dokhtar dam and the scale of the structure, the huge ditch is probably a large canal constructed during the Achaemenid period. This canal is probably part of a canal reported by D. Stronach (1978: 00). Stronach dated the canal to the Islamic period, but as for this large canal, it is more likely to have been built during the Achaemenid period.

Although we were not able to identify the water source of the canal, the water source must be located to the north of Pasargadae Plain and probably taking water also from the Sivand River.

Since the canal is not properly recorded as archaeological remains, if the construction work progresses in its vicinity, this important structure is in danger of disappearing.

**3) Jû-ye Tang-e Sa'âdatshahr Canal**

A canal is located on the foothills of the mountain to the west of the southern entrance of Tang-e Sa'âdatshahr (Fig.11.30). Unfortunately, a large portion of the canal has been destroyed by the road and railway construction. Observing a small remaining part of the canal, it was constructed by cutting the rocks on the mountain surface and extending to the south towards Sa'âdatshahr. A recently built stone wall covered with cement is located on the lower east side of the canal (Pl.11.100). The sluice gate of the canal was probably located around the Sadd-e Jû-ye Dokhtar dam. Although we do not have any clear evidence as to date the canal, if Sadd-e Jû-ye Dokhtar can be dated to the Achaemenid period, so does this canal probably connecting to the dam can be dated to the same period.

Since the destruction of the canal is still in progress due to the ongoing road and railway

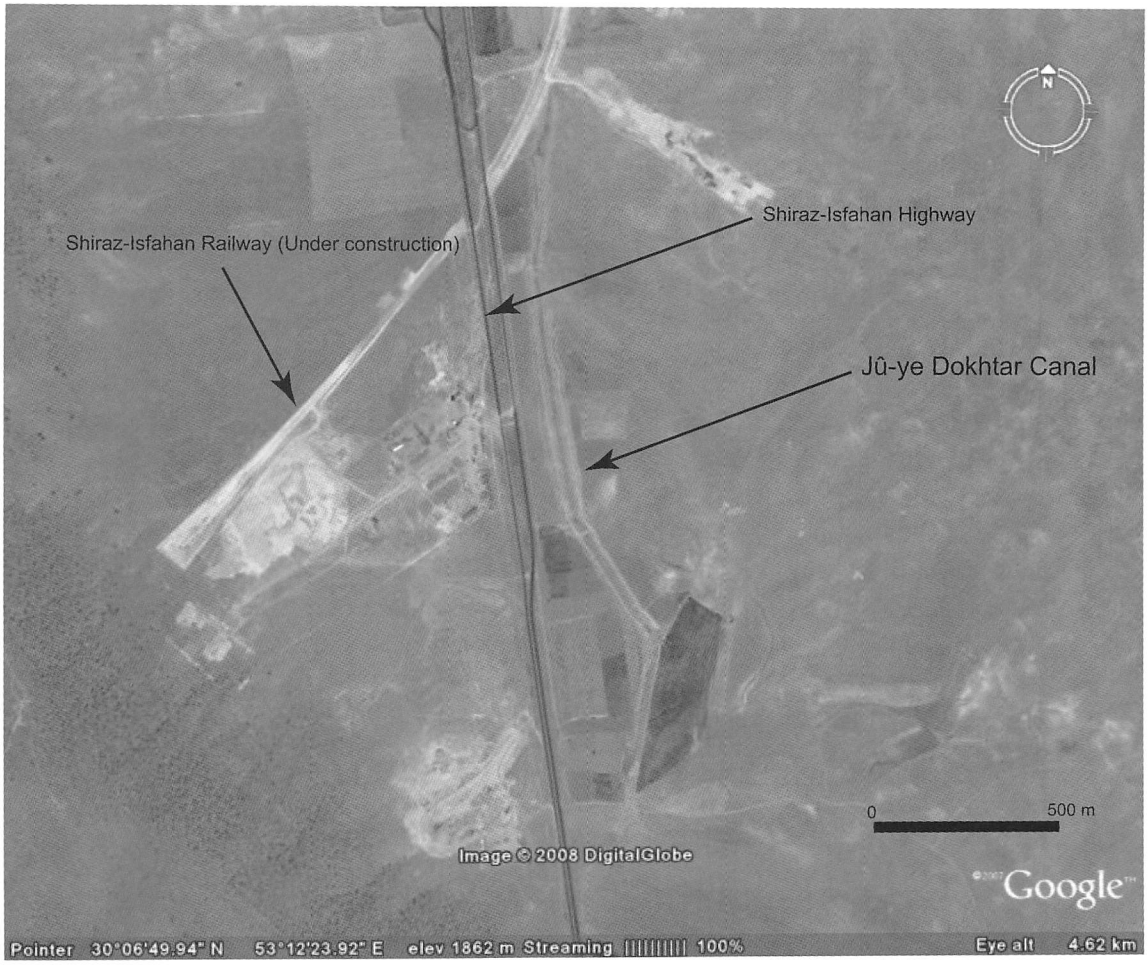


Fig.11.32 Jû-ye Dokhtar Canal in the southern end of the Pasargadae Plain (after Google Earth 2007 ©).

construction, an urgent preservation scheme should be applied.

At present, the water is supplied to the Sa'âdatshahr area from a well dug at the Sadd-e Jû-ye Dokhtar dam using qanat.

**4) Defence Wall**

A stone lining identified as a defence wall is located in the northern part of Tang-e Sa'âdatshahr, ca. 600 m from the northern entrance (Pls.11.101-102). The stone lining is on the ridge of a cliff extending to the east. Although we could not identify whether the wall continues to the west towards the Bolaghi Valley, this wall was probably part of the defence wall system surrounding the Pasargadae Plain.

**5) Qasr-e Dokhtar**

The site of Qasr-e Dokhtar (fort of girl) is located ca. 1.2 km to the southwest from the southern entrance of Tang-e Sa'âdatshahr (Fig.11.30; Pl.11.103). The site is just to the north of the Shiraz-Isfahan highway and is on a cliff extending to the southeast. Some structural remains were observed on the cliff. At the foot of the cliff, several house and animal pens are situated using the caves engraved into the cliff surface. These caves may have been used in the ancient times since on the southern slope below the cliff we observed potsherds probably dated to the Achaemenid period. Thus, it is highly possible that an ancient settlement may

have been located in Qasr-e Dokhtar.

Just to the northwest of Qasr-e Dokhtar, is the southern entrance of Râh-e Shîrî, which is the old route leading to the Pasargadae Plain. In addition, from Qasr-e Dokhtar, we can overlook the plain of Sa'âdatshahr as well as Tang-e Sa'âdatshahr. Considering the location of the site at such a strategic point, Qasr-e Dokhtar must have guarded the two routes leading to the Pasargadae Plain.

## Appendix 8: Transhumance Route of Nomadic Pastoralists from Mobârakâbâd to Cheshme-ye Khorkhore

On 26 February 2008, we made a short trip to the west from the Pasargadae Plain in order to investigate the transhumance routes of nomadic pastoralists who advance to the west from Pasargadae Plain as well as those move towards northwest from Bolâghî Bozorg through Tang-e Khorkhore. We headed west from the village of Mobârakâbâd and surveyed the route to reach the spring of Cheshme-ye Khorkhore (Pl.11.104). Since we followed the modern road, it was not possible to observe in detail at the foothills of mountains where the nomadic pastoralists form their camps. Following is a brief note of the trip.

First, the transhumance route from Mobârakâbâd to Cheshme-ye Khorkhore can be summarized as follows.

Mobârakâbâd→Châhbid→Châhtak→Gel-e Sarshûlî→Tomb-e Khersî→Tang-e Mârî / Cheshme-ye Mârî→Gardan-e Khersî→Cheshme-ye Khersî→Cheshme-ye Zamânbegî / Jûb-e Zamânbegî→Nane'arabî→Dasht-e Nane'arabî→Toll-e Qorbângolî→Cheshme-ye Khorkhore

*The underlined locations are described below.

The following are the brief notes of what we encountered during the trip. It is divided into several points on the transhumance route.

### 1) Châhbid and Châhtak

These places are located on the transhumance route heading west from the Pasargadae Plain. According to the locals, many graves are located in the foothills to the south of these points.

### 2) Gel-e Sarshûlî

The place is located in a valley and is a transit point for nomadic pastoralists. Abundant piles of stones and stone masonry which can be considered as graves were observed here. According to the locals, there is a building structure (probably a watchtower?) located on the summit of a mountain to the south of the place.

### 3) Gardan-e Khersî and Cheshme-ye Khersî

Cheshme-ye Khersî (spring of bear) is rich in water throughout the year. A large number of nomadic pastoralists use the spring. No graves were observed around Gardan-e Khersî and Cheshme-ye Khersî.

### 4) Cheshme-ye Zamânbegî / Jûb-e Zamânbegî

Cheshme-ye Zamânbegî is also rich in water. A canal (Jûb-e Zamânbegî) is constructed using the water of the spring. The date of the canal is unknown.

### 5) Nane'arabî

According to the locals, there was a settlement here but now it is abandoned. A mosque is now being built here by benevolent people.


Fig.11.33 "Wall of Parsa" in the Dasht-e Nane'arabî plain, west of the Pasargadae Plain (after Google Earth 2007 ©).

**6) Dasht-e Nane'arabî**

**(6a) Summer Pasture**

A large plain is located from Dasht-e Nane'arabî to Cheshme-ye Khorkhore through Toll-e Qorbângolî (Figs.11.33-34; Pl.11.105). The entire area of the plain is used as the summer pasture of nomadic pastoralists, especially the Kordshûlî and Bâserî tribes. According to the locals, a wide range of social life, including marriage, was performed in this summer pasture. A part of the Lor tribe uses the eastern part of the plain to Tang-e Khorkhore as a winter pasture. Currently cultivation of the plain is in progress which is causing a change in the landscape of this area.

**(6b) Stone Lining as the Defence Wall**

A huge stone lining (ca. 3.5 km in length based on the satellite image; ca. 5-6 m in width) crossing the east part of Dasht-e Nane'arabî was identified (Fig.11.33; Pls.11.106-107). The stone lining has a north-south direction and extends almost in a straight line. The northern and southern ends of the stone lining are uncertain, but extend from Tang-e Qâchî, which lies to the northeast of Dasht-e Nane'arabî, to the mountains located in the south. If the stone lining continues to the western foothills of the mountains in the north, the estimated length would be approximately 6-7 km.

The stone lining is in a location which separates the area of summer pasture and the

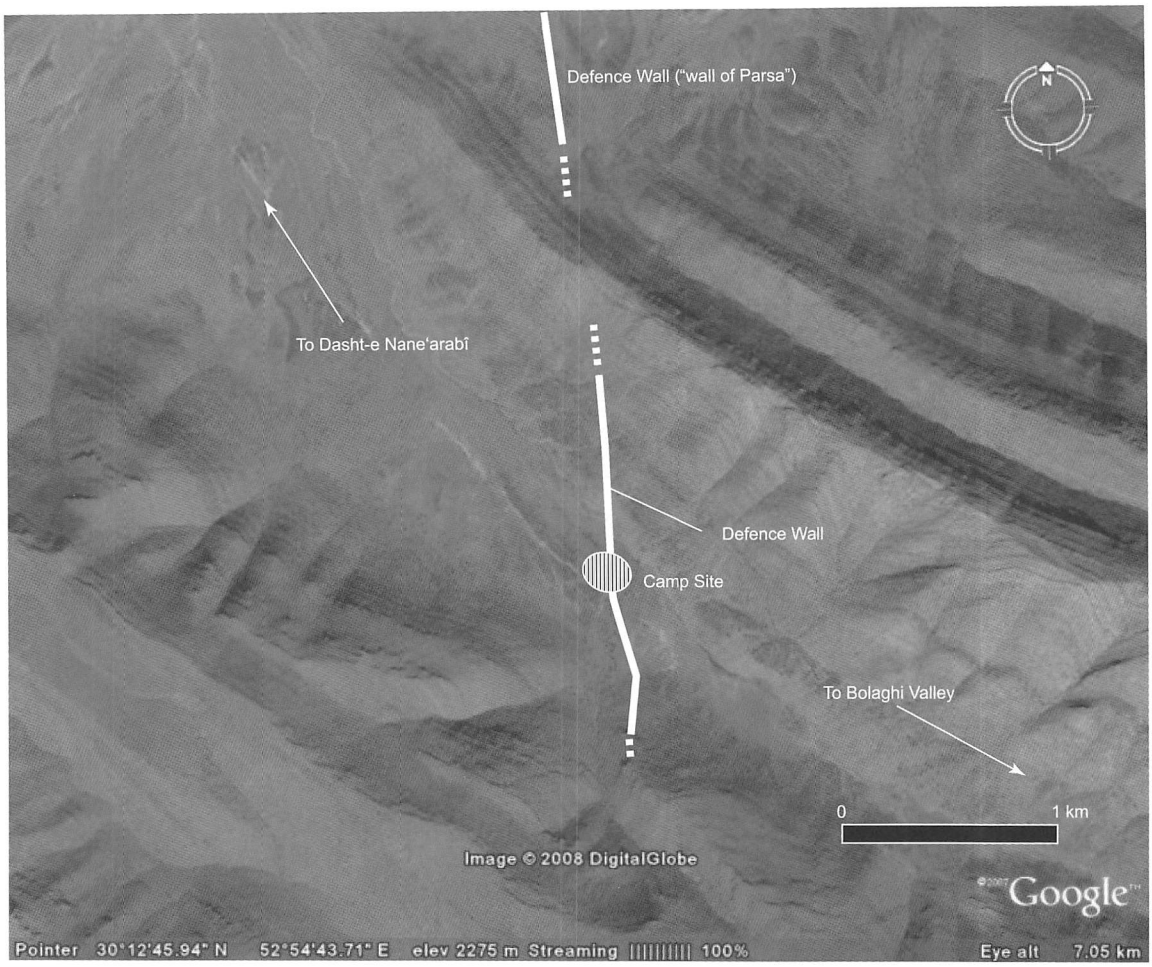


Fig.11.34 Defence wall near Cheshme-ye Khorkhore, northwest of the Bolaghi Valley (after Google Earth 2007 ©).

transhumance route leading into the Pasargadae Plain. Thus, it can be assumed to be a large defence wall to control the movement of nomadic pastoralists as well as other travelling people who pass through the Dasht-e Nane'arabî plain. It may also have functioned as a defence against enemies from the west. No related artifacts were observed at the wall, but its scale and the stone masonry possibly suggest the Achaemenid period.

This defence wall is the largest of its kind compared to the defence walls located around the Pasargadae Plain. This may show not only the powerful authority of the Achaemenid dynasty to built such a wall, but also how crucial it was for the dynasty to control the movement of people and defend enemies from the west.

Considering its grand scale and importance, we would like to propose that the wall be called the "wall of Parsa" (fa. dîvâr-e pârs).

In addition, since the cultivation area is expanding in the plain, an urgent preservation scheme should be executed to protect the structure.

### 7) Toll-e Qorbângolî and its Vicinity

#### (7a) Toll-e Qorbângolî

Toll-e Qorbângolî is a small natural hill located in the above mentioned plain (Fig.11.33). On top of the hill, an Islamic cemetery is located (Pl.11.108). At the foot of the hill, a spring called Cheshme-ye Toll-e Qorbângolî is situated. Part of the hill was destroyed

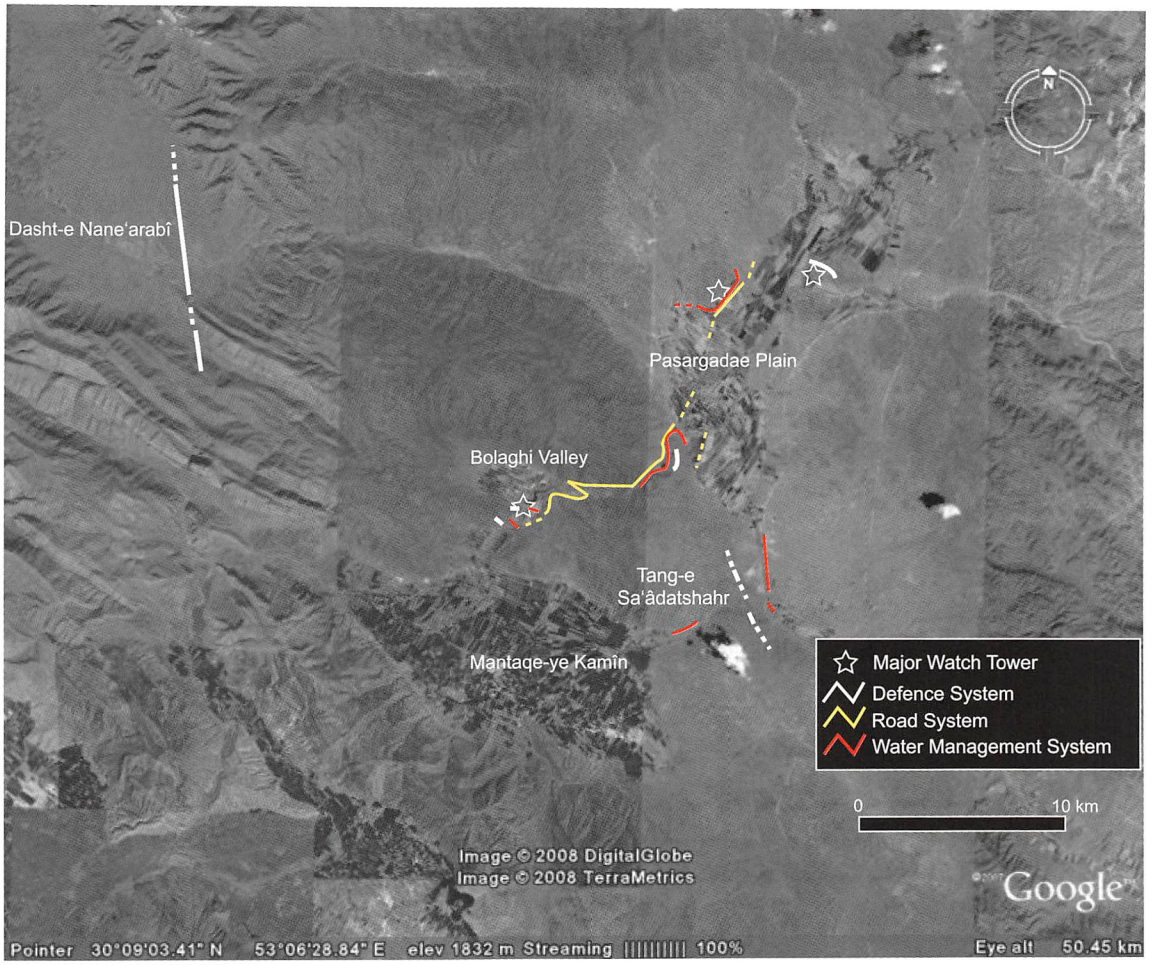


Fig.11.35 Road, water management, and defence systems around the Bolaghi Valley and the Pasargadae Plain (after Google Earth 2007 ©).

by a bulldozer.

In the vicinity of Toll-e Qorbângolî, some natural hills with Islamic cemeteries on the hill top are located. These hills were also partly destroyed by a bulldozer.

**(7b) Culster of Large Building Struictures**

A cluster of large building structures was observed to the west of a small stream (Pl. 11.109). These structures are built by dry stone masonry and are located in an enclosure measuring 100 × 100 m. The potsherds observed on the site surface mainly belong to the early Islamic period.

**8) Defence Wall near Cheshme-ye Khorkhore**

The spring of Cheshme-ye Khorkhore is located ca. 3.5 km to the east from the western entrance of a valley leading to Tang-e Khorkhore/Bolaghi Valley. To the north of Cheshme-ye Khorkhore, a stone lining (ca. 1.7 km in length and ca. 3 m in width) was identified (Fig.11.34; Pl.11.110). The stone lining seems to cross a large valley from the southwest to northwest direction. This stone lining can be also considered as a defence wall. Both ends of the wall seem to be located in the middle of mountains which lie to the south and to the north respectively. Unfortunately, we were not able to identify the both ends due to time constraints.

Since the construction method and the scale are similar to the other defence walls, it was probably constructed during the Achaemenid period and may be considered as a series of defence systems as the "wall of Parsa"(see above). It divides the summer pasture in the plain mentioned above and Tang-e Khorkhore or eventually the Bolaghi Valley. Therefore, the presence of this defence wall indicates the importance of protecting the Bolaghi Valley during the Achaemenid period.

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## Notes

[1] Alizadeh used the term "mobile pastoralist" rather than nomadic pastoralist. The term "nomadic pastoralists" is defined here as those migrate semiannually hundreds of kilometres between winter pastures at low altitude and summer pastures high in the mountains (Beck 2003: 289, and 291).

[2] Participants of the archaeological survey were as follows: Kazuya Yamauchi (2005 and 2007), Shin'ichi Nishiyama (2005 and 2007), Mohsen Zeidi (2007), and Mozafar Zarinkouh (2005).

[3] The narrowest part of Tang-e Bolâghî is located at Tîrandâz (ca. 100 m), while the widest part is at around Pûze-ye Sorkh (ca. 500-600 m).

[4] Although the article of Lamberg-Karlovsky and Humphries (1968: 271) mentions that, based on the survy of Sir A. Stein, the number of cairn burials decreases in Fars compared to the regions in the east, our survey revealed that numerous cairns do exist in Fars as well.

[5] By discussing the rock-cut passage at Dokhtarbor in Tang-e Bolaghi, Kleiss assumed this as a canal (Kleiss 1988a: 27-30, Abb. 6-7).

[6] Further to the west of TB 64, a possible Achaemenid period occupation was discovred at the cave site of TB 75 (see Zeidi and Tsuneki 2007, and Adachi this volume). Although no architectural remains were identified in Layer 2, the presence of abundant fragments of Achaemenid style large storage jars and the strategic position of the site overlooking Bolâghî Bozorg and Bolâghî Kûchak, suggest that the site was possibly functioned as a "watch station" during the Achaemenid period. The storage jars were probably used to store water or other necessary foodstuffs for the guards.

[7] The main result of the Iranian-Polish joint expedition was the discovery of a large building structure and a wine factory dated to the Sasanian period (ca. AD 3-7 century) (Asadi and Kaim 2007).

[8] In the Stronqch report; Site No. 14 in Fig.11.3 corresponds to the site. However, the report mentions the site name as "Tall-i Khari" which was excavated by an Iranian expedition in the 1950s. Tall-e Kharî is corresponds to Site No. 13 in Fig.11.3.

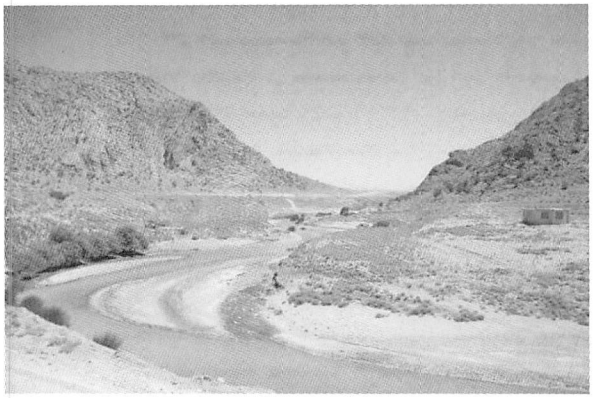


Plate 11.1 The northern entrance of Tang-e Bolâghî (from the southwest).

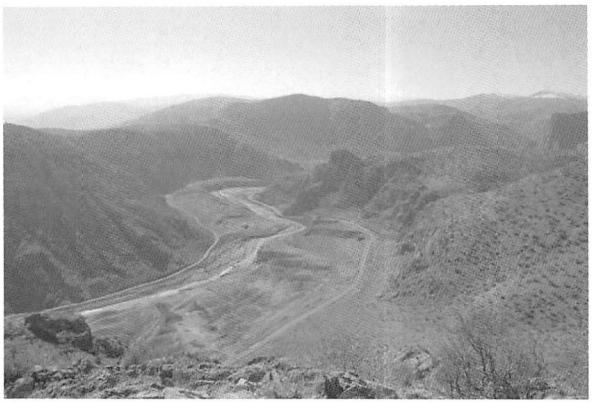


Plate 11.2 The northern entrance of Tang-e Bolâghî (from the north).

