Bronze Age Textiles: A Preliminary Analysis of Fragments Discovered at Tepe Dasht, Sistan

Mehdi Mortazavi[1,*], Moslem Mishmast [2] and Irene Good [3]

[1] Archaeological Sciences Research Centre, University of Sistan and Baluchestan, Zahedan, Iran
[2] Cultural Heritage, Handicrafts and Tourism Organization, Yazd, Iran
[3] School of Archaeology, University of Oxford, Oxford, UK

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Of the many diverse arts that flourished during the third millennium BC, textiles played an especially significant role in society. Archaeological textiles offer an important source of material cultural testimony for daily life in ancient times- relating simultaneously to agriculture, pastoralism, trade, migration, ritual, and so forth as well as to craft technologies. The study of the techniques and production of textiles is therefore highly