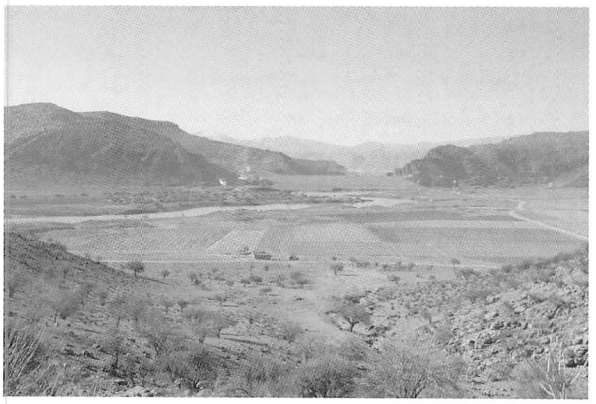


Plate 11.3 Bolâghî Bozorg from the site of TB 75 looking at Bolâghî Kûchak (from the north).

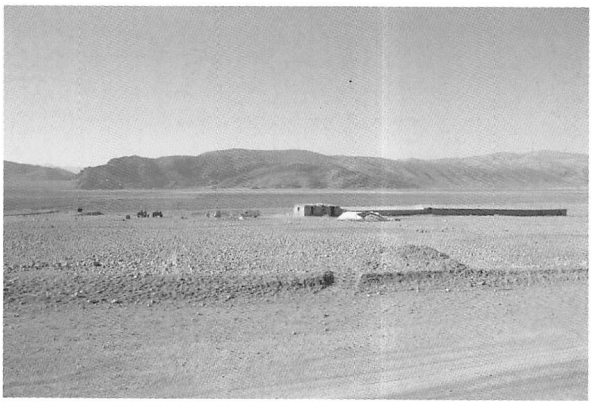


Plate 11.4 Bolâghî Bozorg: mountains in the southwest and a discarded chicken farm (from the north).

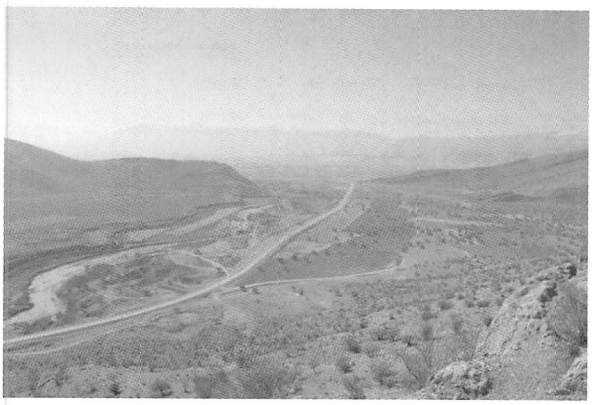


Plate 11.5 General view of Bolâghî Kûchak: The Rahmatâbâd Plain in the back (from the north).

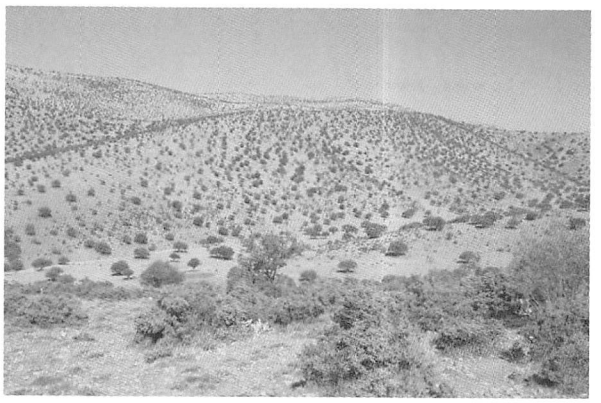


Plate 11.6 General view of Tang-e Khorkhore (from the northeast).

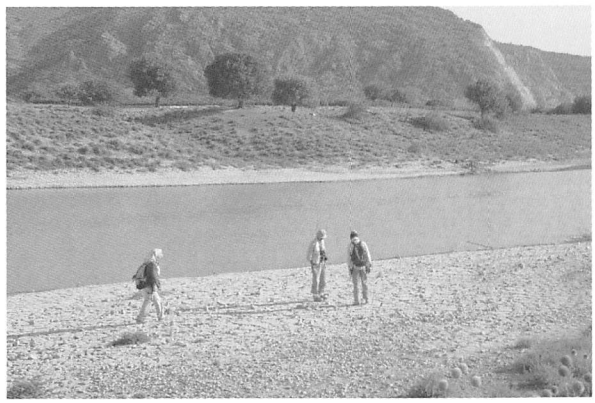


Plate 11.7 The Sivand River in Tang-e Bolâghî, around Pûze-ye Sorkh (from the north).

Plate 11.8 Tang-e Bolâghî : modern camp site on the foot of mountain (from the southeast).

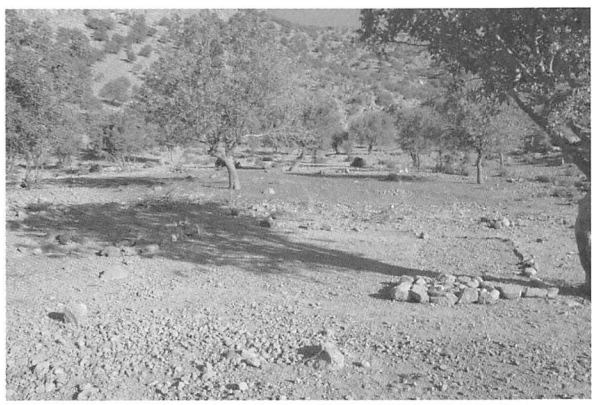


Plate 11.9 Tang-e Bolâghî : modern camp site on the foot of mountain (from the southeast).

Plate 11.10 Tang-e Bolâghî : cairn burial (from the northeast).

Plate 11.11 Toll-e Gholâm, north of Pasargadae Plain : Cairn burial (from the north).

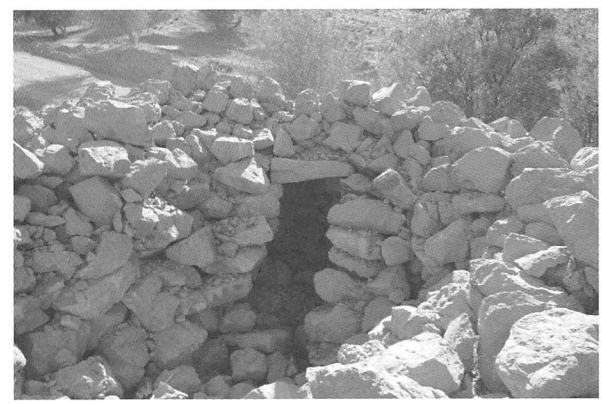


Plate 11.12 Tang-e Bolâghî : a burial chamber of the cairn burial (from the northwest).

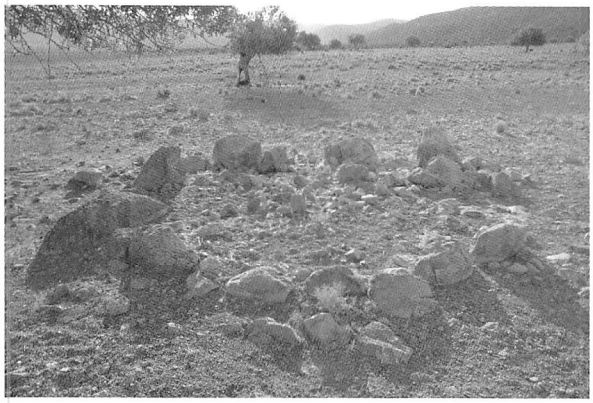


Plate 11.13 Bolâghî Bozorg : grave with a quadrate stone lining.

Plate 11.14 Bolâghî Bozorg : grave with an ellipse, or circular stone lining.

Plate 11.15 Bolâghî Bozorg : grave with an ellipse, or circular stone lining.

Plate 11.16 Bolâghî Bozorg : grave with an irregular clustering of large stones (1).

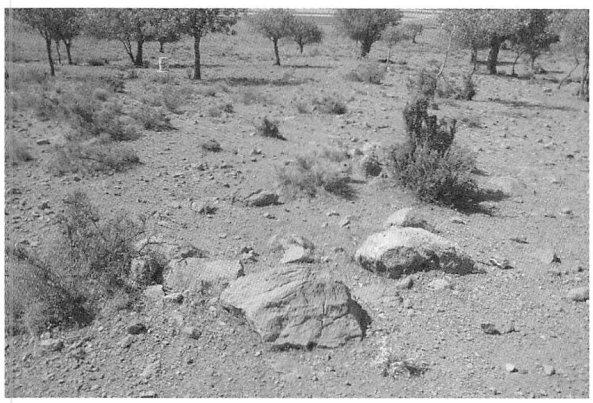


Plate 11.17 Bolâghî Bozorg : grave with an irregular clustering of large stones (2).

Plate 11.18 Bolâghî Bozorg : grave formed beside a large standing stone.

Plate 11.19 Bolâghî Bozorg : grave with a circular stone lining with paved stones inside the circular enclosure (probably the foundation of a cairn with the upper part totally destroyed).

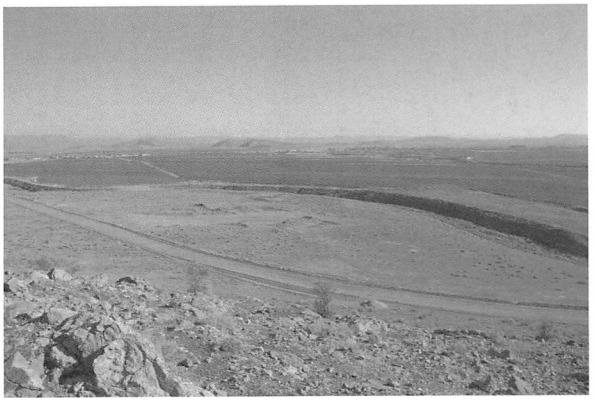


Plate 11.20 A large complex of camp site and cemetery located just to the west of the northern entrance of Tang-e Bolâghî.

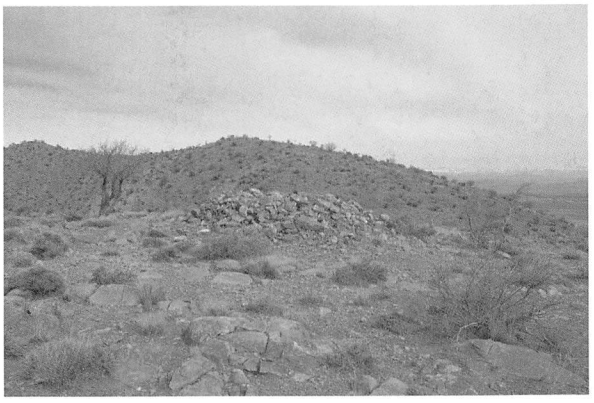


Plate 11.21 Tang-e Bolâghî : cairn burial on the mountain to the south of Kûh-e Kûchakak.

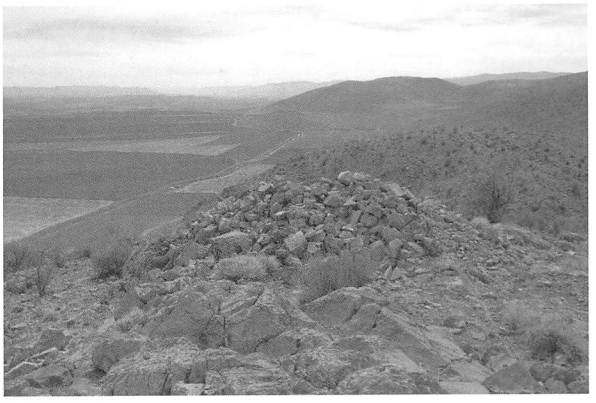


Plate 11.22 Cairn on the mountain which extends to the southeast of Kûh-e Kûchakak.

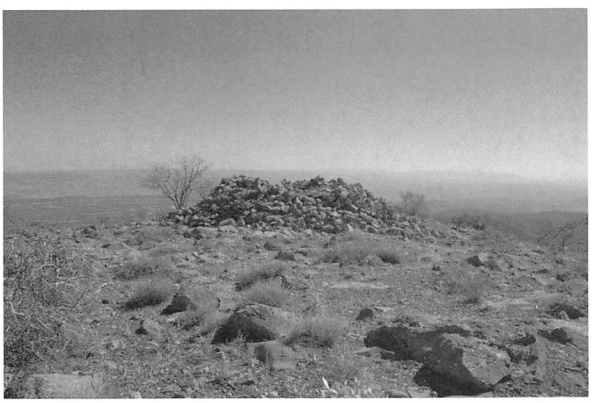


Plate 11.23 Tang-e Bolâghî : cairns on the mountain to the west of the northern entrance of Tang-e Bolâghî.

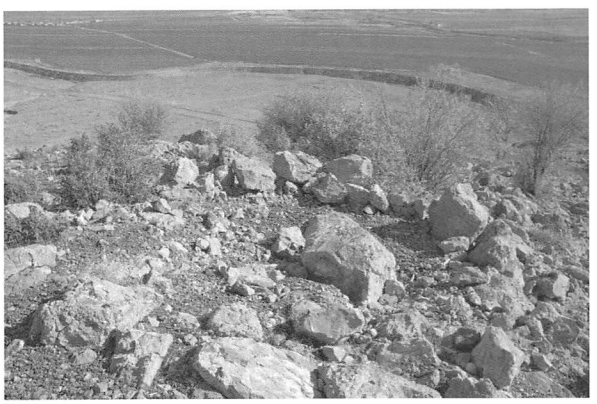


Plate 11.24 Tang-e Bolâghî : graves with stone clustering on the mountain to the west of the northern entrance of Tang-e Bolâghî.

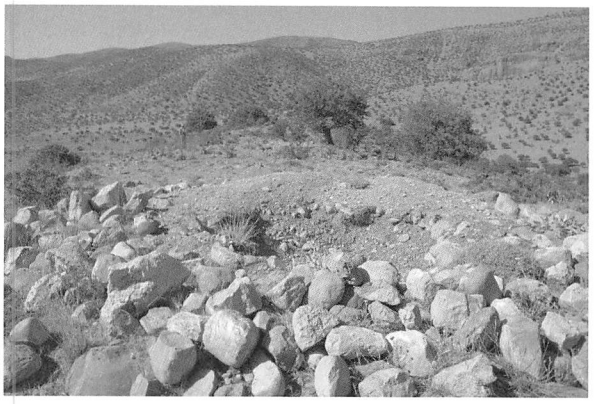


Plate 11.25 Tang-e Khorkhore : cairn on the eastern entrance of Tang-e Khorkhore.

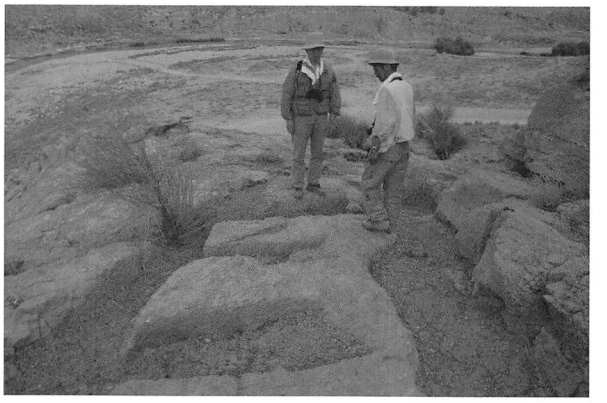


Plate 11.26 Dokhtarbor: an unfinished engraving on the rock surface to the west of the rock-cut passage.

Plate 11.27 Two paralleled rock-cut passages which are located between Dokhtarbor and Tîrandâz.

Plate 11.28 Dokhtarbor: a rock-cut passage on the west bank of the Sivand River (from the northwest).

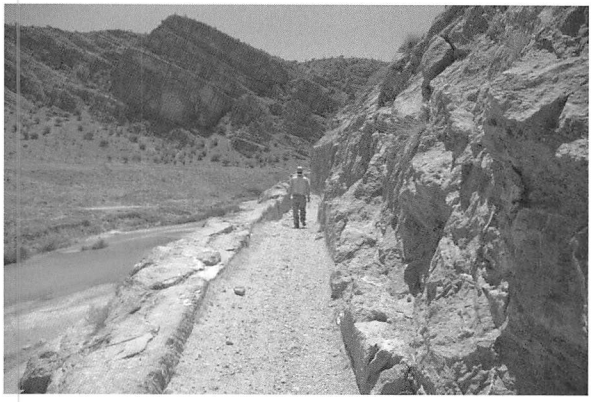


Plate 11.29 Dokhtarbor: a rock-cut passage on the west bank of the Sivand River (from the east).

Plate 11.30 Dokhtarbor: a rock-cut passage on the west bank of the Sivand River (from the northwest).

Plate 11.31 Tang-e Bolâghî: a stone lining constructed as the sidewall of the road.

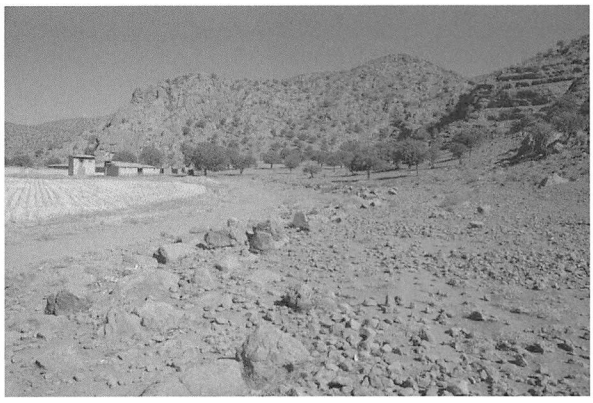


Plate 11.32 Tang-e Bolâghî: a stone lining constructed as the sidewall of the road.

Plate 11.33 Tang-e Bolâghî : a stone lining of the sidewall of the road on the east bank of the Sivand (1) (from the north).

Plate 11.34 Tang-e Bolâghî : a stone lining of the sidewall of the road on the east bank of the Sivand (2) (from the north).

Plate 11.35 A possible crossing point of the Sivand near Pûze-ye Sorkh and TB 64 (from the east).

Plate 11.36 Bolâghî Bozorg: a possible "barrier station" on the south bank of the Sivand (from the north).

Plate 11.37 Tang-e Bolâghî : a rock-cut passage as a canal on the east bank of the Sivand at the northern entrance of Tang-e Bolâghî (from the northeast).

Plate 11.38 Tang-e Bolâghî : a stone lining as the embankment of a canal on the east bank of the Sivand at the northern entrance of Tang-e Bolâghî (from the northeast).

Plate 11.39 The old spring of Cheshme-ye Darre-ye Sorkh, ca. 1 km southeast from the northern entrance of Tang-e Bolâghî.

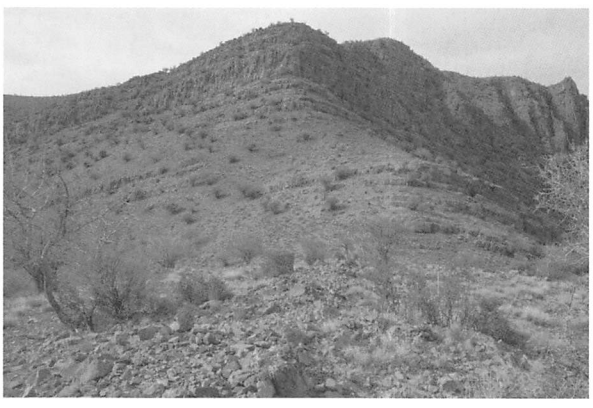


Plate 11.40 A defence wall on the ridge of the mountain to the east of Tang-e Bolâghî (1) (from the northwest).

Plate 11.41 A defence wall on the ridge of the mountain to the east of Tang-e Bolâghî (2) (from the norteast).

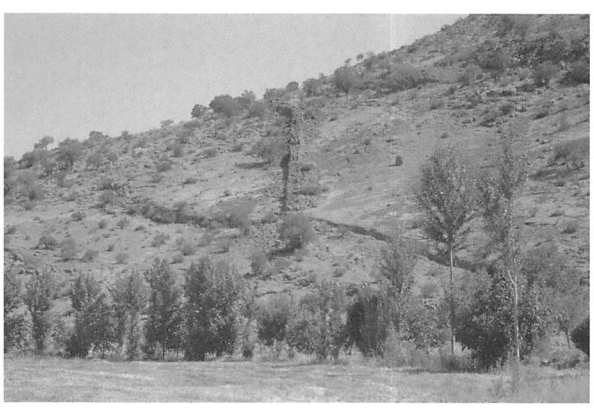


Plate 11.42 A defence wall (in the centre) on the slope of the mountain on the east bank of the Sivand in Tang-e Bolâghî (1) (from the south).

Plate 11.43 A defence wall on the slope of the mountain on the east bank of the Sivand in Tang-e Bolâghî (2) (from the southeast).

Plate 11.44 A stone lining of the "royal hunting ground" on the south bank of the Sivand in Bolâghî Bozorg (1) (from the southwest).

Plate 11.45 A stone lining of the "royal hunting ground" on the south bank of the Sivand in Bolâghî Bozorg (2) (from the southwest).

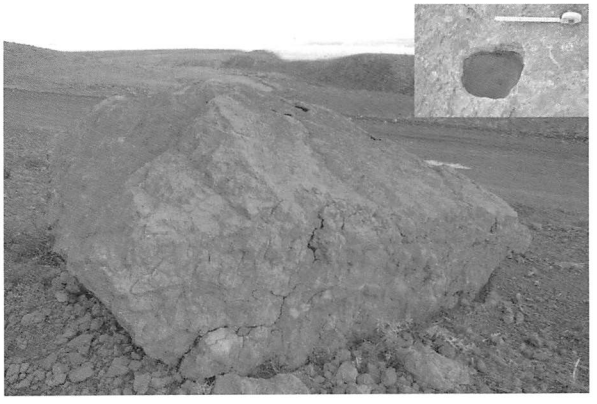


Plate 11.46 A "fire altar" at the northern entrance of Tang-e Bolâghî, (from the southwest). The hole is shown in the upper right.

Plate 11.47 A camp site on the foot of west mountain of Bolâghî Kûchak (from the south).

Plate 11.48 Surface collection from the camp site on the foot of west mountain of Bolâghî Kûchak. The potsherds include Bakun and Lapui wares, and possibly Achaemenid period storage jar.

Plate 11.49 Western part of the settlement site on the foot of west mountain of Bolâghî Kûchak. (from the east).

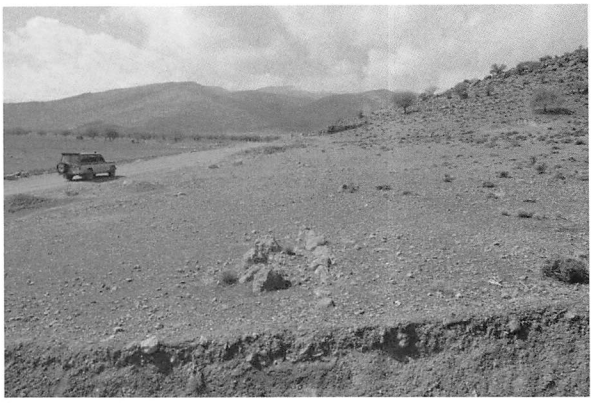


Plate 11.50 A stone lining of the road system on the foot of west mountain of Bolâghî Kûchak. (from the northeast).

Plate 11.51 Possible sidewalls of the road on the foot of the mountain to the southwest of Bolâghî Kûchak (from the southeast).

Plate 11.52 Bolâghî Kûchak: Sadd-e Bôlâghî dam (from the southeast).

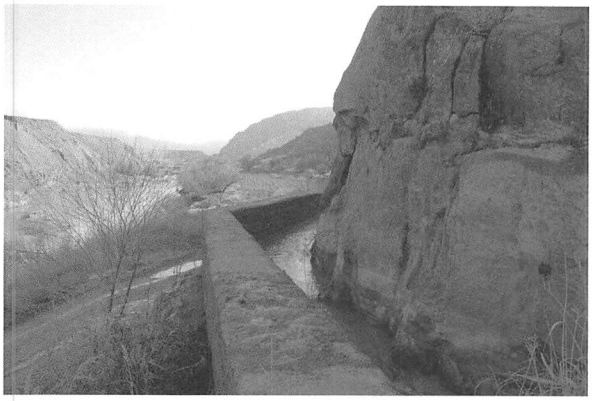


Plate 11.53 Jûb-e Rahmatâbâd (Canal of Sadd-e Bolâghî Dam) to the east of Bolâghî Kûchak (from the south). The canal is still in use with recently built embankment in cement.

Plate 11.54 Bolâghî Kûchak: A defence wall on the ridge of mountain to the west of Bolâghî Kûchak (from the northwest).

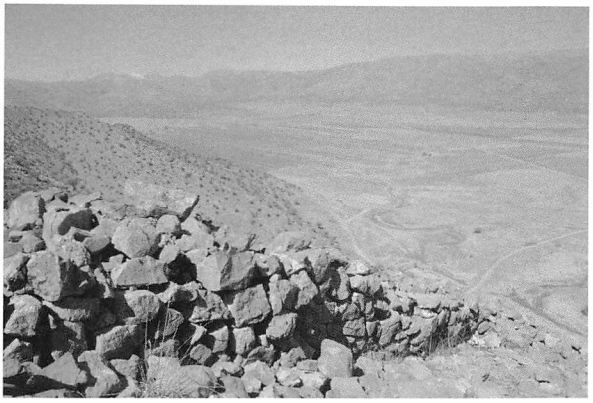


Plate 11.55 Bolâghî Kûchak: a defence wall on the mountain slope overlooking Bolâghî Bozorg (from the southeast).

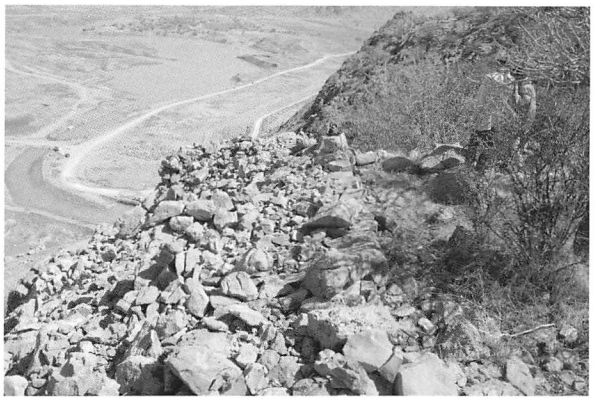


Plate 11.56 Bolâghî Kûchak: a defence wall on the mountain slope overlooking Bolâghî Bozorg (from the west).

Plate 11.57 Bolâghî Kûchak: a watchtower on the ridge of a cliff projecting just to the west of the Sivand dam (from the west).

Plate 11.58 General view of the Toll-e Gholâm area (from the west).

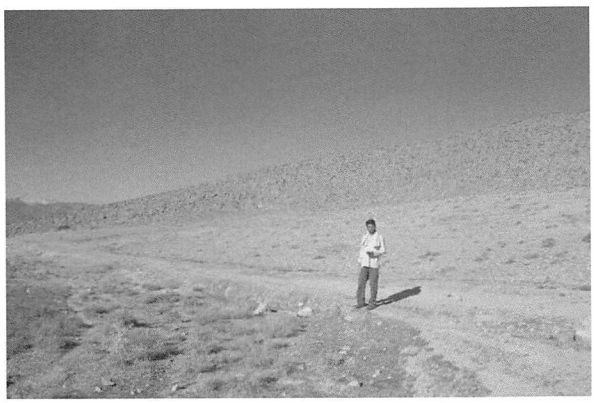


Plate 11.59 Toll-e Gholâm: a prehistoric camp site at the southern end of Toll-e Gholâm (from the northeast).

Plate 11.60 Toll-e Gholâm: a camp site located in a small valley to the east side of the eastern hill of Âushenâsûn (from the north). A square structure in the valley floor is presumably a caravanserai.

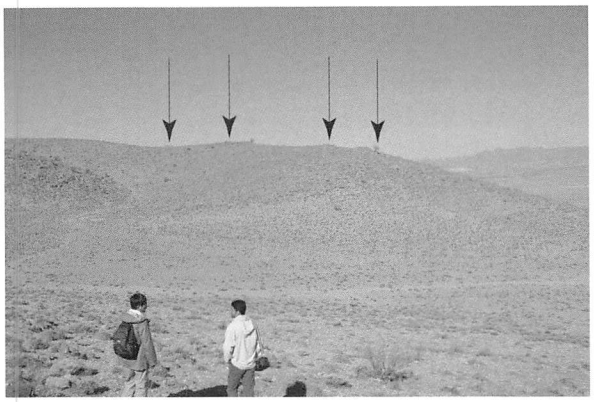


Plate 11.61 Toll-e Gholâm: a series of cairns located on the ridge of the mountain (from the south).

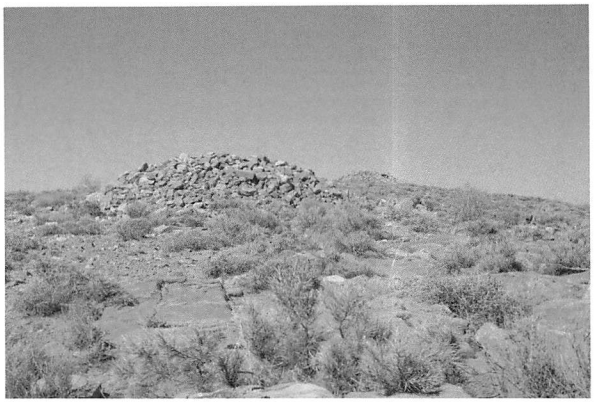


Plate 11.62 Toll-e Gholâm: cairns located on the ridge of the mountain (from the south).

Plate 11.63 Toll-e Gholâm: cairns located on a point slightly below the ridge (from the south).

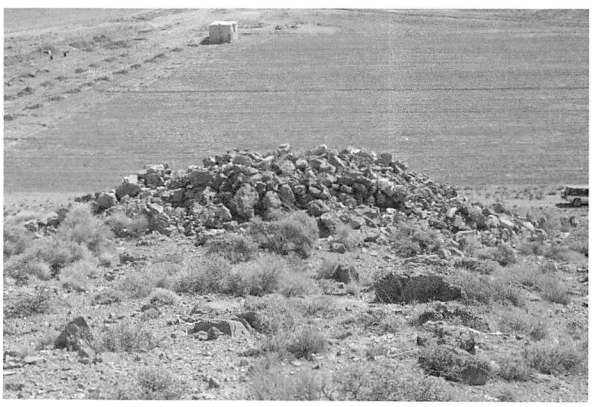


Plate 11.64 Toll-e Gholâm: cairn located on the lower slope of a hill (from the west).

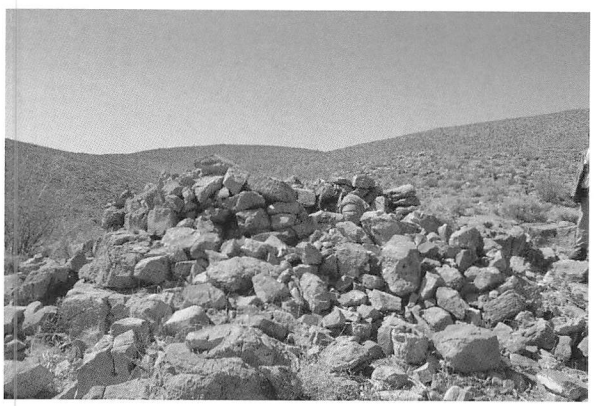


Plate 11.65 Toll-e Gholâm: well-preserved cairns located on a cliff to the east of Âushenâsûn basin (from the east).

Plate 11.66 Toll-e Gholâm: a grave with placing the stones in a circular form (from the northwest).

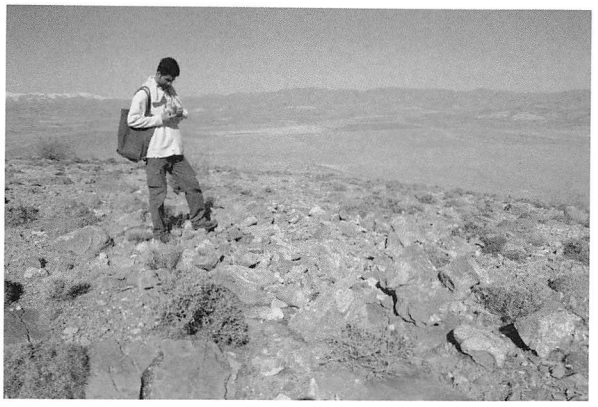


Plate 11.67 Toll-e Gholâm: a grave with paving the stones in a circular form (possibly a destroyed cairn?) (from the southeast).

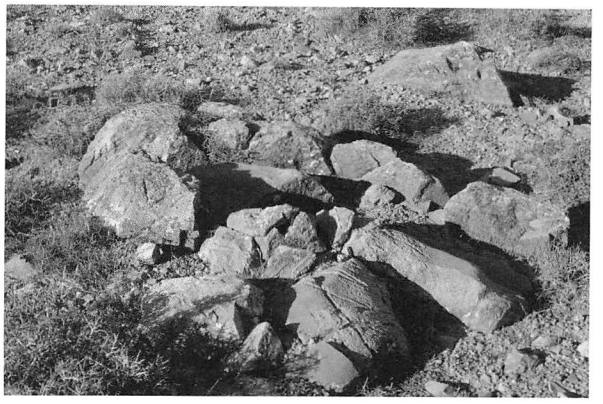


Plate 11.68 Toll-e Gholâm: a grave with cluster of several stones (from the northeast).

Plate 11.69 Toll-e Gholâm: a grave with circular or semi-circular stone linings placed in front of a rock (from the northeast).

Plate 11.70 Toll-e Gholâm: a grave with using space between the rocks (from the east).

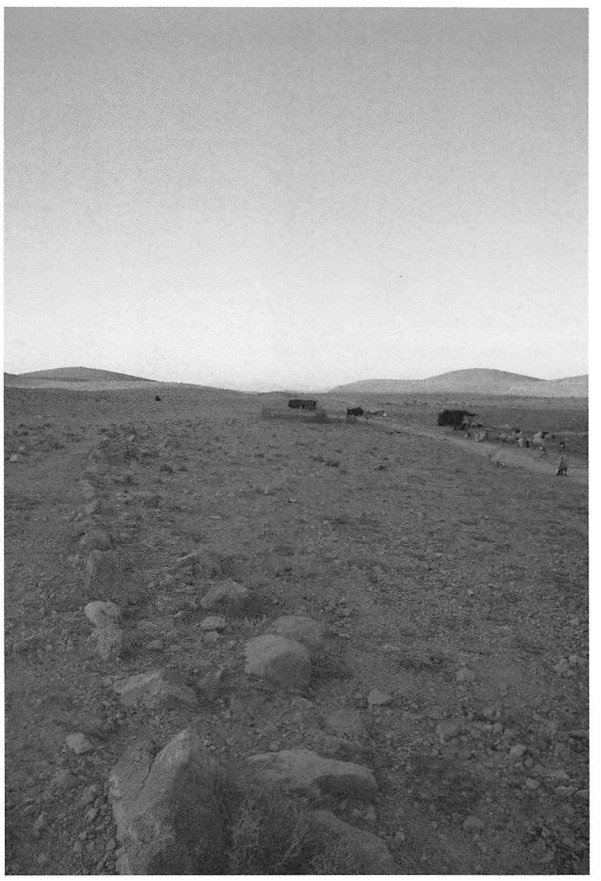


Plate 11.71 Toll-e Gholâm: A stone lining as the sidewalls of the road in the Âushenâsûn basin (from the southwest).

Plate 11.72 Toll-e Gholâm: a stone lining as the sidewalls of the road in the north of Âushenâsûn basin (from the south).

Plate 11.74 Toll-e Gholâm: embankment of the canal consists of two steps of stone linings (from the southwest).

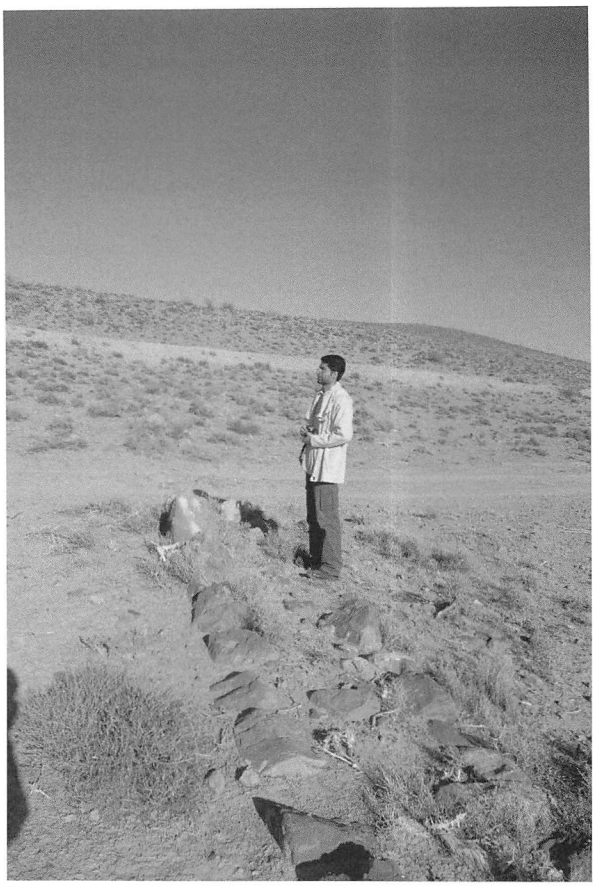


Plate 11.73 Toll-e Gholâm: A stone lining perpendicular to the road just to the north of Âushenâsûn (from the southeast).

Plate 11.75 Toll-e Gholâm: watchtower (marked by arrow) to the southeast of the Âushenâsûn basin (1) (from the southwest).

Plate 11.76 Toll-e Gholâm: watchtower (marked by arrow) to the southeast of the Âushenâsûn basin (2) (from the northwest).

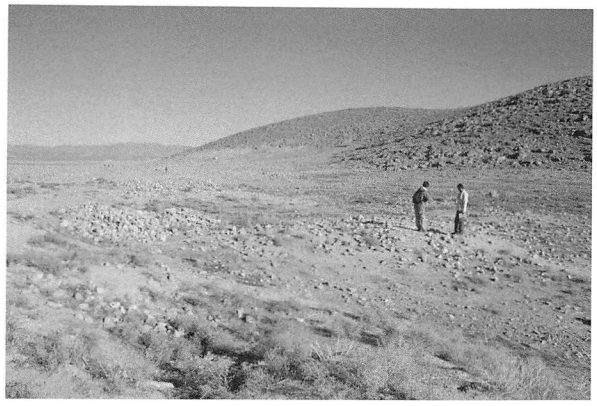


Plate 11.77 Toll-e Gholâm: caravanserai on the southern slope of a hill in the southern end of Toll-e Gholâm (1) (from the east).

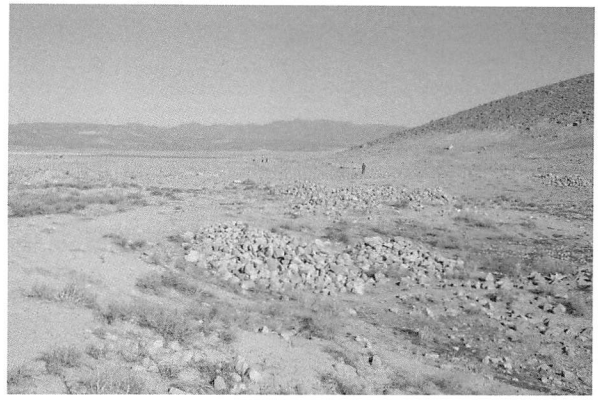


Plate 11.78 Toll-e Gholâm: caravanserai on the southern slope of a hill in the southern end of Toll-e Gholâm (2) (from the east).

Plate 11.79 Toll-e Gholâm: water reservoir (marked by arrow) of the caravanserai in the southern end of Toll-e Gholâm (from the east).

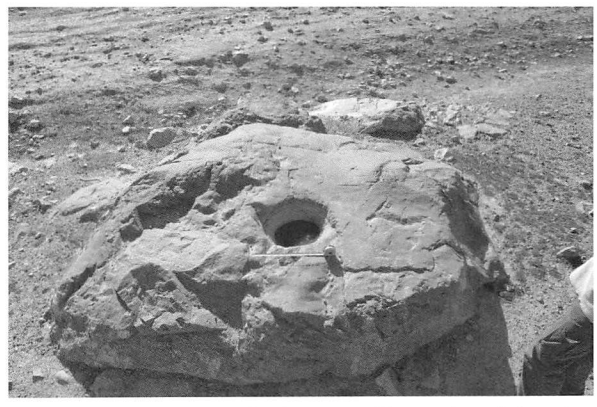


Plate 11.80 Toll-e Gholâm: a "fire altar" in the southern end of Toll-e Gholâm (from the west).

Plate 11.81 Pasargadae: an old canal (layer of stones) near the Sacred Precinct (1) (from the northwest).

Plate 11.82 Pasargadae: an old canal (layer of stones) near the Sacred Precinct (2) (from the west).

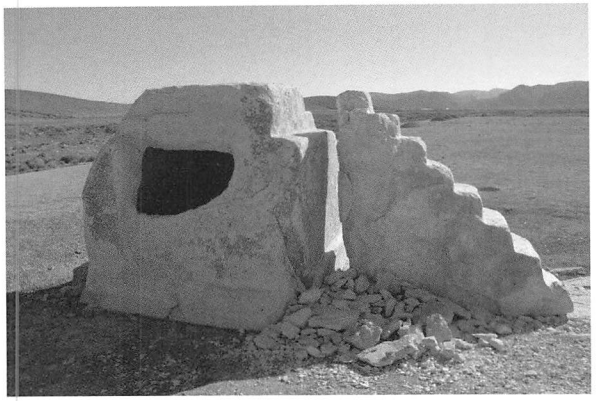


Plate 11.83 Pasargadae: the south altar in the Sacred Precinct damaged by treasure seeking looters (from the north).

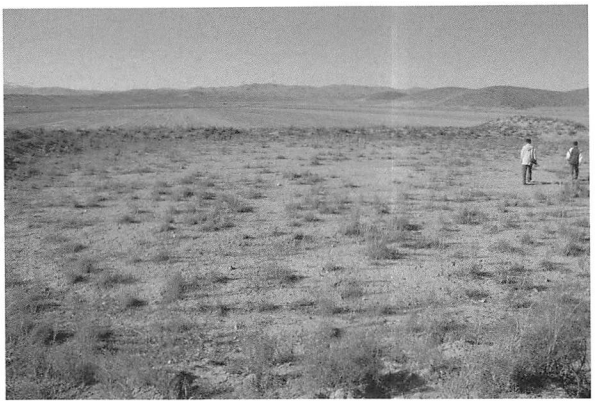


Plate 11.84 Pasargadae: one of the artificial mounds (tappe) near the Sacred Precinct (from the north).

Plate 11.85 Pasargadae: Do Tollûn. Do Tollun A on the left and Do Tollun B on the right (from the west).

Plate 11.86 Pasargadae: the south mound near Do Tollûn (from the south).

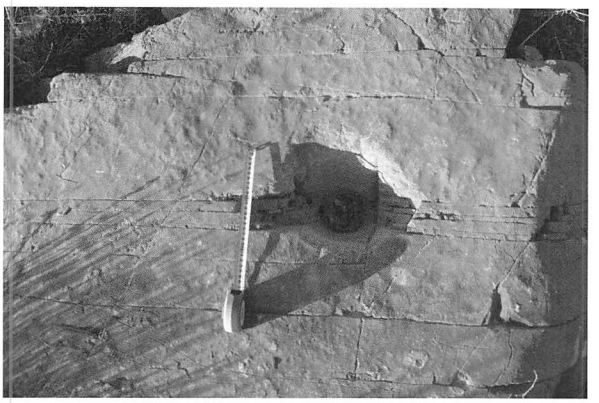


Plate 11.87 Pasargadae: a "fire bowl" on Mound B of Pasargadae.

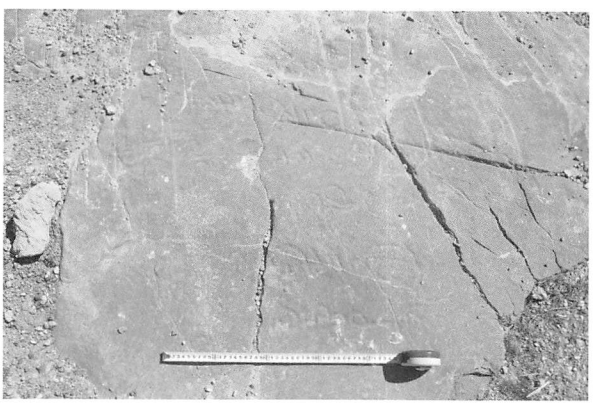


Plate 11.88 Pasargadae: Pahlavi inscribed rock on the foot of the northeast hill of Pasargadae. Inscriptions A-C of the Stronach report (from the west).

Plate 11.89 Pasargadae: a "fire bowl" engraved on the rock near the Pahlavi inscribed rock (from the west).

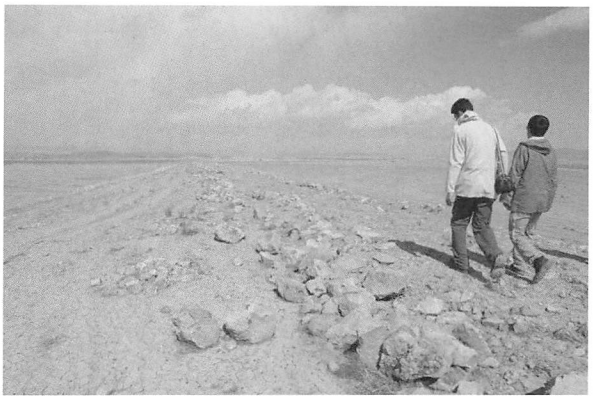


Plate 11.90 The Sadd-e Domdariyâ causeway-dam to the south of the Pasargadae plain (from the south).

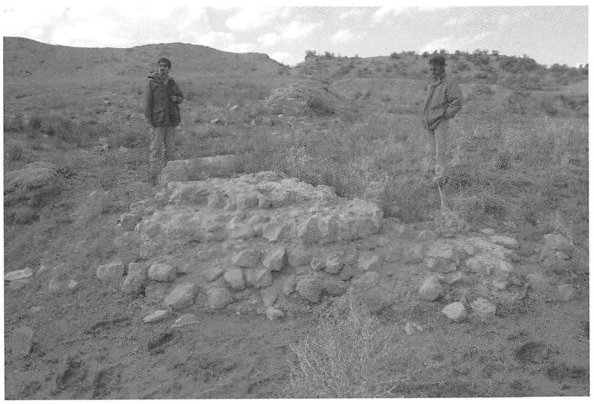


Plate 11.91 Pasargadae: Bridge Pier 1 near Do Tollun A (from the northeast).

Plate 11.92 Pasargadae: Bridge Pier 2 near the bridge connecting the villages of Kordshûlî and Pâsârgâd (from the north).

Plate 11.93 Pasargadae: The road from Kordshûlî to Tang-e Sa'âdatshahr (from the north).

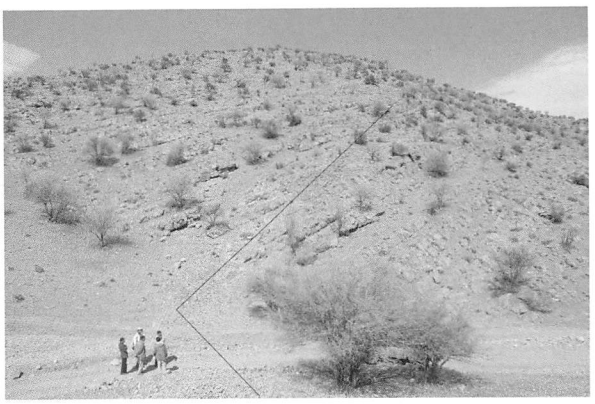


Plate 11.94 Pasargadae: Defence wall on the Reshte-ye Kûh-e Kûchakak mountain to the southwest of the Pasargadae plain (from the south).

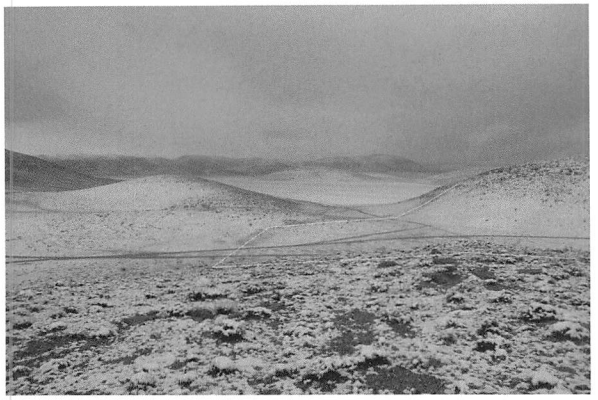


Plate 11.95 Pasargadae: defence wall on the mountains to the northeast of the Pasargadae plain (from the northwest).

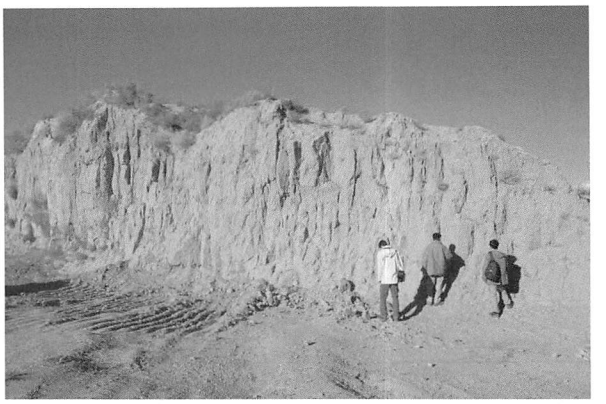


Plate 11.96 Sadd-e Jû-ye Dokhtar dam: A destroyed earthen rampart (from the northeast).

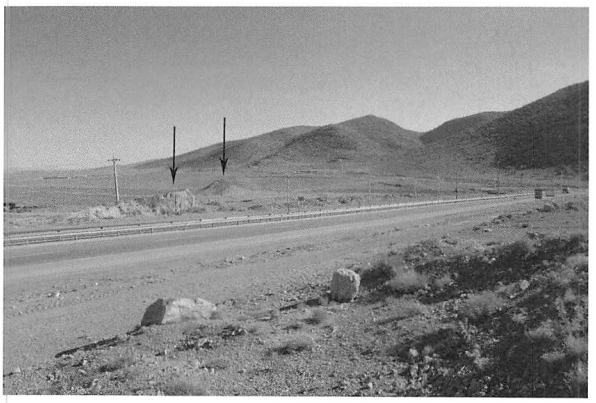


Plate 11.97 Sadd-e Jû-ye Dokhtar dam (marked by arrows) (from the southwest).

Plate 11.98 Jû-ye Dokhtar canal (from the north).

Plate 11.99 Jû-ye Dokhtar canal (from the south). Compare with the size of human in the right hand.

Plate 11.100 Jû-ye Tang-e Sa'âdatshahr canal with modern canal wall constructed by cement and stones (from the south).

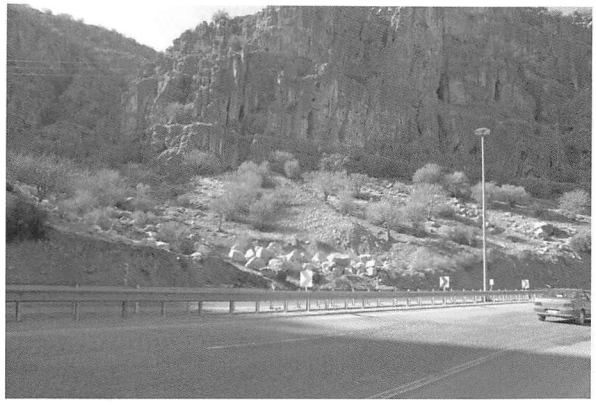


Plate 11.101 A defence wall in the northern part of Tang-e Sa'âdatshahr (from the north).

Plate 11.102 Enlarged view of Plate 101.

Plate 11.103 Qasr-e Dokhtar (from the east).

Plate 11.104 The spring of Cheshme-ye Khorkhore (marked by arrow) (from the southwest).

Plate 11.105 General view of Dasht-e Nane'arabî (from the northwest).

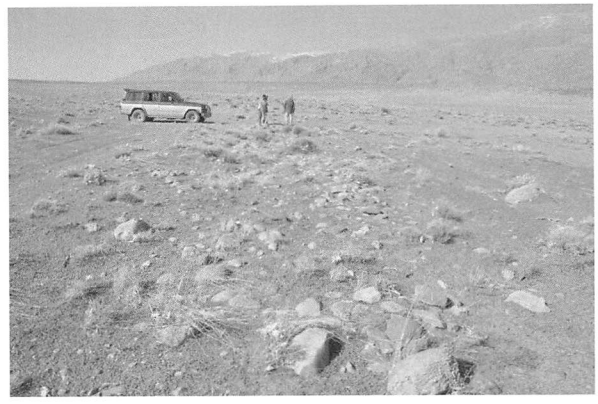


Plate 11.106 A defence wall in Dasht-e Nane'arabî : "Wall of Parsa". (from the south).

Plate 11.107 A defence wall in Dasht-e Nane'arabî : "Wall of Parsa". (from the north).

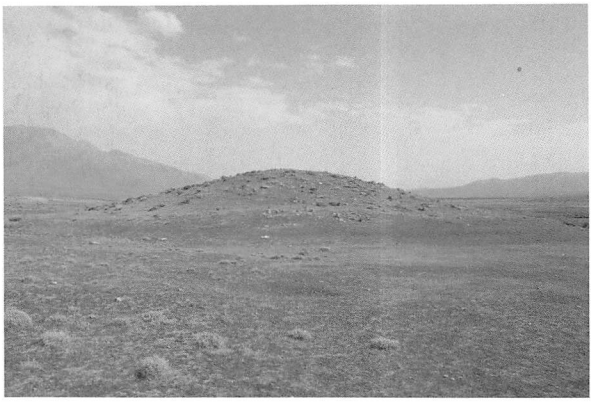


Plate 11.108 A small natural hill with a Islamic cemetery at Toll-e Qorbângolî. (from the southwest).

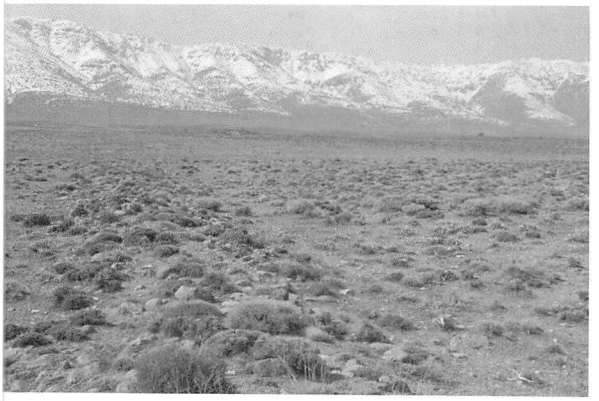


Plate 11.109 Toll-e Qorbângolî : enclosure wall (left) and building structures (right) (from the north).

Plate 11.110 A defence wall near Cheshme-ye Khorkhore (from the east).

# CHAPTER 12

## SUMMARY AND CONCLUSION

# 12. SUMMARY AND CONCLUSION

Akira TSUNEKI

This volume describes the results of Iran-Japan joint archaeological project for the Sivand Dam salvage area. The studies presented by each contributor will be summarized here first with the most important results from the project being discussed later.

## 1. Introduction

The purpose, operation, and procedure of our project were summarized in the first chapter. The climate of Tang-e Bolaghi is an inland one, experiencing drastic temperature changes during the day and between seasons. Precipitation is at the very limit for dry-farming. The top soil is heavily covered with limestone pebbles, and the vegetation of Tang-e Bolaghi is comprised of oak steppe-forest. The valley provides relatively poor conditions for agriculture, but could be suitable for hunter-gathers or pastoralists. After a short trip to the Bolaghi area, we believed that the area showed great potential archaeologically for the study of hunter-gathers, transhumance and trade activities both in the prehistoric and historic periods. Therefore, we decided to carry out two main operations, i.e. 1) Excavations at two caves and 2) Investigation of travel routes and site distribution patterns in the valley. An Iran-Japan joint archaeological mission was organized, and the research was undertaken in 2005-2007.

## 2. Geology of the Bolaghi area

A summary of the tectonic significance and stratigraphy of Tang-e Bolaghi were discussed in this chapter. The geology of Tang-e Bolaghi must be discussed in tandem with the Zagros Suture. The Zagros Suture is defined as a zone including ophiolite remnants and is a product of the final collision between the Gondwana-Land derived Cimmerian continent and Afro-Arabia. The Zagros thrust can be regarded as the compressed expression of the

northeast edge of the Zagros Suture on the surface. Limestone extensively underlies Tang-e Bolaghi, and the stratigraphy of Tang-e Bolaghi was reconstructed. A large-scale injection structure was observed along the *wadi* where TB75 is located, and the injection probably occurred during and immediately subsequent to the Cretaceous. The chemical composition of the massive, injected and alternated material collected in Tang-e Bolaghi was analyzed by fluorescent X-ray with the abundance order of inferred clay minerals being injected, bedded and massive. The geological structure of Tang-e Bolaghi was studied, and the dip difference is the result of the topographical difference between the Bolaghi basin and the valley. A wider open syncline may have formed the Bolaghi basin. The folded structures are developed in the extensive area between Pasargadae and Persepolis. The fold axis trends from NW to SE, and its wavelength ranges from a few kilometers to several kilometers.

## 3. Geological prospect for source rocks of prehistoric raw materials in the Bolaghi and Arsanjan area

This chapter also discusses the geology of Tang-e Bolaghi, but it concentrates on the problem of source rocks used by the prehistoric people there. At first, the authors clarified the terminology regarding flint and chert, and then classified the origins of chert into three major categories. They examined the source rocks from the Epi-Paleolithic and Proto-Neolithic suitable to be utilized for artifacts from exposed rocks on the ground and from river bed pebbles in Tang-e Bolaghi. Then, candidate rocks for artifacts, i.e. 1) siliceous nodule in limestone, 2) river gravel, were discussed. The distribution, production, and the chemical composition of the rocks were examined. The geological characteristics of more appropriate raw materials for artifacts were also studied, based on the species and occurrence of radiolarians in the chert. These studies indicated that the procurement zones for the prehistoric artifacts might be located not in the Bolaghi area, but in the Abadeh Tashk ophiolite, which is tens of kilometers from the Bolaghi area. They seem to have been transported as river pebbles and/or as trading material.

## 4. Excavations at TB75 (Haji Bahrami Cave)

TB75 is the most conspicuous cave in the Bolaghi Valley, having a c. 9 m wide and 2.8 m high opening. It was chosen for excavation because of its strategic location in the valley and for the presence of prehistoric materials on the surface. We dug three trenches (Trenches A, C and D totaling 10m$^2$) inside the cave and one 2 x 1m trench (Trench B) in the middle of the terrace slope. We reached virgin soil at around 2m deep inside the cave trenches. They produced almost the same cultural deposits, consisting of six cultural layers. Layer 1 is Islamic, layer 2 is Achaemenid, layers 3 and 4 are Proto-Neolithic, and layers 5 and 6 are Epi-Paleolithic. Layer 2 produced characteristic large ribbed pithoi and an iron trilobate arrowhead. It is supposed that the cave was used as an army post during the Achaemenid or post-Achaemenid period. On the other hand, lower prehistoric layers produced a large number of chipped stones and some animal bones. Their characteristics indicated the existence of Proto-Neolithic and Epi-Paleolithic cultural sequence there, and they suggest new data for the study of Neolithization in the eastern Zagros. The cultural deposits of Trench B on the terrace slope are about 1 m thick, and could be divided into various layers. However, except recently accumulated surface soil, all of the layers showed similar lithofacies and produced a great number of flint chipped stones belonging to the Proto-Neolithic period. Therefore, most of the Trench B deposits were accumulated at the same

time as layers 3 and 4 of the cave trenches.

## 5. Excavations at TB130

TB130 is one of the caves on the southern skirt of Kuh-e Bolaghi Bozorg, about 1.2km east of TB75. It is not so deep so we called it a shelter rather than a cave. The shelter is 9m wide by 6m long, and the height of the opening is about 9m. The front terrace slope is steep but produced many chipped stones on the surface, especially on the middle and lower terraces. One 2 x 2m trench (Trench A) inside the shelter and five 2 x 1m trenches (Trench B – E) on the terrace outside were sunk. Therefore, the excavated area covered 12m$^2$ in all. A few modern potsherds were the only objects recovered from Trench A, and we concluded that the shelter was used only by modern sheepherders, or that the prehistoric deposits had completely eroded away. In contrast, all trenches on the terrace produced many chipped stones, which seem to belong to the Proto-Neolithic period. The most important feature is a stone floor paved with many angular limestone pebbles, which was discovered in Trench D-E. The chipped stone assemblages discovered from these trenches essentially belong to the same lithic industry, and they are quite similar to those from layers 3 and 4 (Trenches A, B and C) of TB75.

## 6. Lithic assemblages from TB75 and TB130

Chipped stones obtained from the excavations at TB75 and TB130 were summarized and reported in this chapter. A hypothetical dating of these lithic assemblages within the Epi-Paleolithic to Proto-Neolithic chronological framework of the Zagros Mountains was also discussed. Firstly, overall characteristics of the lithic artifacts were outlined. The study material contained 10,703 pieces of chipped stones from both sites. The material, the types, the shapes, and the flaking techniques were considered. Then, a layer by layer description of the lithic artifacts followed. Five phases can be established for the lithic assemblages at TB75 and TB130 designated in chronological order as Phase 1 to Phase 5. The oldest, Phase 1 is represented by layer 6 (Trench D) of TB75. Phase 2 is represented by layer 5 (Trench D) of TB75, showing the characteristics of late Zarzian lithic industry. Phase 3 consists of layer 4 (Trench D) of TB75, layer 4 (Trench C) of TB75, layer 3 (Trench B) of TB75 and layer 4 (Trench B) of TB130. The people made pressure-flaked micro-blades, using good quality raw materials obtained from distant places. Phase 4 consists of layer 3 (Trench D) of TB75, layer 3 (Trench C) of TB75, and layer 3 (Trench D) of TB130. For micro-blade production they used pressure flaking and finer quality raw materials than those used for blade production which utilized percussion. The latest Phase 5 is represented by layer 2 (Trench B) of TB75 and layer 2 (Trench E) of TB130. The presence of geometric microliths of the lunate and trapezoid categories is the most indicative characteristic of this phase. These five phases were compared with those of sites in the surrounding areas. Then, the hypothetical dating of these phases was ordered within the Epi-Paleolithic to Proto-Neoltihic chronological framework of the Zagros Mountains. Phase 1 is dated to the Zarzian, and Phase 2 is dated to the Late Zarzian, contemporary with KMC Cave in the south-east Zagros. Phases 3 and 4 are dated to the Proto-Neolithic in the Zagros, particularly to a period subsequent to M'lefaat and Karim Shahir. Phase 5 can be dated to the Aceramic Neolithic, contemporary with the Aceramic Jarmo.

## 7. Achaemenid and Post-Achaemenid objects from TB75, TB130 and the general survey

Layer 2 (Trenches A, C and D) of TB75 produced a relatively large number of Achaemenid-like pottery and other objects. Most of the pottery from layer 2 at TB75 are wheel made and well fired. The most diagnostic type is the fragments of ribbed pithos. One high quality canteen jar fragment is also notable. Based on typology, they seem to belong to the late Achaemenid and/or post Achaemenid period. Besides pottery, the most remarkable object from layer 2 is an iron trilobate arrowhead. Similar specimens were reported from the Treasury of Persepolis and Susa. The historic period pottery from TB130 and the general survey were also reported in this chapter.

## 8. Faunal remains from TB75

About 4300 pieces of animal bone were recovered from Trenches A and D of TB75 and were analyzed in order to reconstruct subsistence patterns. The results of analysis suggest that a wide range of fauna was exploited during the Epi-Paleolithic and Proto-Neolithic periods at the site. However, gazelle was the most important game species exploited during layers 6-5, i.e. the Epi-Paleolithic period. An increase in the proportion of sheep and goats from layers 6-5 to layers 4-3, i.e. the Proto-Neolithic period, is evident at TB75. Distribution of LSI for both sheep and goats suggest a rather homogeneous population, and comparison of individual measurements of goats indicated that the specimens are in the size range of wild goats. However, the intensive use of sheep and goats in the Proto-Neolithic period is quite impressive for considering the neolithization in this region. Pigs and cattle also appeared only from the Proto-Neoltihic layers. It is suggested that most of the sheep, goat, cattle and pig remains in the Achaemenid and Islamic layers are domestic. Gazelle hunting still continued. Equid remains increased dramatically in the Achaemenid layer, reflecting the strategic importance of the site.

## 9. Plant remains from TB75

The plant remains collected with a small-scale manual water-sieve during the excavations were sent to a specialist for analysis. All of the plant remains were obtained from inside the cave trenches (Trenches C and D) in the 2006 season. Wheat, barley, legumes, and other charred remains were identified in the samples. One grain of bread wheat, discovered from one of the Epi-Paleolithic samples, is considered intrusive. This paleobotanical study based on the samples from TB75 gives us a first glance for Epi-Paleolithic and Proto-Neolithic botanical aspects of the region, but more materials and detailed study are necessary to draw any general picture about prehistoric vegetation and plant use by the people at that time.

## 10. Radiocarbon dating

Two radiocarbon dating groups measured the charcoal samples collected from the prehistoric layers of Trenches C and D of TB75. Each group measured ten samples using an AMS. The Nagoya University group results were as follows; One sample of layer 3 (Trench D) dated to 8480 ± 45BP; Three samples of layer 4 (Trench D) dated to 9265 ± 45BP -

10190 ± 45BP; Three samples of layer 5 (Trench D) dated to 12225 ± 50BP - 12640 ± 50BP; Two samples of layer 6 (Trench D) dated to 16330 ± 60BP - 16650 ± 70BP. The University of Tokyo group results were as follows; Three samples of layer 4 (Trench D) dated to 8403 ± 43BP - 9452 ± 47BP; Three samples of layer 5 (Trench C) dated to 11930 ± 56BP - 14774 ± 61BP. Three samples obtained at locus 12 of layer 4 (Trench C) dated to 1368 ± 33BP - 1448 ± 33BP, and it is highly possible that there was contamination from the upper layers. One sample of each group did not produce any results. Therefore, we can say that the dates proposed by the two groups are compatible. Based on their results, layer 3 dates to the middle of the 9th millennium cal BC; layer 4 to the 10th - early 9th millennium cal BC; layer 5 to the14th -13th millennium cal BC; and layer 6 to the 18th millennium cal BC.

## 11. The archeological survey in the Bolaghi Valley and its vicinity

We undertook an archaeological survey to investigate the relationship between past transhumance routes and related archaeological remains in the Bolaghi Valley and its vicinity. We also carried out the analysis of archaeological remains related to road, water management and defence system during the Achaemenid period. The survey was carried out by employing an intensive field walking method using high-resolution satellite images. The archaeological remains were directly recorded on to a satellite image magnified to a scale of 1:3000. GPS was also used to confirm the location of the remains. Transhumance movement was reconstructed by analyzing the distribution and situation of camp sites, cairns and cemeteries with reference to modern nomadic pastoralists around the Bolaghi Valley and the Pasargadae Plain. Based on the distribution of transhumance remains, Tang-e Khorekhore, i.e. the west route, was considered to be the most important gateway to and from the Bolaghi Valley except during the Achaemenid period. During the Achaemenid period, the east route which traversed the Bolaghi Valley from Bolaghi Kuchak to Tang-e Bolaghi became increasingly important, due to the construction of the "royal road" which connected Pasargadae and Persepolis. After the collapse of the Achaemenid Empire, the abandonment of the "royal road" probably led to the revival of the west route as the main traverse route for the Bolaghi Valley. The west route as the main route within the Bolaghi Valley must have continued throughout the Islamic period to the present. The remains of stone linings which indicate road, water management and defence systems are not dateable. However, some cairns located directly on these stone linings. These cairns were dated to the post-Achaemenid or Parthian-Sasanian periods based on the collected potsherds, therefore the stone linings should be dated earlier than these cairns, namely to the Achaemenid period. Our intensive field survey identified the remains of a dynamic road, water management system and defense system during the Achaemenid period. These systems were strongly related to the transhumance movement of nomadic pastoralists. Based on these results, we concluded that the protection and control of the Bolaghi Valley was crucial for the Achaemenids in Pasargadae.

## Conclusion

We believe that our three seasons' investigation in the Bolaghi Valley sheds new light on the prehistory and the study of transhumance in the Fars province. The most remarkable results are the first discovery of a cultural sequence from the Epi-Paleolithic to the Proto-Neolithic in the eastern Zagros region. The eastern Zagros curiously lacks sites with this transitional cultural deposit, and no archaeological reports showing this transition have been

published up until now. As mentioned in Chapter 1, many Epi-Paleolithic caves and shelters, and Pottery Neolithic tappeh-type settlements have been discovered and investigated in Fars Province, especially in the Marvdasht Plain. However, the transition period between the end of the Epi-Paleolithic and the beginning of the Pottery Neolithic remains as a strange hiatus in the eastern Zagros. Of course, this transitional period holds the key to the problem of Neolithization. Such a gap in the archaeological record made us suppose that the eastern Zagros did not play an important role in this transition. Previously it was thought that there were no archaeological sites of this transitional period in this region. It has been supposed that Neolithic way of life in the eastern Zagros started quite late around the beginning of the Pottery Neolithic period. However, our investigation revealed the existence of occupation that dated to this key period. We tentatively call this transitional phase the "Proto-Neolthic" in this report, and the discovery of this phase at TB75 and TB130 reveals new data which suggests a need to reconsider the traditional view, that is, the eastern Zagros is one of the regions which lagged behind the Fertile Crescent in terms of Neolithization. As you see in this report, we discovered a series of archaeological sequences and a series of $^{14}C$ sequences from the Epi-Paleolithic to Proto-Neolithic and / or Aceramic Neolithic at TB75. Proto-Neolithic and / or Aceramic Neolihtic cultural deposits were also revealed at TB130.

We still need more material to define the way of life and subsistence during the Epi-Paleoltihic and Proto-Neolithic periods in the Bolaghi Valley. The lithic artifacts mainly consist of blades, micro-blades and scrapers with a few notches, burins and geometric microliths. These artifacts indicate activities which relate to hunting, butchering and woodworking. Not a single sickle element or flake with silica-sheen was discovered either in the Epi-Paleolithic or in the Proto-Neolithic layers. With the slight paleoethnobotanic evidence, we have no evidence for farming at all. The analysis of faunal remains indicated that the prehistoric people of TB75 hunted mainly gazelle, sheep and goats. It seems that the game of these medium sized bovids had been most important for subsistence. Therefore, the people of the Epi-Paleolithic and Proto-Neolithic periods in the Bolaghi Valley mainly engaged in the hunting of wild bovids and probably gathering of wild plants. These subsistence activities are in accord with the natural environment of the Bolaghi Valley discussed in Chapter 1. We found a hearth and a spread of limestone in the Epi-Paleolithic layers of TB75 and a rough stone floor in Proto-Neolithic layer of TB130. These structural remains were probably used by temporal hunter-gathers for cooking, butchering animals, as a lithic workshop, and so on. All things considered, nomadic hunter-gatherers came to the Bolaghi Valley repeatedly for hunting gazelles, sheep, and goat, and for gathering wild legumes and nuts during the Epi-Paleolithic and Proto-Neolithic periods.

It does not seem that the fundamental subsistence and way of life between the Epi-Paleolithic and Proto-Neolithic in the Bolaghi Valley differed drastically. The occupation debris in both periods were observed in similar locations such as caves and terrace slopes, and the major types of lithic artifacts were also similar though a technological jump could be observed between them. However, it is notable that the proportion of sheep and goats in the faunal assemblage increases drastically from 17% in the Epi-Paleolithic layers to 46% in the Proto-Neolithic ones. Though the goats in the Proto-Neolithic seem to have been wild species from the point of size, such an inclination to sheep and goat indicates a tendency toward domestication. Only further investigation will resolve this problem.

The excavations at TB75 also provided new data for the Achaemenid period. It is very probable that the cave was used as an army post during the Achaemenid and / or post-Achaemenid period. This hypothesis is supported by the excavated remains and the strategic location of the site itself. If we discuss TB75 within a framework of traffic routes and transhumance not only within the Bolaghi Valley but also in the context of the whole region between Persepolis and Pasargadae, we can understand the dynamics of the site more clearly.

Therefore, the results of our excavations at TB75 must be discussed together with the results of our general survey.

Our general survey proposed a new perspective for the Bolaghi Valley for its role in transhumance and trade routes. The importance of the routes within the valley shifted from period to period. The west was the most important gateway for the Bolaghi Valley from the prehistoric to modern periods. The exception was during the Achaemenid period, when the east and south routes gained prominence. The location of TB75 as a vital location was understood within this context. Our general survey provided substantial data for understanding past transhumance movement, and the authors who carried out the general survey suggested that the Bolaghi Valley played a role within the defence system for Pasargadae during the Achaemenid Empire. It is a fascinating suggestion though the evidence must be reviewed further.

Many archaeological teams have worked in the Bolaghi Valley and provided a lot of precious data for studying human history and the natural environment. I believe that our joint Iran-Japan mission also contributed to this research. At the same time, I pray that cooperation between Iranian and foreign archaeologists will progress further.

هیئت های باستان شناختی زیادی در تنگ بلاغی به فعالیت پرداختند و مقدار زیادی داده هـای ارزشـمند جهـت مطالعه تاریخ و محیط زیست طبیعی به دست آمد. ما معتقدیم که هیئت مشترک ایران–ژاپن نیز در این کار سهیم بوده است. به این امید که همکاری مشترک مابین باستان شناسان ایرانی و غیر ایرانی در آینده نیز ادامه پیدا کند.

به دست نیامد. با توجه به مدارک مربوط به مطالعات گیاه باستان شناسی، هیچ گونه مدرکی دال بر کشاورزی به دست نیامد. تحلیل های بقایای جانوری نیز بیانگر این است که ساکنان پیش از تاریخ در محوطه TB75 به طور عمده به شکار غزال، گوسفند و بز پرداخته اند. به نظر می رسد که اندازه های متوسط در چنین حیواناتی دارای بیشترین اهمیت در اقتصاد معیشتی بوده است. بنابراین، ساکنان پیش از تاریخ در دوران فراپارینه سنگی و آغاز نوسنگی در تنگ بلاغی به طور عمده شکار چنین حیوانات وحشی و احتمالاً جمع آوری دانه های گیاهیِ وحشی را به کار گرفته اند. به کارگیری چنین فعالیت های معیشتی با محیط زیست تنگ بلاغی نیز سازگار است. بقایای یک اجاق و پراکنش سنگ های آهکی در لایه های فراپارینه سنگی و یک سنگ فرش خَشن نیز در لایه آغاز نوسنگی در محوطه TB75 یافت شد. این بقایای ساختاری احتمالاً توسط شکارگران-جمع آورندگانِ موقت جهت پخت و پز، قصابی حیوانات، کارگاه ابزار سازی، و غیره استفاده شده است. با توجه به این موارد ذکر شده، می توان چنین تصور کرد که شکارگران-جمع آورندگانِ کوچرو برای شکار غزال، گوسفند و بز، و برای جمع آوری دانه های گیاهی وحشی در طی دوران فراپارینه سنگی و آغاز نوسنگی به تنگ بلاغی آمده اند.

به نظر نمی رسد که اقتصاد معیشتیِ اصلی و شیوه زندگی مابین دوران فراپارینه سنگی و آغاز نوسنگی در تنگ بلاغی به طور چشمگیری تفاوت داشته است. بقایای استقراری در هر دو دوره در محل های مشابه مثل غار و شیبِ تراس مقابل آن مشاهده شده، و گونه های اصلی مصنوعات سنگی نیز شبیه به هم بودند گرچه یک جهشِ تکنولوژیکی را می توان مابین آنها مشاهده کرد. همچنین، قابل ذکر است که نسبتِ گوسفند و بز در مجموعه بقایای جانوری، بیانگر افزایش قابل ملاحظه از 17 درصد در لایه های فراپارینه سنگی به 46 درصد در لایه آغاز نوسنگی است. گرچه از نظر اندازه، به نظر می رسد که بزهای به دست آمده در لایه آغاز نوسنگی مربوط به نمونه های وحشیِ آن است، چنین ویژگی در گوسفند و بز نشانگر گرایش به اهلی سازی در آنهاست. تنها مطالعات بیشتر قادر به حل این مسئله خواهد بود.

کاوش های انجام گرفته در محوطه TB75 همچنین داده های جدیدی مربوط به دوران هخامنشی را به دست داد. به احتمال بسیار زیاد این غار در دوران هخامنشی و یا فراهخامنشی جهت پُست دیده بانی نظامی استفاده شده است. این فرضیه با توجه به بقایای به دست آمده در طی کاوش و همچنین موقعیت استراتژیک این محوطه قابل پشتیبانی است. چنانچه ما محوطه TB75 را در چارچوب مسیرهای ارتباطی و نه تنها در تنگ بلاغی ولی در بافت کل منطقه مابین تخت جمشید و پاسارگاد در نظر گیریم، می توانیم پویاییِ این محوطه را بیشتردرک کنیم. بنابراین، نتایج حاصل از کاوش های ما در محوطه TB75 باید همراه با نتایج به دست آمده از بررسی کلی منطقه مورد بحث قرار گیرد.

بررسی کلی ما در منطقه، چشم انداز جدیدی را برای تنگ بلاغی و نقش آن در مسیرهای تجاری نشان داد. اهمیت این مسیرها از دوره ای به دوره دیگر در تنگ بلاغی تغییر کرده است. بخش غربی آن مهمترین دروازه برای تنگ بلاغی از دوران پیش از تاریخ تا کنون بوده است. تنها استثنا در دوران هخامنشی است، زمانی که مسیرهای ارتباطی در شرق و جنوب اهمیت بیشتری یافت. موقعیت محوطه TB75 به عنوان یک محل اصلی در این دوران مد نظر بوده است. بررسی کلی ما داده های قابل ملاحظه ای را جهت درک جابجایی ها و مسیرهای ارتباطی در گذشته نشان می دهد، و به نظر می رسد که تنگ بلاغی نقش یک سیستم دفاعی را برای پاسارگاد در دوران هخامنشی ایفا می کرده است.

خاک کوبیده شده ساخته شده اند و دو دیواره سد با قلوه سنگ پوشیده شده است. اگر همه این آثار را بتوان به دوره هخامنشی تاریخ گذاری کرد، بیانگر این است که سیستم آبرسانی تنگ بلاغی و دشت پاسارگاد با دقت زیاد برای بهره مندی از حداکثر استفاده مفید از منابع آبی در این مناطق طرح ریزی شده بوده است. در نهایت، از آنجایی که این سیستم های آبرسانی در مقیاس گسترده ای ساخته شده اند و اغلب در دوره های بعد (حتی تا دوران حاضر) نیزمورد استفاده قرار گرفته اند، ما می توانیم بخش های زیادی از این سیستم آبرسانی که توسط ساخت و سازهای جدید از بین رفته اند را مشاهده کنیم. بررسی های باستان شناختی سال 1384 و 1385 در تنگ بلاغی و پیرامون آن، اهمیت تاریخی تنگ بلاغی را در حرکت عشایر کوچرو آشکار کرد. علاوه بر این، این بررسی ها بیانگر وجود یک سیستم دفاعی و مدیریت منابع آبی درمقیاس گسترده طی دوره هخامنشی است. اهمیت تاریخی تنگ بلاغی تنها در وجود محوطه های باستانی موجود در آن نیست، بلکه ارتباطات درون منطقه ای این محوطه ها نیز دارای اهمیت است.

## 12. نتیجه گیری

کاوش و بررسی های باستان شناختی انجام شده در طی سه فصل توسط هیئت ایران-ژاپن در تنگ بلاغی، اطلاعات جدیدی مربوط به دوران پیش از تاریخ و مطالعه جوامع کوچرو در استان فارس به دست داد. مهمترین نتایج به دست آمده مربوط به شناسایی توالی فرهنگی از دوران فراپارینه سنگی به آغاز نوسنگی در منطقه شرقِ زاگرس جنوبی است. در این بخش از زاگرس، محوطه هایِ با نهشته های فرهنگی مربوط به این دوران انتقالی تا کنون گزارش نشده است. تعداد زیادی غار و پناهگاه صخره ای مربوط به دوران فراپارینه سنگی، و تعدادی تپه های نوسنگیِ با سفال در استان فارس به ویژه در مرودشت، شناسایی و مورد مطالعه قرار گرفته است. به هر حال، دوران انتقالی مابین فراپارینه سنگی و آغاز نوسنگیِ با سفال همچنان به صورت یک وقفه در این منطقه باقی است. و البته، این دوران انتقالی، کلید حلِ معمای مسئله نوسنگی گرایی است. چنین وقفه ای در مطالعات باستان شناختی چنین می نماید که این بخش از زاگرس نقشی در این دوران انتقالی مهم نداشته است. پیش از این چنین انگاشته می شد که محوطه های باستان شناختی مربوط به این دوران انتقالی در این منطقه وجود ندارد. و نیز چنین انگاشته شده بود که دوران نوسنگی در این بخش از زاگرس کاملاً دیرتر و با فاز نوسنگیِ با سفال شروع شده است. به هر حال، مطالعات اخیر ما بیانگر وجود استقرارهای مربوط به این دوران کلیدی در این منطقه است. در این گزارش، ما این دوران انتقالی را "آغاز نوسنگی" می نامیم، و کشف این فاز فرهنگی در محوطه TB75 و TB130 داده های جدیدی را به دست داد که بیانگر تجدید نظر در مطالعه این دوران انتقالی است، که این بخش از زاگرس یکی از مناطقی است که از نظر مطالعات نوسنگی گرایی پس از حلال حاصلخیز، قابل مطالعه و بررسی است. همانطور که در این گزارش مشاهده می کنید، ما یک سِری از توالی های باستان شناختیِ تاریخ گذاری شده با روش کربن 14 مربوط به دوران فراپارینه سنگی تا آغاز نوسنگی و یا نوسنگی بی سفال را در محوطه TB75 شناسایی کردیم. نهشته های فرهنگی مربوط به دوران آغاز نوسنگی و یا نوسنگی بی سفال نیز در محوطه TB130 به دست آمد.

هنوز مواد بیشتری برای درک شیوه زندگی و اقتصاد معیشتی در طی دوران فراپارینه سنگی و آغاز نوسنگی در تنگ بلاغی مورد نیاز است. مصنوعات سنگی به دست آمده بیشتر شامل ریزتیغه ها و خراشنده ها، اِسکنه ها و ریزتیغه های هندسی است. این مصنوعات سنگی بیانگر فعالیت های مربوط به شکارگری، قصابی و کار با چوب است. نه در لایه های فراپارینه سنگی و نه در لایه های آغاز نوسنگی، هیچ گونه تیغه یا تراشه با اثر جَلایِ داس

برخی از قسمتهای معبر کنده شده در صخره و مسیر سنگچین به سمت این منبع آب امتداد یافته است. یک دیوار دفاعی نیز برروی حاشیه کوه در نزدیکی ورودی شمالی تنگ بلاغی شناسایی شد. با بررسی مجدد مسیر سنگچینی که در بخش مرکزی رودخانه سیوند یافت شد، ما حدس زدیم که آنها مربوط به دیوارهای سنگی شکارگاه شاهی بوده- اند. مسیر سنگچین، دشت سیلابی یکنواختی را احاطه کرده که به صورت یک زمین "بسته" است و رودخانه سیوند نیز در بخش شمالی آن جریان دارد. ما حدس می زنیم که احتمالاً یک ساختمان مهم در اینجا ساخته شده بوده است. تنگ بلاغی کوچک، به عنوان ورودی جنوبی تنگ بلاغی است و همچنین به عنوان نقطه استراتژیک مهمی برای دره و پیرامون آن، که دشت پاسارگاد نام دارد محسوب می شود. این دره همچنین از نظر منابع آبی و انتقال آب از رودخانه سیوند به دشت رحمت آباد یا دشت کمین دارای اهمیت است. یک استقرارگاه موقت بزرگ بر روی حاشیه تپه های غربی تنگ بلاغی کوچک شناسایی شد که دارای چندین دوره استقراری بوده، و از دوره باکون الف تا دوره هخامنشی را در برمی گیرد و احتمالاً استقرار اصلی در تنگ بلاغی کوچک بوده است. بر روی تپه های غربی تنگ بلاغی کوچک، موفق به شناسایی دو دیوار دفاعی دیگر و یک برج دیده بانی شدیم. این موضوع احتمالاً بیانگر این مطلب است که بخش غربی تنگ بلاغی کوچک مسیر حرکتی اصلی بوده و احتیاج به کنترل داشته است. بر اساس اطلاعات محلی، در این قسمت یک سد (سد سبزعلی) که محل فعلی سد سیوند بر روی آن قرار دارد وجود داشته است. کمی به سمت جنوب، نیز موفق به شناسایی بقایای یک سد قدیمی شدیم، که تا حدودی از بین رفته ، و از دیواره خاکی همراه با پوشش قلوه سنگ بر روی سطح آن ساخته شده است. اعتقاد ما بر این است که این دو سد در طی دوره هخامنشی ساخته شده و نقش مهمی را در تامین آب دشت رحمت آباد داشته اند. سیستم دفاعی که احتمالاً می توان آن را به دوره هخامنشی تاریخ گذاری کرد در یک محدوده جغرافیایی گسترده و همچنین در تنگ بلاغی یافت شد. اجزای اصلی سیستم دفاعی شامل 1) دیوار دفاعی، 2) برج دیده بانی، و 3) سیستم جاده شامل دیوارهای جانبی، مسیرهای سنگچین که به صورت متقاطع از جاده عبور می کنند، و ساختمان ها است. دیوارهای دفاعی در چند بخش شناسایی شد: 1) بر روی حاشیه تپه ها در شمال شرق دشت پاسارگاد، 2) بر روی حاشیه تپه ماهورهای شرق تنگ سعادت شهر، 3) در کوه دُم دریا، در جنوب شرقی دشت پاسارگاد، 4) بر روی حاشیه کوههای شمال غرب تنگ بلاغی، 5) بر روی حاشیه کوههای غرب تنگ بلاغی کوچک، 6) در دشت نَنه عربی درشمال غربی دشت پاسارگاد، و 7) در دره تنگ خُرخُره. برجهای دیده بانی بر روی تپه ای در حوضه آبشناسون، و بر روی پرتگاهی در تنگ بلاغی کوچک یافته شد. سیستم جاده شامل دیوارهای جانبی، مسیرهای سنگچین که به طور متقاطع از جاده عبور می کرد، و ساختمان ها (شاید محلهای کنترل) در شمال آبشناسون، بلاغی بزرگ، و بلاغی کوچک شناسایی شد. به نظر می رسد سیستم دفاعی جهت کنترل کردن حرکت مردمی که وارد تنگ بلاغی و دشت پاسارگاد می شدند، ساخته شده بوده است. برای مثال، دیوارهای دفاعی در طول یا در بالای مسیر حرکتی اصلی در تنگ بلاغی واقع شده اند. احتمالاً تنگ بلاغی نقطه استراتژیک در جنوب دشت پاسارگاد بوده و نیاز به کنترل حرکت مردم، شامل عشایر کوچرو، بازرگانان، پیک ها، حاملان هدایا، و غیره بوده که از این محل وارد دشت پاسارگاد می- شدند. در طی بررسی، بقایای چندین ساختار مربوط به سیستم آبرسانی تنگ بلاغی و دشت پاسارگاد کشف گردید. این ساختارها شامل کانال های کوچک و بزرگ، و سدها است. اعتقاد ما بر این است که همه این آثار مربوط به دوره هخامنشی هستند. کانال های آبرسانی در شمال غربی دشت پاسارگاد، در محدوده تل غلام، تنگ بلاغی، بلاغی کوچک، و در جنوب تنگ سعادت شهر یافته شد. یک کانال بزرگ نیز در جنوب شرقی دشت پاسارگاد در شرق جاده شیراز به اصفهان نیز شناسایی گردید. بقایای مربوط به سدها تنها در شمال تنگ سعادت شهر به سمت جنوب شرقی دشت پاسارگاد، و در تنگ بلاغی کوچک شناسایی شدند. این دو سد از

مطالعه اهمیت تاریخی تنگ بلاغی از نقطه نظر حرکت عشایرِ کوچرو بود. در طی این بررسی، پـراکنش محوطـه های باستان شناختی، شامل استقرارها، استقرارگاههای موقت، گورستان هـا، جـاده هـا، کانـال هـای آبرسـانی، و دیوارهـــای دفـــاعی بـــه طـــور کامـــل از طریـــق بررســـی پیمایـــشی گـــسترده و فـــشرده مـــشخص شـــد. هدف از بررسی در تابستان 1384، درک پراکنش محوطه های باستان شناختی در طول بخش هـای شـمالی و جنوبی رودخانه سیوند در تنگ بلاغی بود. تمرکز اصلی در این بررسی، مشخص کردن "جاده شاهی" کـه توسـط آقای عطایی در سال 1382 بازشناسی شده بود قرار گرفت. علاوه بر این، بررسیِ پیمایشی در دره های کوچکی که در بخش شمالی تنگ بلاغی از ورودی شمالی به طرف تنگ خُرخُره ادامه می یافت، انجام شد. هدف بررسـی در زمستان 1385، به دو بخش مجزا تقسیم می شد. اولین بخش، پرداختن به اهمیت تـاریخی تنـگ بلاغـی از نقطه نظر مسیرهای حرکت عشایر کوچرو بود. به همین منظور، بخش شمالی دشت پاسارگاد، یعنی محـدوده تُـل غلام و ورودی جنوبی تنگ بلاغی، یعنی محدوده بلاغی کوچک انتخاب شد. دومین بخش، ارزیابی دوباره اهمیت تاریخی تنگ بلاغی در طی دوره هخامنشی، به ویژه از نظر ساخت و سازهای مربوط بـه جـاده هـا، کانـال هـای آبرسانی، و سیستم دفاعی بود. به همین منظور، ما برخی از آثار باستان شناختی موجود در تنـگ بلاغـی را کـه در سال 1384 بررسی شده بود، دوباره مورد بررسی قرار دادیم. علاوه بر این، بررسی بر روی کوههای اطراف تنگ بلاغی شامل بخش شمالی کوه بلاغی کوچک نیز انجام شد.

در طول بخش های شمالی و جنوبی رودخانه سیوند، بقایای مربوط به جاده و سیستم کانال آبرسـانی و همچنـین استقرارگاههای موقت، گورستان ها و گورهای سنگچین شناسایی شد. جاده و سیستم کانال آبرسـانی از ورودی شمالی دره بلاغی امتداد یافته و به سمت جنوب در بخش مرکزی دره کشیده شـده و سـپس وارد تنـگ بلاغـیِ کوچک می شود. بر اساس اطلاعات به دست آمده از افراد محلی، عشایر کوچروی جدید از سـمت تنـگ بلاغـیِ کوچک وارد تنگ بلاغی می شوند. آنها یا به سمت غرب در طول دامنه جنوبی کوهها و یـا بـه سـمت شـمال و سپس به سمت غرب در طول دامنه شمالی کوهها حرکت می کنند. مـسیر دوم بـه تنـگ خُرخُـره و سـپس تُـل قربانقلی منتهی می شود، و پس از آن به سمت استقرارگاههای تابستانی امتداد می یابد. به طور مسلم، آنها مسیر مورد استفاده دیگر را در پاییز استفاده کرده و به سمت استقرارگاههای زمـستانی کـه در بخـش جنـوبی منطقـه فارس قرار گرفته اند حرکت می کنند. چنین مسیرهای حرکتی برای مدتی طولانی مـورد اسـتفاده قـرار گرفتـه است. در طی دوران هخامنشی، احتمالاً مسیری که از شرق به غربِ تنگ بلاغی می گذشـته اسـت بـه تـدریج دارای اهمیت شد. اهمیت این مسیر به علت ساخت و سازهای مربوط به "جاده شاهی" که پاسارگاد را به تخـت جمشید متصل می کرده است به طور چشمگیری افزایش یافت. پس از فروپاشی امپراطوری هخامنشی، در طـی دوران پارتی و ساسانی، "جاده شاهی" احتمالاً اهمیت خود را از دست داده و متروک شد. این موضوع با توجه به وجود گورهای سنگچین که بر روی "جاده شاهی" با استفاده از سنگهای به کـار بـرده شـده در سـاخت "جـاده شاهی"ساخته شده اند قابل اثبات است. از رونق افتادن و متروک شدن "جاده شاهی" احتمالاً منجـر بـه احیـای دوباره مسیر غربی در بالا به عنوان مسیر حرکتی اصلی در تنگ بلاغی شد. گرچه مسیر حرکتی اصلی به سـمت غرب تغییر کرد، ولی مسیری که از تنگ بلاغی می گذشت احتمالاً توسط عشایر کوچرو مورد استفاده قرار گرفته است. در طی بررسی سال 1385، معبرکنده شده در صخره موسوم به دختر بُر و مسیر سنگچینی که در بخـش شرقی رودخانه سیوند در تنگ بلاغی قرار داشت مورد بررسی مجدد قرار گرفت. دوبـاره متـذکر مـی شـویم کـه کانال آبرسانی، جاده، و دیوار دفاعی وجود داشته است. در مورد کانال آبرسانی، موفق شدیم تا منبـع آبـی کـه در حدود 1.5 کیلومتری جنوب شرقی ورودی شمالی تنگ بلاغی (چشمه دره سُرخ) قرار داشت را شناسایی کنـیم.

محوطه های قدیم غرب آسیا رواج ندارد.

اشکفت حاجی بهرامی مربوط به دوران مابین فراپارینه سنگی و آغاز نوسنگی دانسته شده است. این دوره تاکنون در این منطقه مورد کاوش قرار نگرفته، بنابراین مطالعه بقایای گیاهی به دست آمده دارای ارزش زیادی است. نتایج مطالعه حاضر به طور یقین نشان دهنده گونه های Astragalu/Trigonella، legumes و احتمالا Stipa است که همگی به مقدار زیاد از محوطه های قدیمِ غرب آسیا یافت شده اند. از طرفی چندین نمونه گیاهی مشکوک برای دوره های قدیم مانند گندم نان (نمونه شماره7) احتمالاً بیانگر درهم ریختگی لایه ها در هنگام کاوش است. این مشکلِ آلودگی احتمالی، به همراه تعداد بسیار محدود بقایای سوخته ، به طور حتم بر درستیِ شناسایی گونه ها تاثیر داشته است، در واقع، هیچ گونه قابل تشخیص از نمونه های شماره 1، 3، 4 و 10 یافت نشد. مطالعه حاضر، اطلاعات مقدماتی جنبه های گیاه شناختی ای منطقه را به دست می دهد، ولی مطالعات دقیقِ بیشتری برای بازسازی پوشش گیاهی و استفاده از گیاهان در این منطقه در دوران باستان لازم است.

## 10. تاریخ گذاری زغالهای به دست آمده از محوطه TB75 به روش کربن 14

در مطالعات باستان شناختی، تاریخ گذاری به روش کربن 14 به طور معمول برای تخمین مدت زمان استفاده از یک محوطه باستانی، بر اساس مطالعه مواد اُرگانیکِ باقی مانده در محوطه هایی که کمتر از 50000 سال قدمت دارند استفاده می شود (Libby 1955). به ویژه، تاریخ گذاری کربن 14 با استفاده از روش AMS برای نمونه های کوچک استفاده می شود، چراکه با استفاده از این روش، تنها چند میلی گرم کربن برای اندازه گیری در مراحل نهاییِ تاریخ گذاری نیاز است (Nakamura 2000).

دَه نمونه زغال به دست آمده از محوطه TB75 جهت تاریخ گذاری به روش کربن 14 با استفاده از روش AMS در آزمایشگاه بخش پژوهش- های گاهشناختی دانشگاه ناگویای ژاپن تاریخ گذاری شده است. چهار نمونه از این تعداد، از لایه منتسب به آغاز نوسنگی برداشت شده و تاریخی مابین 45±8480 تا 45±10190 سال پیش و پنج نمونه نیز مربوط به لایه فراپارینه سنگی است که تاریخی مابین 50±12225 تا 70±16650 سال پیش را نشان می دهد. این تاریخ ها پس از کالیبره شدن، به ترتیب تاریخی برابر با 7490-7590 پ.م. تا 9760-10115 پ.م. و 11980-12290 پ.م. تا 17600-18000 پ.م. را ارائه دادند. تاریخ گذاری های کربن 14 و همچنین تاریخ های کالیبره شده از این دو دوره تاریخی، به صورت کاملاً یکپارچه در طبقه بندی مربوط به هر دوره چنانچه در بافت باستان شناختی نیز تخمین زده شده بود هستند.

مشخصه های نمونه زغال های برداشت شده برای تاریخ گذاری کربن 14 در جدول 10.1 آورده شده است. چهار نمونه مربوط به دوران آغاز نوسنگی و شِش نمونه نیز مربوط به دوران فراپارینه سنگی است. ستون دوم اینِ جدول بیانگر ترانشه، شماره سطل و لایه ای است که نمونه ها از آن برداشت شده است.

## 11. بررسی باستان شناختی تنگ بلاغی و پیرامون آن.

بررسی باستان شناختی تنگ بلاغی و پیرامون آن توسط هیئت باستان شناختی ایران-ژاپن (پژوهشکده باستان شناسی و دانشگاه سوکوبا) در تابستان 1384 و زمستان 1385 انجام شد. هدف از این بررسی، بررسی و

## 9. بقایای گیاهی به دست آمده از محوطه TB75

مقداری بقایای سوخته با استفاده از شناورسازی با سَرَند دستی در طی کاوش جمع آوری شده که جهت مطالعه به آزمایشگاه فرستاده شد. موقعیت نمونه های برداشت شده در حفاری، تاریخ و دیگر اطلاعات مربوط به این نمونه ها در جدول 9.1 آورده شده است. مقدار خاکی که نمونه ها از آن برداشت شده اندازه گیری نشده و تنها مقدار کمی بقایای سوخته از آنها به دست آمده است. با این حال، برخی گونه های قابل شناسایی نیز وجود دارند. نتایج مطالعه این نمونه ها در جدول 9.2 آورده شده است.

### نمونه شماره 2 (فراپارینه سنگی)

سه گونه Leguminosae، یک گونه Gramineae و یک گونه دانه نامشخص از نمونه شماره 2 یافت شده است. از سه گونه Leguminosae یافت شده، 1 دانه احتمالامربوط به Astragalus یا Trigonella است (شکل 9.1). این دو گروه به جز برخی گونه های شاخصِ آن به سختی قابل تشخیص هستند. این سختی بیشتر به دلیل ریخت شناسی برخی دانه های Astragalus است که دارای گونه های مختلف هستند. دیگر دانه های Leguminosae و یک دانه Gramineae به علت آسیب دیدگی، به سختی قابل تشخیص هستند ولی شکل استوانه ای گونه دوم نزدیک به شاخصه Stipa است. از طرفی یک دانه نامشخص، احتمالاً مربوط به نوعی از Malva به دست آمده که ریخت شناسی آن برای این نوع خیلی شاخص نیست و سطح مشخصی ندارد، و شناسایی این گونه را ناممکن می کند.

### نمونه شماره 6 (آغاز نوسنگی)

تنها یک تکه از عدس (Lens) یافت شد.

### نمونه شماره 7 (فراپارینه سنگی)

این نمونه دارای گونه های قابل تشخیص زیادی است. تکه های دانه گندم(1)، دانه جو(1)، تکه های Prunus و Amzgdalus(2)، دانه Papaveraceae (1) (شکل 9.2) و دانه Leguminosae(2) یافت شد. دانه گندم این نمونه، به احتمال زیاد مربوط به گندم نان است (شکل 9.3)، گرچه بقایای سُنبله آن برای شناسایی درستِ این گونه از گندمِ بدون پوست ضروری است (i.e. Triticum turgidum, durum, Triticum aestivum). از آنجا که قدیمی ترین گونه شناخته شده از گندمِ بدون پوست مربوط به 6650- 7250 پ.م در تل بوغراس در سوریه است، به نظر می رسد که احتمالاً دانه گندم به دست آمده از لایه فراپارینه سنگی در اشکفت حاجی بهرامی به صورت مظطرب وارد این لایه شده است.

### نمونه شماره 8 (فراپارینه سنگی)

بقایای گیاهی به دست آمده از نمونه شماره 8 تا حدود زیادی شبیه به گونه های به دست آمده از نمونه شماره 2 است. دو Leguminosae و دو Gramineae به دست آمد. یکی از دو Leguminosae به دست آمده، مربوط به گونه Astragalus/Trigonella است. یکی از Gramineae های به دست آمده احتمالاً مربوط به Stipa بوده و دیگری شبیه به ریخت شناسی Setaria است (شکل 9.4). گونه دوم چندان در

نتایج بررسی کلی تنگ بلاغی در فصل 11 آورده شده است. ولی برخی از تکه سفالهای شاخص به دست آمده در طی این بررسی در اینجا توضیح داده می شود. لبه های خمره های بزرگ دارای انتهایِ تخت و شیارهای افقی هستند (شکل4-7.4.1). برخی از آنها دارای تزئین کنده هستند. شبیه به این نمونه، از تپه سوروان (Atarashi and Horiuchi 1963: Pl.16:13) و شوش (Niveau 3, Chaour:Larbrosse and Boucharlat 1974: Fig.48:2)، گزارش شده و دارای خمیره مشابه به آنهایی است که از بررسی کلی تنگ بلاغی به دست آمده است. بنابراین، این خمره ها را می توان به اواخر دوران هخامنشی تاریخ گذاری کرد. سفال های لعاب دار اسلامی نیز به دست آمده است (شکل 7.4.8). ته این ظروف در هر دو سطح با لعابِ رقیق سفید رنگ و سطح داخلی سفال با لعاب سبز رنگ پوشیده شده است.

گرچه یافته های شاخص دوره فراهخامنشی که از تل تَختِ پاسارگاد ، برای نمونه، "بشقاب ماهی"، که "کاسه ای با کف حلقوی و لبه به داخل برگشته" است، و دیگر انواع سفال در محوطه TB75 و TB130 به دست نیامده ، ولی بعضی از سفالهای یافت شده در لایه 2 محوطه TB75 قابل تاریخ گذاری به این دوره هستند. به هرحال، امکان تقسیم بندی نمونه های به دست آمده به دو دوره هخامنشی و فراهخامنشی وجود ندارد. در آینده، این موضوع دارای اهمیت است که یافته های به دست آمده از لایه 2 محوطه TB75، را با آنهایی که از پاسارگاد، TB76,77,85 و TB88 به دست آمده (پژوهشکده باستان شناسی 1385و 1386)، جهت مطالعه توالی گاهنگاری مواد فرهنگی دوران هخامنشی و فرا هخامنشی در تنگ بلاغی مقایسه کنیم.

## 8. بقایای جانوری به دست آمده از محوطه TB75

نتایج مطالعات انجام شده بر بقایای جانوری به دست آمده از محوطه TB75 بیانگر طیف وسیعی از جانوران استفاده شده در دوران پیش از تاریخ در این محوطه است. گاوسانان با اندازه متوسط مهمترین جانور شکار شده از نظر منابع غذایی در این طیف گسترده هستند، در این میان غزال مهمترین حیوان شکار شده در طی دوران فراپارینه سنگی و آغاز نوسنگی است. افزایش در تعداد گوسفند و بز، به ویژه بز، از دوران فراپارینه سنگی به آغاز نوسنگی به طور مشخص دیده می شود. با توجه به مدارک موجود نمی توان مشخص کرد که گوسفند و بز پیش از این در دوران آغاز نوسنگی اهلی شده بوده اند یا نه. پراکنش مقدار استخوان های به دست آمده از بز و گوسفند بیانگر جمعیت نسبتاً یکسان است، و مقایسه اندازه گیری های جداگانه انجام شده در رابطه با استخوان بزها نیز بیانگر این است که نمونه های موجود در طیف اندازه های مربوط به نوع وحشیِ آن است.

استخوان های مربوط به خوک و گاو در در لایه های فراپارینه سنگی به دست نیامد، ولی در لایه آغاز نوسنگی وجود دارد. گرچه دندانِ مربوط به گاو در لایه آغاز نوسنگی به دست آمده، ولی احتمالاً این حیوان بعد ها به این منطقه وارد شده است، و تنها در دوران هخامنشی است که افزایش تعداد نمونه ها کاملاً دیده می شود.

بیشتر نمونه های به دست آمده از گوسفند، بز، گاو و خوک در لایه های دوران هخامنشی و اسلامی احتمالاً اهلی شده هستند. این نمونه ها بیش از نیمی از نمونه های شناسایی شده در دوره هخامنشی را شامل می شوند. شکار غزال همچنان ادامه داشته، ولی اهمیت آن نسبت به دوران پیش از تاریخ کاهش یافته است. بقایای اسب سانان نیز به مقدار زیادی در دوراه هخامنشی افزایش داشته، و بیانگر اهمیت استراتژیک محوطه است.

محوطه TB75 به دست آمده است (شکل 7.2.10). دارای خمیره بسیار ظریف همراه با ماده چسباننده ماسه سفید رنگ است. قمقمه های سفالی یکی از شاخص ترین ظروف سفالی اواخر دوران هخامنشی و فرا هخامنشی است. سطح خارجی آن به رنگ نارنجی، و داغدار است. مغز تیره سفال در مقطع آن به رنگ خاکستری مایل به سبز است.

تکه سفالهای به رنگ خاکستری مایل به زرد به تعداد زیاد از لایه 2 در محوطه TB75 به دست آمده است. از آنجا که بیشتر آنها دارای اندازه کوچک و مربوط به بدنه سفال هستند، بازسازی شکل اصلی سفال دشوار است. یکی از این نمونه ها مربوط به سبویی با کف تخت است (شکل 7.2.12). سطح درونی آن دارای پوشش دست مرطوب به شکل افقی است. خمیره آن خشن و سخت است. سطح درونی سفال و رنگ خمیره آن خاکستری مایل به نارنجی است و سطح بیرونی آن نارنجی مایل به زرد کم رنگ است.

همچنین تعدادی تکه سفال خاکستری روشن وجود دارد (شکل 7.2.13). این نمونه ها، چرخ ساز بوده و دارای پوشش دست مرطوب به شکل افقی هستند. خمیره آنها خشن و دارای ماده چسباننده شن است.

گرچه لایه 1 مربوط به دوران اسلامی است، ولی تکه سفالهای اواخر هخامنشی و فرا هخامنشی نیز از آن به دست آمده است. یک تکه لبه سفال، از این لایه به دست آمده، که به نظر می رسد مربوط به اواخر دوران هخامنشی یا فرا هخامنشی است (شکل 7.2.2). همان شکل ظرف از تل تخت، در پاسارگاد به دست آمده است (Stronach 1978: Pl.119:26). خمیره آن خشن و دارای ماده چسباننده شن است. سطح خارجی آن به رنگ نارنجی و سطح داخلی و خمیره آن به رنگ قهوه ای مایل به قرمز کم رنگ است. یک تکه لبه مربوط به یک بطری سفالی نیز از لایه 1 به دست آمده است، که احتمالا مربوط به اواخر دوران هخامنشی و یا فرا هخامنشی است (شکل 7.2.5). مشابه این نمونه از تل تَخت، در پاسارگاد گزارش شده است (Stronach 1978: Fig.116:7-10,12,13).

تعداد کمی اشیای آهنی نیز از محوطه TB75به دست آمده است. نمونه قابل ملاحظه مربوط به یک سرپیکان سه پَره است (شکل 7.3.1). گرچه سرپیکان های سه پَره ای در دوران هخامنشی رایج هستند، نمونه های آهنیِ آن جزو نمونه های استثنائی هستند. با این حال، یک نمونه سرپیکان سه پَره آهنی از گنجینه تخت جمشید گزارش شده است (Schmidt 1957: Pl.76:15). علاوه بر این، یک سرپیکان چهار پَره از دهکده هخامنشی در شوش به دست آمده است (Ghirshman 1954: Pl.43:G.S.1030c). باید این نکته را خاطر نشان کرد که این نمونه از نظر شکل ، شبیه به سرپیکان آهنی به دست آمده از محوطه TB75 است. علاوه بر این، تکه هایی از یک سوزن یا میخ آهنی از لایه 2 به دست آمده است. هردو سرِ این نمونه از بین رفته و مقطع آن به صورت نامنظم دیده می شود.

تنها یک نمونه قاشقک مفرغی از لایه 1به دست آمده که بخش پایینی آن از بین رفته است. نمونه های مشابه به این نمونه از تل تَخت، در پاسارگاد (Stronach 1978: Fig.91:12) و کاخ شائور در شوش (Labrousse 1974: Fig.28:2,3) به دست آمده است. نمونه یافت شده از پاسارگاد به دوران فرا هخامنشی، و نمونه یافت شده از شوش به دوران ساسانی یا اوایل اسلام تاریخ گذاری شده است.

تعداد کمی تکه سفال از محوطه TB130 نیز یافت شد (شکل 7-7.3.5). به دلیل صدماتی که به سطح سفال ها رسیده و همچنین کوچک بودن این نمونه ها، تاریخ گذاری دقیق این سفالها میسر نبود.

امیدواریم که در آینده مصنوعات سنگی قابل مقایسه با مصنوعات سنگی به دست آمده از محوطه TB75 و TB130 در کاوشهای سیستماتیک مناطق همجوار یافت شود، تا از گاهنگاری دوران مابین فراپارینه سنگی تا آغاز نوسنگیِ پیشنهاد شده در این گزارش حمایت کند.

## 7. بقایای هخامنشی و فرا هخامنشی به دست آمده از محوطه TB75 ، TB130 و بررسی کلی منطقه

بیشتر سفالهای یافت شده از لایه 2 در محوطه TB75، قابل تاریخ گذاری به دوره هخامنشی و فرا هخامنشی هستند. تعدادی مصنوعات ساخته شده از آهن و مفرغ نیز از این لایه به دست آمده که مربوط به این دوره ها هستند. از آنجایی که تعدادی تکه سفال مربوط به خمره های با تزئین نوارهای برجسته در لایه 2 به دست آمده، می توان این لایه را به اواخر دوره هخامنشی تاریخ گذاری کرد. علاوه بر این، یک قمقمه و یک سرپیکان سه پَره، که از اشیای شاخص اواخر دوره هخامنشی هستند در فصل دوم یافت شد. تعدادی تکه سفال، که مربوط به دوره فراهخامنشی هستند، نیز از لایه 2 در محوطه TB75 به دست آمد. در حال حاضر، لایه 2 در این محوطه مربوط به دوره هخامنشی و فراهخامنشی دانسته شده است، گرچه تعدادی تکه سفال غیر شاخص نیز از لایه 2 به دست آمده است.

بیشتر سفالهای به دست آمده از لایه 2 محوطه TB75، چرخ ساز و دارای پخت مناسب هستند. رنگ سطح این سفالها دارای طیفی از خاکستری تا نارنجی، و تعداد کمی از آنها دارای رنگ خاکستری روشن هستند. بیشتر نمونه های ما دارای ماده چسباننده شن هستند و سطح سفال به صورت افقی دارای پوشش دست مرطوب است، ولی تعداد کمی از آنها نیز دارای سطح داغدار یا خراشیده شده هستند.

بیشتر سفالهای شاخص اواخر دوران هخامنشیِ به دست آمده از محوطه TB75، مربوط به تکه هایی از خمره های بزرگ با تزئین نوار برجسته هستند (شکل 7.1.1، 3، 8-5). تزئینات نوار برجسه از نظر شکل و فاصله مابینِ آنها متفاوت هستند. گرچه نمونه های به دست آمده از تخت جمشید (Schmidt 1957: Pl.73:7)، تل تَخت، در پاسارگاد (Stronach 1978: Fig.121:10) و تپه سوروان (Atarashi 1963: Pl.17) دارای تزئینات برجسته به شکل پهن تری هستند، ولی نمونه های به دست آمده از محوطه TB75 به نظر می رسد که به طور نسبی باریک تر هستند. دو نمونه از آنها دارای پوشش غلیظ خاکستری روشن یا نارنجی مایل به زرد هستند (شکل 7.1.5،8). این نمونه ها در پیتِ شماره یک در ترانشه D به دست آمده اند. دارای خمیره خشن، ماده چسباننده شن و به خوبی حرارت دیده اند. مغز و سطح داخلی آنها به رنگ نارنجی است. هر دو سطح آنها نیز دارای پرداخت به روش پوششِ دست مرطوب است.

یک تکه از سبوی سفالی نیز از همان پیت به دست آمده است (شکل 7.2.4). این نمونه دارای خمیره ظریف همراه با ماده چسباننده ماسه های سفید و سیاه است. هر دو سطح سفال دارای پرداخت به روش دست مرطوب به شکل افقی است.

نمونه های مشابه به این نمونه از تل تخت، در پاسارگاد (Stronach 1978: Fig.118:1,2,4-6,8,9) و تپه سوروان (Atarashi and Horiuchi 1963: Pl.15:9) گزارش شده است. تاریخ این ظروف به اواخر دوران هخامنشی و یا فرا هخامنشی نسبت داده شده است. تنها یک تکه از یک قمقمه سفالی در لایه 2

نظر گرفته شده اند، و ریز تیغه ها نیز تیغه هایی با عرض کمتر از 1.2 سانتی متر در نظر گرفته شده اند.

شکل های سنگ مادرهای مربوط به تیغه ها بیشتر به شکل منشوری، و سنگ مادرهای ریزتیغه ها به شکل مخروطی، هِرَمی یا منشوری است، ولی تنها تعداد اندکی سنگ مادر "فِشنگی" مربوط به ریزتیغه ها به دست آمده است.

تراشه های حاصل از احیای سنگ مادر شامل دیسک های سنگ مادر، تراشه های مربوط به بخش تحتانیِ سنگ مادر، تراشه های جدا شده از سطح سنگ مادر و تغییر جهتِ ساخت تراشه ها است.

خرده ریزهای بسار کوچک در اینجا حاصلِ ساخت تراشه های جدا شده از سطح سنگ مادر، و تراشه های روتوش شده حاصل از تعدیل دوباره روتوش در نظر گرفته شده است. به هرحال، تمایز قائل شدن میان این دو مشکل است، مگر اینکه آنها را بازسازی مجدد کرد. در دسته تراشه های روتوش شده، اِسکنه ها و تراشه های حاصل از احیای لبه های خراشنده های انتهایی قرار دارند.

نمونه های روتوش شده شامل ابزارها و یا سلاح ها از قبیل قطعات کول دار، دندانه دار، خراشنده های جانبی، خراشنده های انتهایی، خراشنده های شَستی و اِسکنه ها است. در بیشتر مواقع، آنها بسیار کوچک هستند، و تعدادی از آنها را می توان جزو ریزابزارهای غیر هندسی، مانند ریزتیغه های کول دار، روتوش شده و دندانه دار در نظر گرفت. به این مجموعه می توان ریزابزارهای هندسی از دسته لونِیت(Lunate) و ذوذنقه ای شکل را اضافه کرد، گرچه از نظر تعداد اندک هستند.

نکته قابل توجه این است که تیغه های ساخته شده با تکنیک جداسازی فشاری، که مشخصه صنایع سنگی نوسنگی متاخر در این منطقه است، هرگز به دست نیامده است. همچنین نکته قابل توجه دیگر، نبود تکنیک استفاده از حرارت است، که گفته شده در دوران نوسنگی جهت بهبود بخشیدن کیفیت مواد خام برای ساخت آسان ترِ مصنوعات سنگی بکار برده شده است. علاوه بر این، هیچ نمونه ای با اثر جَلا حاکی از استفاده آن برای دروکردن غلاتِ کشت شده به دست نیامده است.

هیچ نمونه ای از ریز- اسکنه به دست نیامده است، و نبود آنها در محوطه TB75 و TB130 به طور قوی بیانگر این است که ریزابزارهای هندسیِ این محوطه ها با روش روتوش کردن ریزتیغه ها ساخته شده اند، و نه با استفاده از تکنیک ریز- اسکنه. این موضوع از طریق اندازه های ریزتیغه ها، با عرض 2 تا 5 میلی متر، و توسط اندازه های ریزابزارهای هندسی قابل اثبات است.

نبود تکنیک ریز- اسکنه در محوطه TB75 و TB130 ما را به این موضوع رهنمون می کند که استفاده از این تکنیک پیش از این توسط ساکنان تنگ بلاغی متوقف شده و یا هرگز شناخته شده در این منطقه نبوده است.

مصنوعات سنگی به دست آمده از این دو محوطه، بدون تردید داده های جدیدی را برای پژوهش های پیش ازتاریخِ مربوط به دوران فراپارینه سنگی و آغاز نوسنگی در منطقه زاگرس ارائه داده است. این مواد نه تنها از این نظر که داده های جدیدی هستند قابل اهمیت است بلکه از این نظر که داده های جالبی را ارائه داده اند که می تواند به حل یک موضوع پژوهشیِ مهم در باستان شناسی کمک کند دارای اهمیت هستند، به عبارت دیگر، ارتباط مابین "تغییرات فرهنگی" و "تغییرات رفتار انسانی".

پایینی تراس، که مقدار زیادی مصنوعات سنگی در طی بررسی از آن به دست آمد قابل مشاهده است. وجود این مصنوعات سنگی، ما را برای کاوش در این بخش ترغیب کرد چرا که این مصنوعات نیز متعلق به دوران فراپارینه سنگی و آغاز نوسنگی است.

در ابتدا ترانشه ای به ابعاد 2 × 2 متر (ترانشه A) درون پناهگاه ایجاد شد، و دو ترانشه به ابعاد 1 × 2 متر (ترانشه B و C) در بخش میانی تراس مقابل محوطه در یک محور شمالی- جنوبی ایجاد شد. سپس، ترانشه دیگری به ابعاد 1 × 2 متر (ترانشهD) در فاصله چهار متری شرق ترانشه B ایجاد شد. از آنجا که در این ترانشه بخشی از یک سطح سنگچین شده به دست آمد، ترانشه دیگری به ابعاد 1 × 2 متر (ترانشه E) به آن متصل شد. بنابراین، مساحت کاوش شده در این محوطه به 12 متر مربع رسید.

همه این ترانشه ها، به جز ترانشه A، دارای لایه های فرهنگی آغاز نوسنگی هستند، که مقدار قابل ملاحظه ای مصنوعات سنگی و خُرده ریزهای دورریز از آنها به دست آمد. یک سطح سنگچین شده خشن و ناصاف نیز در ترانشه D-E به دست آمد. بنابراین، به احتمال زیاد مردمِ آغاز نوسنگی، تراس محوطه TB130 را به عنوان کارگاه ابزارسازی استفاده کرده اند.

## 6. مصنوعات سنگی به دست آمده از محوطه TB75 و TB130

مصنوعات سنگی به دست آمده از محوطه TB75(اشکفت حاجی بهرامی) و محوطه TB130 در سال 1384 و 1385 مجموعاً شامل 10730 قطعه است. از این تعداد، نمونه های کامل شامل 3922 قطعه در سال 1384، شامل 1250 نمونه از محوطه TB75و TB130، و 2672 نمونه در سال 1385 از محوطه TB75 به دست آمده است.

مصنوعات سنگی از چِرت- شبیه به فلینت ساخته شده اند. مصنوعات سنگی محوطه TB75 و TB130 دارای رنگهای مختلف در طیفی از قهوه ای تیره تا سبز هستند، و اندازه مواد خام این مصنوعات سنگی کوچک است، به ویژه در لایه های بالایی. بنابر اندازه گیری های انجام شده، بزرگترین دست افزار سنگی در لایه های پایین (6 و 5) در محوطه TB75 مربوط به یک سنگ مادرِ تیغه از لایه 5 است که دارای 82 میلی متر طول، 53 میلی متر عرض و 48 میلی متر ضخامت است. بزرگترین دست افزار سنگی در لایه های بالایی (4 تا1 ) محوطه TB75 مربوط به یک سنگ مادر با یک سکوی ضربه است که از لایه 1 به دست آمده است، و دارای 47 میلی متر طول، 24 میلی متر عرض و 24 میلی متر ضخامت است.

مصنوعات سنگی به دست آمده به چندین گروه تقسیم می شوند که شامل، خُرده ریزهای دورریز، تراشه های حاصل از احیایِ سنگ مادر، قطعات بسیار کوچک یا تراشه های روتوش شده، قطعات روتوش شده و سنگ مادرها است. از نظر گونه شناسی ابزارها، مصنوعات سنگی دارای مشخصه های یکدست و مشابهی در تمام لایه ها هستند. مشخصه های ساخت این مصنوعات، به هرحال، به صورت تدریجی و مداوم از لایه- ای به لایه دیگر دارای تغییراتی نیز هست.

قطعات دورریز، مربوط به ساخت تراشه های حاصل از احیایِ سنگ مادر در نظر گرفته شده اند، و به تراشه هایِ با کورتِکس، تا حدی با کورتِکس و تراشه های بدون کورتِکس تقسیم شده اند، مابقی آنها نیز بیشتر به تراشه ها، تیغه ها و ریز تیغه ها تقسیم شده اند. تیغه ها در اینجا به تراشه هایی با طول مساوی یا بیش از دوبرابرِ عرض در

این عمق به بستر صخره ای غار نرسیدیم. همانطور که به صورت دقیق تر خواهید دید، نهشته های فرهنگی در این قسمت را می توان به سه فاز فرهنگی تقسیم کرد: اسلامی، هخامنشی، و آغاز نوسنگی. ترانشه B در میانه تراس مقابل غار، در ارتفاع مابین 1863- 1862.5 متر، و در فاصله حدود 36 متری جنوب غربی ترانشه A ایجاد شد. نهشته های فرهنگی از سطح تا بستر صخره ای کوه حدود 1 متر ضخامت دارد. گرچه نهشته های فرهنگی ترانشه B را می توان به سه لایه تقسیم کرد، همه آنها دارای ویژگی های مشابه و مربوط به فاز آغاز نوسنگی هستند.

به خاطر دستیابی به مواد باستان شناختی بیشتر، به ویژه مواد اُرگانیک مانند ذغال، استخوان های حیوانی و بقایای گیاهی، دو ترانشه دیگر در دهانه ورودی غار در فصل دوم (1385) مورد کاوش قرار گرفت. ترانشهC ، به ابعاد 2 × 2 متر، در شرق ترانشه A ایجاد شد. ترانشه D، به ابعاد 3 × 2 متر، در دهانه ورودی غار، و 1.5 متری جنوب ترانشه C ایجاد شد (شکل 4.3). در عمق حدود 2 متر، هر دو ترانشه به خاک بکر رسید. هر دو ترانشه تقریباً فازهای فرهنگی مشابهی را ارائه داد، یعنی اسلامی، هخامنشی، آغاز نوسنگی و فراپارینه سنگی. در مجموع، 12 متر مربع از نهشته های فرهنگی در داخل غار، و 2 متر مربع در تراس مقابل غار مورد کاوش قرار گرفت.

## 5. کاوش در محوطه TB130

همانطور که پیش تر گفته شد، دامنه جنوبی کوه بلاغیِ بزرگ شرایط زمین شناختی مناسبی را برای شکل گیری غارهای آهکی فراهم کرده است. محوطه TB130 یکی از این غارهاست، که در حدود 1.2 کیلومتری شرق محوطه TB75 واقع شده است. به هر حال، TB130 دارای عمق زیادی نبوده و می توان آنرا یک پناهگاه صخره ای نامید تا یک غار(تصویر 5.1، 5.2). این پناهگاه صخره ای در میانه دامنه کوه در ضلع غربی دره ای کوچک واقع شده است، و وادی کوچکی با جهت شمالی- جنوبی در کنار آن وجود دارد(تصویر 5.3). این پناهگاه در یک پیش آمدگیِ آهکی با جهت شرقی شکل گرفته است. دهانه آن به سمت جنوب شرقی است و بخش کمی از تنگ بلاغی از این قسمت قابل مشاهده است. دیدِ این محوطه بسیار کمتر از محوطه TB75 است. احتمالاً این یکی از دلایلی است که نهشته های فرهنگی دوران هخامنشی در این محوطه وجود ندارد. به هرحال، محیط زیست طبیعی اطراف محوطه TB130، جدای از چشم انداز، کاملاً شبیه به محوطه TB75 است. در اینجا نیز صخره های آهکی بزرگی در دامنه های این دره کوچک در جایی که محوطه TB130 قرار دارد پراکنده است. در اینجا نیز هیچ گونه زمین حاصلخیزی برای کشاورزی به جز رسوبات رودخانه سیوند در تنگ بلاغی در نزدیکی این محوطه وجود ندارد. درخت های پسته و بادام وحشی در دامنه های خشک این بخش پراکنده هستند (تصویر 5.4، تصویر 5.5). قلوه سنگ های کوچک فلینت در مقابل وادی و در کنار رودخانه سیوند قابل مشاهده است(تصویر 5.6).

محوطه TB130 دارای ارتفاع 1848 متر از سطح دریاست و ارتفاع آن از وادی کنار آن حدود 30 متر است(شکل 5.1، 5.2). این پناهگاه دارای 9 متر طول و 6 متر عرض، و ارتفاع دهانه آن حدود 9 متر است(شکل 5.3). بخش داخلی این پناهگاه دارای مساحت 50 متر مربع است، و فضای داخل آن با بقایای خاکستر و کود حیوانیِ جدید پر شده است. تراس مقابل این محوطه دارای شیب تند است، و صخره های آهکی در همه جا، به ویژه در نزدیکی پناهگاه پراکنده است. بنابراین، نهشته های فرهنگی بخش بالاییِ تراس، بسیار کم ضخامت و محدود است. از طرفی، به طور نسبی نهشته های فرهنگی با ضخامت زیاد در بخش میانی و

## 4. کاوش های محوطه TB75(اشکفت حاجی بهرامی)

محوطه TB75 به طور نسبی غار بزرگی است که اشکفت حاجی بهرامی نامیده می شود و در دامنه جنوبی کوه بلاغی بزرگ واقع شده، و دهانه ورودی آن به سمت جنوب غربی، و درست در مقابل سد سیوند است(تصویر 4.1). این غار، شاخص ترین غار در تنگ بلاغی است و هنگام ورود به دره از سمت جنوب به خوبی قابل مشاهده است(تصویر 4.2 و 4.3). از این محوطه، بخش مرکزی تنگ بلاغی و بخش هایی از دشت کمین قابل مشاهده است(تصویر 4.4). این موقعیت استراتژیک و دید بسیار خوب احتمالاً یکی از دلایل استفاده از این غار است، به ویژه در دوران هخامنشی، که بعداً توضیح داده خواهد شد. دامنه جنوبی کوه بلاغی دارای تعداد زیادی غارهای آهکی است، که دلیل آن سازندهای زمین شناختی این محدوده است که شامل انبوهی از سنگ های آهکی و بستر های آهکی نوع 1 است(ن.ک. فصل دوم). به نظر می رسد که غار حاجی بهرامی در نتیجه متلاشی شدن بلوک های آهکی بسیار بزرگ که با تَرَک های زیاد احاطه شده اند به وجود آمده است. یک وادی کوچک، با نام تنگ جیلی، در مقابل تراس مقابل غار وجود دارد. وادی کوچک دیگری نیز در شرق غار قرار گرفته است. دهانه ورودی غار، 1875 متر از سطح دریا ارتفاع دارد و ارتفاع آن از وادی مقابل آن حدود 30 متر است(شکل 4.1). شیب تراس مقابل غار، تند بوده و حدود 20 درجه است(شکل 4.2). تراس مقابل غار با تعداد زیادی صخره آهکی در اندازه بزرگ (بیش از 1 متر قطر) و متوسط (حدود 50 سانتی متر قطر)، که از بالای کوه به پایین پرتاب شده اند پوشیده شده است. این صخره های آهکی، به ویژه اندازه های بسیار بزرگ آن، به مقدار زیادی تغییر شکل داده اند. در اینجا هیچ زمین حاصلخیزی برای کشاورزی در نزدیک غار وجود ندارد. تنها درخت های پسته و بادام وحشی در دامنه های خشکِ نزدیک غار پراکنده هستند.

دهانه غار دارای 9 متر طول و 2.8 متر ارتفاع، و عمق غار حدود 19 متر است (شکل 4.3). دهانه غار رو به جنوب غربی است و جهت غار به صورت جنوب غربی- شمال شرقی است. ارتفاع داخل غار متفاوت بوده و مابین 2.5 تا 3 متر در نوسان است. در دیواره انتهایی، جهت غار به شکل یک زاویه قائمه به سمت شمال غربی تغییر جهت داده، و تا حدود 15 متر به سمت بالا ادامه پیدا می کند. شکل داخل غار به صورت جنوب شرقی- شمال غربی است. نور خورشید به این بخش نمی رسد و تاریک است. در این قسمت، صخره های آهکی بزرگی از بالا به سمت پایین پرتاب شده و بخش انتهایی غار را پُر کرده است. ارتفاع بخش انتهایی غار 2 متر است، و یک فرد بزرگسال به راحتی نمی تواند وارد این قسمت شود. به نظر می رسد که این بخش از غار مورد سکونت قرار نگرفته است.

این غار به عنوان پناهگاهی برای حیوانات و دام در دوران متاخر استفاده شده و کود و پِهِن آنها بخش جلویی غار را پوشانده است. تعداد بسیار کمی یافته باستان شناختی در داخل غار یافت شد. به هرحال، تعداد کمی تکه سفالهای تاریخی و مصنوعات سنگی در جلوی غار و تراس مقابل آن پراکنده شده است. این یافته ها ما را برای کاوش در این بخش از غار ترغیب کرد. بنابراین تصمیم گرفتیم که داخل غار و در تراس مقابل آن کاوش باستان شناختی انجام دهیم.

در فصل اول کاوش (1384)، دو ترانشه کوچک، به ابعاد 1 ×2 متر که یکی در داخل غار (ترانشه A) و دیگری در میانه تراس مقابل غار (ترانشه B) به ترتیب کاوش شد. موقعیت ترانشه A در حدود 2 متری دهانه ورودی غار و حدود 1.5 متری دیواره غربی غار است. ترانشه A تا عمق حدود 1.5 متر کاوش شد، ولی ما در

## 3. چشم انداز زمین شناختی منابع سنگِ مصنوعات سنگی دوران نوسنگی در محدوده بلاغی

در طی بررسی زمین شناختی محدوده بلاغی ، تلاش شد تا منابع سنگِ مصنوعات سنگی به کار برده شده در دوران اوایل نوسنگی را که احتمالاً از صخره های آشکار شده در سطح و بستر رودخانه در تنگ بلاغی و همچنین در حوضه آن موجود است را در محدوده بلاغی مورد بررسی قرار دهیم. منبع اول شامل بُرون زد های سیلیسی است که در سنگ های آهکی لایه لایه وجود دارند، و منبع دوم مربوط به سنگ چِرت و ژاسبِ رادیولاریته شده است. علاوه بر این، ما با یک نوع سنگِ لوح سیلیسی با رنگ قرمز تیره مواجه شدیم که از محل A5-3 (غار تَنگ شِکن) جمع آوری شد که برای ساخت مصنوعات سنگی از آن استفاده نشده است. در این گزارش، می توان به وفور یک توالی چینه ای از بُرون زد های سیلیسی مناسب و قابل انعطاف یافت. سه گونه از این بُرون زد های سیلیسی در اینجا، گونه لایه ای (L)، گونه مجزا با شکل نامنظم (IIS)، و گونه بستر (B) است. به هرحال، کیفیت این بُرون زد های سیلیسی برای ساخت مصنوعات سنگی به دلیل نداشتن ویژگی های فیزیکی کافی، نا مناسب است.

همچنین قلوه سنگهای رودخانه ای که برای ساخت مصنوعات سنگی در دوران نوسنگی مناسب هستند نیز جمع آوری شد. در ابتدا تعداد قلوه سنگهای سیلیسی با رنگ زرد، قرمز، و آجری که از سه محلِ (RG01, 02,03)در بستر رودخانه سیوند جمع آوری گردیده بود شمارش گردید. قلوه سنگ های سیلیسی شامل سنگ چرتِ رادیولاریته شده، سنگ ژاسب زرد رنگ و انواع دیگر شامل بُرون زدهای سیلیسی است. به طور کلی، واضح است که سنگ چِرت رادیولاریته شده را می توان در انواع رسوبات عمیق دریایی طبقه بندی کرد. بنابراین این موضوع که سنگ های آهکی حوضه بلاغی همراه با چِرت رادیولاریته شده هستند را باید کنار گذاشت. این به این معنی است که قلوه سنگ های چِرت رادیولاریته شده از جایی دیگر در بالادست رودخانه به این محل آورده شده اند. شکل سنگ چِرت رادیولاریته شده در سه محل پیش گفته ازدو جنبه، یعنی زاویه داربودن زیاد و دسته بندی نا مناسب آنها قابل تشخیص است. این موضوع احتمالاً بیانگر این است که فاصله حمل این مواد تا محل مورد نظر چندان طولانی نبوده است. یک سنگ لوح به رنگ قرمز تیره از محل A5-3 (غار تَنگ شِکن) دارای بقایای جانوری رادیولاریته شده بود که بیانگر دوران قدیم تا جدید کِرتاسه است.

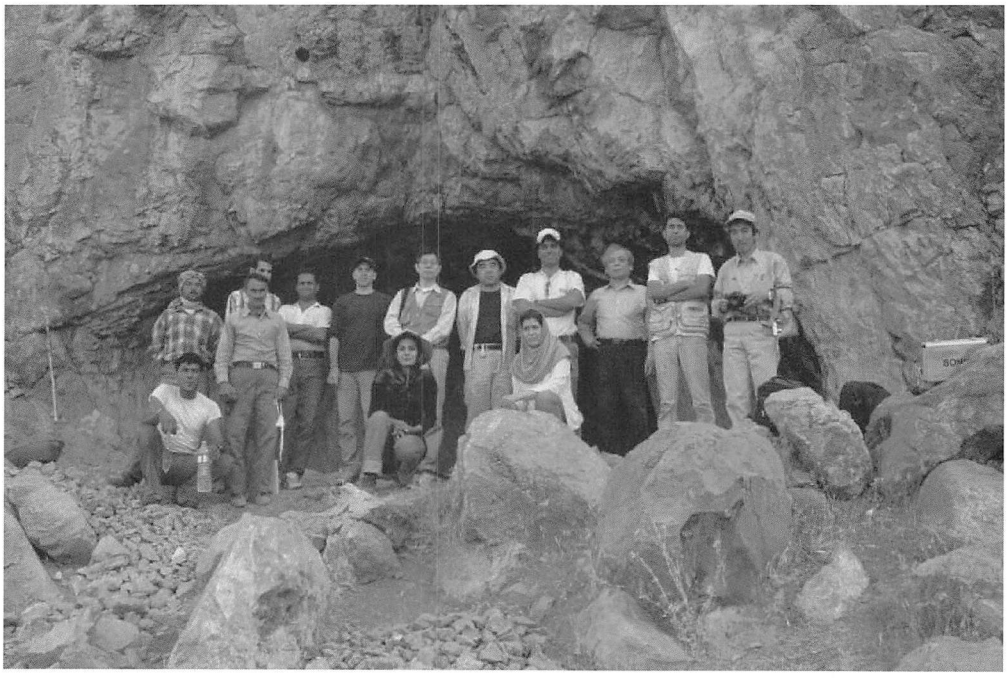
ترکیب سنگ چِرت رادیولاریته شده، سنگ ژاسب و سنگ لوح سیلیسی قرمز در مجموعه سنگ های اُفیولیت پیش بینی شده بود. در منطقه زاگرس، در دو محل وجود سنگ های اُفیولیت-رادیولیت شناخته شده است؛ کرمانشاه و آباده- تشک (در شرق شیراز). جزئیات هردو سنگ اُفیولیت-رادیولیت ناشناخته است، ولی به نظر می رسد که این دو در سنگ های کربن دار دوران ژوراسیک و کِرتاسه ایجاد شده اند. از آنجایی که رسوبات اقیانوسی (سنگ لوح سیلیسی قرمز تیره) مربوط به اواسط دوران کِرتاسه هستند، شکل گیری لایه های اقیانوسی باید پس از آن رخ داده باشد.

در این گزارش، ما نشان دادیم که مجموعه سنگ اُفیولیت می توانسته منابع خام مناسب را تهیه کند. خوشبختانه، محدوده بلاغی در فاصله نه چندان دوری از منابع سنگی اُفیولت واقع در آباده- تشک، حدود 60 کیلومتری منطقه ، واقع شده است. همچنین رودخانه سیوند نیز بخشی از این مجموعه سنگ اُفیولیت را در حوضه زهکش خود دارد. بنابراین، مردم قدیم احتمالاً قادر بودند تا مواد خامِ خود را به راحتی به دست آورند.

## 2. زمین شناسی محدوده بلاغی

لایه نگاری و چینه شناسی سنگ های آهکی درمحدوده تنگ بلاغی و حوضه آن در سال 1384 و 1385 مورد بررسی قرار گرفت. محدوده بلاغی از نظر زمین شناختی بخشی از کوههای زاگرس است که در بخش مرکزی میان کوههای آلپ و هیمالیا قرار گرفته است. بخش زاگرس به عنوان منطقه ای که شامل بقایا و آثار اُفیولیت (رسوب دریای تتیس) است شناخته شده و در اثر برخورد نهایی مابین Gondwana-Land که باعث ایجاد قاره Cimmerian (یعنی بلوک لوت )و عربی-آفریقایی (یعنی صفحه عربستان) ایجاد شده است. احتمالاً سنگ های آهکیِ مربوط به دوران کِرتاسه در محدوده بلاغی پراکنده است. سنگ های آهکی به طور کلی شامل میکریت (micrite) به رنگ خاکستری تیره، و در بعضی مواقع فسیل هایی مانند pelecypod، مرجان و غیره را به همراه دارد. مقدار زیادی از این ساختار در طول وادی که محوطه TB75 در ورودی آن قرار گرفته است مشاهده گردید. این ساختار احتمالاً در دوران کِرتاسه و بلافاصله پس از آن ایجاد شده است. با توجه به این موضوع می توان نتیجه گرفت که حرکت تکتونیکی قبل از مرحله ایجاد آلپی شکل گرفته است. ترکیبات شیمیایی این توده، بخش های متناوبی را در حوضه بلاغی ایجاد کرده که با استفاده از روش اشعه ایکس مشخص شده است. این بخش ایجاد شده به طور نسبی توسط ترکیبات زیادی از SiO2,Al2O3,Fe2O3 و K2O و مقدار کمی CaO، که قابل مقایسه با توده و بخش های لایه لایه است مشخص شده است. این بخش ایجاد شده از نظر اصطلاحات ترکیبات شیمیایی، در تضاد با توده آهکی است. منبع مواد SiO2,Al2O3,Fe2O و K2O مسئله ای حل نشده است، ولی این احتمال وجود دارد که آنها مواد معدنی خاک بوده اند. ساختار زمین شناختی در محدوده بلاغی به صورت مشخصه ای از یک حوضه باریک و طولانی دیده می شود. محور طولی آن دارای جهت غرب شمال غربی به سمت شرق جنوب شرقی است. حاشیه های شرقی و غربی حوضه نیز با شیب ملایم، 13 درجه غربی و 18 درجه شرقی به ترتیب مشخص شده است. محور ناودیسی اصلی نیز در این منطقه در بخش مرکزی محدوده بلاغی قابل ردیابی است. این ناودیسِ باز و گسترده احتمالاً حوضه بلاغی را شکل داده است. در این گزارش، ما ساختار چین خورده در محدوده بلاغی را ناودیس بلاغی می نامیم. ساختار چین خورده در این محدوده به موازات کوههای زاگرس با جهت شمال غربی به جنوب شرقی قابل مشاهده است. با توجه به تصاویر ماهواره ای، خطوط کلی ساختارهای زمین شناختی قابل ترسیم است. ساختارهای چین خورده در محدوده وسیعی از پاسارگاد تا تخت جمشید گسترش یافته است. محور این چین خوردگی دارای جهت شمال غربی به جنوب شرقی است و طول موج آن در برخی قسمتها کم و در برخی قسمتها زیاد است. به نظر می رسد که تاقدیس و ناودیس به ترتیب با کوهها/تپه ها ی حوضه مطابقت دارد. به طور کلی، شیب ملایم بسترها و شیب یا بسترهای واژگون شده، به ترتیب ساختارهای چین خورده را بر روی جبهه های جنوبی و شمالی مشخص می کند. در تصاویر ماهواره ای، می- توان "لایه های سفید" مربوط به سنگ های آهکی دوران مزوزوئیک را تشخیص داد. این لایه ها تاحدودی در جبهه جنوبی ناودیس در غرب حوضه بلاغی واژگون شده اند، گرچه سنگ شناسی دقیق آن شناخته نشده است. ساختار چین خورده در اطراف تخت جمشید را می توان یک ساختار موج دار نامید تا یک تاقدیس، چرا که جهت شیب آن در برخی از قسمت ها یکنواخت و یکسان نیست.

اعضای هیئت در سال 1384



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**اعضای هیئت ژاپنی:** سرپرست کل: کازوتادا کاتااوکا، سرپرست بخش میدانی: آکیرا سونِکی، دیگر اعضای هیئت: کازویا یامائوچی، شین ایچی نیشیاما، کاتسوهیکو اوناما، کِن- ایچیرو هیسادا، آتسونوری هاسِگاوا، سانائه ایتو

**فعالیت های عمده:** کاوش در محوطه های TB75 و TB130، بررسی زمین شناختی، بررسی پیمایشی باستان شناختی

## 1385

**مدت زمان کار:** تیر و مرداد ماه 1385

**اعضای هیئت ایرانی:** سرپرست: محسن زیدی، دیگر اعضای هیئت: روشنک جهرمی، بنفشه ملازاده، مجید کوهی، وحید بارانی

**اعضای هیئت ژاپنی:** سرپرست کل: کازوتادا کاتااوکا، سرپرست بخش میدانی: آکیرا سونِکی، دیگر اعضای هیئت: سِتسو فوروساتو، کاتسوهیکو اوناما، کِن- ایچیرو هیسادا، ایتسورو تومیتا، مارک دیاب ، تاکورو آداچی ، هوتاکا ایتو

**فعالیت های عمده:** کاوش در محوطه های TB75، بررسی زمین شناختی

## 1385

**مدت زمان کار:** بهمن و اسفند ماه 1385

**اعضای هیئت ایرانی:** سرپرست: محسن زیدی

**اعضای هیئت ژاپنی:** کازویا یامائوچی، شین ایچی نیشیاما

**فعالیت های عمده:** بررسی پیمایشی باستان شناختی

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کاوش قرار گرفته (Rosenberg 1985)، و تعداد زیاد دیگر مربوط به دوران پارینه سنگی میانه، جدید و فراپارینه سنگی مورد بررسی قرار گرفته است (e.g. Rosenberg 2003). در بخش آرسَنجان، در جنوب شرقی مرودشت، قبلاً هیئت باستان شناختی ژاپنی بررسی فشرده باستان شناختی انجام داده و 144 غار و پناهگاه صخره ای از دوران پارینه سنگی میانه تا دوران متاخر را کشف کردند (Ikeda 1979, Nishida et al. 2007).

تعدادی تپه نوسنگیِ با سفال به ویژه در مرودشت مورد کاوش قرار گرفته است. کاوش در محوطه هایی مانند تل موشکی (Fukai et al.1973)، تل جَری ب (Maeda 1986)، تل بَشی (Abdi et al. 2003) ، قدیمی ترین فازهای نوسنگیِ با سفال در این منطقه را مشخص کرده است.

همه این مطالعات بیانگر این است که فارس دارای پتانسیل خوبی جهت مطالعات پارینه سنگی و نوسنگی در آینده است. به هر حال، به طور عجیبی، محوطه های مابین دوران فراپارینه سنگی و نوسنگیِ با سفال تاکنون در استان فارس گزارش نشده است. این دوره در تاریخ بشر دارای اهمیت زیادی است، چراکه این دوره، بیانگر فاصله زمانی و تغییرات مربوط به جوامع جمع آوری کننده غذا به جوامع تولید کننده غذا است.

همانطور که پیش تر گفته شد، تعدادی غار و پناهگاه صخره ای در دامنه کوههای اطراف تنگ بلاغی وجود دارد، که به دلیل ساخت سد سیوند در معرض خطر هستند. برخی از آنها دارای مصنوعات سنگی مربوط به دوران فراپارینه سنگی و اوایل نوسنگی هستند. بنابراین، ما تصمیم گرفتیم که دو محوطه TB75 و TB130 را مورد کاوش قرار دهیم. این کار موجب شد تا مدارک جدیدی مربوط به دوران انتقالی از فراپارینه سنگی به اوایل نوسنگی در زاگرس جنوبی به دست آید.

## 2) مطالعه و بررسی مسیرهای ارتباطی و الگوی پراکنش محوطه ها در تنگ بلاغی

این فعالیت میدانی نیز بر اساس بازدید کوتاه و مقدماتی ما از منطقه انجام گرفت، که نشان می داد تنگ بلاغی یکی از محدوده های مناسب جهت مطالعه مسیرهای ارتباطی و فعالیت های تجاری هم در دوران پیش از تاریخ و هم دوران تاریخی است. برای درک مسیرهای ارتباطی و تجاری، ما می بایست همه انواع محوطه های باستانی موجود در تنگ بلاغی را مورد مطالعه و بررسی قرار می دادیم. این کار با استفاده از تصاویر ماهواره ای با قدرتِ تفکیک بالا و همچنین بررسی پیمایشی انجام گرفت. این بررسی منجر به آشکار شدن ارتباطات مابین مسیرهای ارتباطی در درون و برونِ تنگ بلاغی با الگوی پراکنش محوطه ها در تنگ بلاغی گردید. این موضوع بیانگر آثار و نشانه های حمل و نقل، عبور و مرور و تجارت پویا در تنگ بلاغی در طی دوران مختلف است. ثبت و ظبط دقیق آنچه که به "جاده شاهی" معروف و احتمالاً مربوط به دوران هخامنشی است، نیزجنبه دیگری از اهمیت تاریخی تنگ بلاغی را که تاکنون مشخص نبود فراهم کرده است.

### اعضای هیئت، مدت زمان کار و فعالیت های عمده انجام شده در هر فصل

### 1384

**مدت زمان کار:** تیر و مرداد ماه 1384

کار ساده ای نیست. به هر حال، برخی از این محوطه ها دارای شرایط مساعد زیستی در این محدوده هستند. در این میان، محوطه TB75 در حاشیه مرکزی این حوضه قابل ملاحظه است( تصویر 1.29- 1.25). تکه سفال های مربوط به دوران اسلامی بیشترین یافته های قابل تشخیص در تراس مقابل این محوطه است. به هرحال، ما انتظار وجود نهشته های غنی از دوران پیش از تاریخ در این محوطه را داشتیم چراکه تعدادی مصنوعات سنگی مربوط به دوران فراپارینه سنگی و آغاز نوسنگی از سطح این محوطه جمع آوری کرده بودیم.

در دره باریکِ تنگ بلاغی، گذرگاه معروف به دختر بُرکه در صخره های دو طرف رودخانه کنده شده ، قابل مشاهده است. این آثار بارها توسط پژوهشگران ایرانی و غیر ایرانی مطالعه شده است. آنها در حالت نسبتاً خوبی حفظ شده اند (تصویر 1.33-1.30). تاریخ دقیق این آثار که به "جاده شاهی" معروف است کاملاً مشخص نیست، ولی بخش های کنده شده در صخره هنوز آثار حکاکی با اِسکنه را به خوبی نشان می دهد.

بازدید کوتاه ما از تنگ بلاغی با در نظر گرفتن ویژگی های باستان شناختی آن، نتایج زیر را به دنبال داشت. به طور کلی، تنگ بلاغی دارای تعداد زیادی استقرارهای موقت و گورستان مانند محوطه های موقت و گورهای سنگچین است. در مقابل، تپه های بزرگ مربوط به استقرارهای دایم در آن وجود ندارد. از آنجا که تنگ بلاغی مابین پاسارگاد و تخت جمشید قرار گرفته است، می بایست یکی از مهمترین مسیرهای ارتباطی و عبور و مرور در دوران هخامنشی بوده باشد. مدارک باستان شناختی موجود در این محدوده بیانگر این است که نقش مهمی نه تنها در دوران هخامنشی بلکه در دوره های دیگر نیز ایفا کرده است، و حداقل از دوران فراپارینه سنگی تا اوایل دوران اسلامی به عنوان مسیر ارتباطی دارای اهمیت بوده است. بنابراین، ما چنین نتیجه گرفتیم که تنگ بلاغی دارای پتانسیل زیادی از نظر باستان شناختی برای مطالعه ارتباطات و فعالیت های تجاری هم در دوران پیش از تاریخ و هم در دوران تاریخی است.

بعدها نیز تصورات ما از این منطقه با نتایج به دست آمده از فعالیت های باستان شناختی دیگر توسط هیئت های ایرانی- غیر ایرانی در تنگ بلاغی تایید شد (پژوهشکده باستان شناسی 1385).

## فعالیت میدانی

براساس نتایج به دست آمده از بازدید کوتاه ما از منطقه و همچنین با توصیه و مشورت دکتر آذرنوش، ریاست پیشین پژوهشکده باستان شناسی، طرحی برای شرکت در پروژه سد سیوند ارائه شد. خوشبختانه، این طرح توسط پژوهشکده باستان شناسی مورد موافقت قرار گرفت، و فعالیت میدانی ما در قالب هیئت مشترک ایران- ژاپن در سالهای 1385 و 1386 انجام گرفت.

همکاری ما در پروژه نجات بخشی سد سیوند شامل دو فعالیت میدانی عمده بود؛ 1) کاوش در محوطه های TB75 و TB130، و 2) مطالعه و بررسی مسیرهای ارتباطی و الگوی پراکنش محوطه ها در تنگ بلاغی.

### 1) کاوش در محوطه TB75 و TB130

فعالیت میدانیِ اول در واقع بر اساس نظر اصلی ما مبنی بر اهمیت استان فارس به عنوان یکی از مناطق باستان شناختی مهم جهت مطالعه دوران پارینه سنگی و نوسنگی انجام گرفت. در استان فارس، به ویژه در مرودشت، تعداد زیادی غار و پناهگاه صخره ای گزارش شده است. برخی از آنها، مانند اشکفت گاوی، مورد

## محوطه های باستانی تنگ بلاغی

بر اساس بررسی پیشین انجام گرفته در تنگ بلاغی توسط عطایی (1383)، بیش از صد محوطه باستانی شناسایی شده است. در میان این تعداد، محوطه های جدید مربوط به کوچروها و قبرستان های آنها نیز وجود دارد. عطایی چهل و پنج محوطه را که دارای بیشترین اهمیت بودند مشخص کرده است (شکل 1.3)، و پیشنهاد کرده تا این محوطه ها باید پیش از آبگیری سد سیوند مورد مطالعه قرار گیرند. به دلیل بازدید محدود ما از منطقه و همچنین دشواری های مربوط به ناهمواری های آن، ما تنها نیمی از محوطه های مهم را در زمستان 1384 مورد بازدید قرار دادیم.

تمرکز بیشتر این محوطه ها در بخش شمالِ مرکزیِ این حوضه است. تعدادی از گورهای سنگچین (TB107, TB93, TB90, TB88)، که احتمالاً مربوط به دوران ساسانی تا اوایل اسلام هستند، در طولِ دامنه کوههای شمالی واقع شده اند (تصویر 1.12- 1.9). تپه های کم ارتفاع و شالوده ساختمان ها (TB91, TB92)، تقریباً مربوط به همان دوره، در مقابل این گورستان ها قابل مشاهده است (تصویر 1.13، 1.14). این گونه پراکنش محوطه ها، یعنی گورهای سنگچین و استقرارهای کوچک یا محوطه های موقت، نه تنها در این بخش بلکه در دیگر بخش های دشت بلاغی نیز قابل تشخیص است (برای مثال TB66و TB64، TB45 و TB47).

به غیر از یافته های مربوط به دوران ساسانی و اوایل اسلام، تعدادی تپه کم ارتفاع (مانند TB91) و محوطه های موقت (مانند TB92) نیز دارای مواد قدیم تر هستند که شامل آجرهای هخامنشی و تکه سفالهای شاخص دوره باکون الف است (تصویر 1.15، 1.16). بنابراین، استقرارهای موجود در این محدوده حداقل به دوران مس- سنگی باز می گردد. به هر حال، مدارک مربوط به استقرارهای قدیم تر به طور نسبی ضعیف است. برخی از محوطه ها نیز دارای جوش کوره و دورریزهای فلز هستند که نشان دهنده فعالیت های مربوط به ذوب فلز در آنهاست. تپه کم ارتفاعِ TB84 یکی از این نمونه هاست، که مقدار زیادی بقایای جوش کوره فلز در سطح آن پراکنده است (تصویر 1.17، 1.18). گرچه نمی توان تاریخ دقیق این محوطه ها را مشخص کرد، برخی از آنها مربوط به دوران اسلامی است. در طول بازدید کوتاه ما از منطقه، تپه ای کوچک و کم ارتفاع در جنوب محوطه TB84 کشف شد. این محوطه توسط عطایی ثبت نشده بود و احتمالاً محوطه ای جدید مربوط به این دوره بوده است (تصویر 1.19، 1.20). تعدادی غار و پناهگاه صخره ای در دامنه کوههای اطراف تنگ بلاغی قابل تشخیص هستند. از آنجا که بیشتر آنها به عنوان پناهگاه برای حیوانات و دام استفاده شده است، نهشته های حاصل از کود و پهِن این حیوانات بخش داخلی و سطح جلوی این محوطه ها را پوشانده است. بنابراین، آثار مربوط به پیش از تاریخ در تعداد کمی از این محوطه ها قابل شناسایی است. در میان این محوطه ها، پناهگاه صخره ایِ واقع شده در بالای محوطه TB66 بیشتر از بقیه قابل ملاحظه است، چراکه مصنوعات سنگی مربوط به دوران فراپارینه سنگی و یا آغاز نوسنگی در تراس مقابل این محوطه قابل تشخیص بود(تصویر 1.24- 1.21). این مدارک نشانگر حضور انسان حداقل از دوران آغاز نوسنگی در این منطقه است. از آنجا که این پناهگاه صخره ای توسط عطایی شناسایی و ثبت نشده بود، به دنبال محوطه های ثبت شده، ما آنرا محوطه TB130 نامگذاری کردیم. گرچه در این محدوده تعداد زیادی غار و پناهگاه صخره ای در ارتفاعات پایین ترِ کوههای اطراف وجود دارد، ولی یافتن مواد پیش ازتاریخ به دلیل ضخامت زیاد نهشته های جدید در آنها چندان

زاگرس توسعه یافته است (ن.ک. به فصل دوم کتاب). رودخانه سیوند از شمال شرقی دشت پاسارگاد (دشت مُرغاب) به سمت تنگ بلاغی جریان دارد (تصویر1.2). این رودخانه با پیچ و خم های زیاد به سمت جنوب غربی در دره مابین کوه بلاغی بزرگ و کوه بلاغی کوچک جریان پیدا می کند. پس از 4 کیلومتر، رودخانه به سمت غرب تغییر جهت می دهد (تصویر 1.3). سپس، دشت بلاغی که با کوه بلاغی احاطه شده است نمایان می شود (تصویر 1.4). رودخانه دوباره در میانه دشت بلاغی به سمت جنوب غربی و خروجی تنگ بلاغی تغییر جهت می دهد. این قسمت، محلی است که ساخت و سازهای سد سیوند قرار دارد. پس از گذر از این بخش، رودخانه در طول دره ای باریک به سمت جنوب تغییر جهت داده و به سمت دشت کَمین جریان پیدا می کند. محدوده تنگ بلاغی شامل بر 25 کیلومتر مربع است. حوضه مرکزی آن دارای 9 کیلومتر طول با جهت شرقی- غربی و 3 کیلومتر عرض با جهت شمالی- جنوبی است. ارتفاع کف دره از سطح دریا حدود 1800 متر است.

درجه حرارت و میزان بارندگی در چند دهه اخیرِ تنگ بلاغی از طریق داده های جَویِ ایستگاه هواشناسی شیراز محاسبه شد است (جدول 1.1). میانگین درجه حرارت شیراز مابین سالهای 1330 و 1384 شمسی، 17.9 درجه سانتیگراد بوده است. سردترین ماه، بهمن ماه و میانگین درجه حرارت، 5.7 درجه سانتیگراد است (میانگین حداقل درجه حرارت، 0.2 درجه سانتیگراد است). گرم ترین ماه، تیر ماه و میانگین درجه حرارت، 30 درجه سانتیگراد است (میانگین حداکثر درجه حرارت، 37.8 درجه سانتیگراد است). اختلاف درجه حرارت مابین روز و شب زیاد بوده و مابین 11.9 درجه سانتیگراد (بهمن ماه) و 18.6 درجه سانتیگراد (شهریور ماه) در نوسان است. فصل بارانی دراین منطقه در طول پاییز و زمستان از آذر تا اسفند است. میزان بارش سالیانه شیراز مابین سالهای 1330 و 1384، 346 میلی متر، و بیشتر بارندگی در طول ماههای زمستان بوده است. در برخی مواقع، بارش باران به بارش برف تبدیل شده است. فصل تابستان، بسیار گرم و خشک است. ارتفاع ایستگاه هواشناسی شیراز، 1484 متر است و حدوداً 400 متر پایین تر از ارتفاع تنگ بلاغی است. بنابراین، آب و هوای تنگ بلاغی می بایست سخت تر از شیراز باشد. می توان چنین نتیجه گرفت که آب و هوای تنگ بلاغی از نوع داخلی بوده که با تغییرات عمده درجه حرارت در طول روز و فصل های سال مواجه است. میزان بارش برای کشت دیم بسیار محدود است. مردم مجبور هستند تا شالیزارها و مزارع سبزیجات خود را آبیاری کنند. خاک تنگ بلاغی مرغوب نبوده و سطح خاک با مقدار زیادی قلوه سنگهای آهکی پوشیده شده است. بنابراین، تنگ بلاغی به طور نسبی جهت کشاورزی فقیر است.

پوشش گیاهی تنگ بلاغی شامل جنگلِ استپی بلوط است. درختهای بلوط به مقدار محدودی در دامنه کوهها پراکنده شده است. از طرفی، درختهای پسته و بادام وحشی در دامنه کوهها و بر حاشیه بخش های مسطحِ درون دره آشکار هستند. این نوع پوشش گیاهی شامل درختچه های استپیِ Pistachia- Amzgdalus، و بوته زارهای استپی پسته است که از نوع جنگل های استپی زاگرس بوده و در آن درخت بلوط وجود ندارد (Zohary 1973: 583-585). مردم محلی، شیره درخت پسته وحشی را برای مصارف دارویی (تصویر 1.5، 1.6)، و دانه های کوچک بادام وحشی را جهت خوراک جمع آوری می کنند (تصویر 1.7، 1.8). چنانچه پوشش گیاهی تنگ بلاغی در دوران پیش از تاریخ نیز مانند امروزه بوده باشد، احتمالاً این منطقه برای سکونت شکارگران و جمع آورندگان غذا و احتمالاً کوچروها مناسب بوده تا برای کشاورزان.

**چکیده فارسی**

محسن زیدی

## سپاسگزاری

جهت انجام برنامه کاوش و بررسی های باستان شناختی در تنگ بلاغی، جای دارد که از دولت جمهوری اسلامی ایران ، به ویژه جناب آقای دکتر سید طه هاشمی، ریاست محترم پژوهشگاه سازمان میراث فرهنگی، صنایع دستی و گردشگری و جناب آقای دکتر حسن فاضلی، رئیس پژوهشکده باستان شناسی بسیار تشکر کنیم. همچنین از جناب آقای دکتر مسعود آذرنوش، رئیس پیشین پژوهشکده باستان شناسی، که ما را برای انجام پروژه مشترک تنگ بلاغی دعوت کرده و یاری رساندند بسیار سپاسگزاریم. همچنین از کلیه کارشناسان پژوهشکده باستان شناسی، به ویژه آقای کریم علیزاده و خانم مژگان سیدین به خاطر همکاری همیشگی شان بسیار سپاسگزاریم.

در طی انجام این پروژه، سازمان میراث فرهنگی استان فارس و به ویژه، بنیاد پژوهشی پارسه-پاسارگاد کمک و همکاری شایانی به ما رساندند. لذا از آقای دکتر محمد حسن طالبیان، رئیس بنیاد پژوهشی پارسه-پاسارگاد و آقای مازیار کاظمی، سرپرست داخلی مجموعه میراث جهانی تخت جمشید بسیار سپاسگزاریم. مجموعه میراث جهانی پاسارگاد نیز وسایل و امکانات لازم را برای انجام و ادامه کار در تنگ بلاغی فراهم کردند. از آقای حسین عباسی مهر، سرپرست داخلی مجموعه میراث جهانی پاسارگاد، و دیگر کارشناسان این مجموعه به ویژه، خانم فرزانه گرامی و آقای عابدی بسیار تشکر می کنیم.

کمک های مالی و مخارج انجام این پروژه از طریق بنیاد پژوهشی پارسه-پاسارگاد، پژوهشکده باستان شناسی و بخش پژوهش های علمی بین المللی آموزش عالی دولت ژاپن تامین گردیده است.

## 1. مقدمه

کتاب حاضر، گزارش پایانی مطالعات باستان شناختی هیئت مشترک ایران-ژاپن در محدوده بلاغی، استان فارس، در جنوب ایران است. سد سیوند در خروجی جنوبی رودخانه سیوند در محدوده بلاغی، که حوضه آبریز کوچکی در کوههای زاگرس است قرار گرفته است. ساخت و سازهای مربوط به سد در حدود 30 کیلومتری شمال شرقی تخت جمشید و حدود 12 کیلومتری جنوب غربی پاسارگاد قرار دارد (شکل 1.1، 1.2، تصویر 1.1). محدوده بلاغی شامل یک دره باریک (تنگ بلاغی) و حوضه آبریز کوچک (دشت بلاغی) است. این دره و بیشتر بخش های این حوضه با آبگیری سد سیوند به زیر آب خواهد رفت (از این پس، هم دره بلاغی و هم دشت بلاغی را تنگ بلاغی می نامیم). پس از فراخوان پژوهشکده باستان شناسی از باستان شناسان ایرانی و غیر ایرانی جهت شرکت در پروژه نجات بخشی محوطه های باستانی این محدوده در سال 1384، باستان شناسان ژاپنی در این پروژه شرکت کرده و دو نفر از اعضای این هیئت، آکیرا سونکی و کازویا یامائوچی در زمستان 1384 برای بازدید از محوطه های محدوده آبگیری سد سیوند عازم منطقه شدند.

## محیط زیست تنگ بلاغی

تنگ بلاغی یکی از حوضه های آبریز کوچک است که توسط گُسل زاگرس شکل گرفته، و با جابجایی و رانش

## فهرست مطالب

-پژوهشکده باستان شناسی

تهران، میدان بهارستان، خیابان اکباتان، عمارت مسعودیه، شماره ۱۵

-گروه باستان شناسی، تاریخ و انسان شناسی،

بخش مطالعات علوم اجتماعی و علوم انسانی،

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**تَنگ بُلاغی: پروژه باستان شناختی ایران- ژاپن**

**درکاوشهای نجات بخشی محدوده سد سیوند**

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و گروه باستان شناسی دانشگاه سوکوبا

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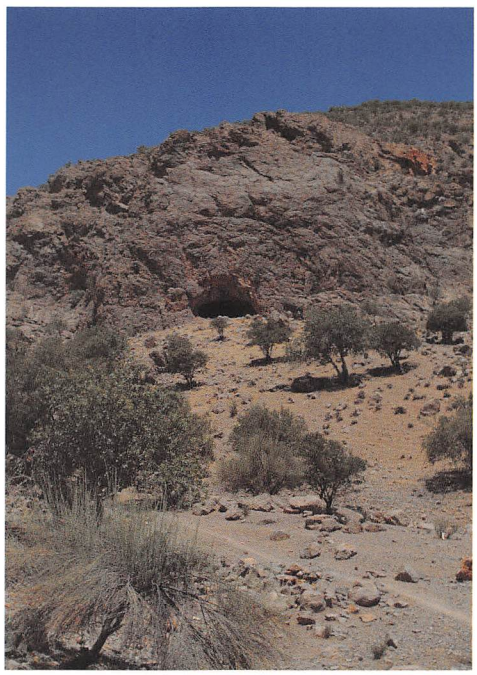
## درکاوشهای نجات بخشی محدوده سد سیوند



ویراسته

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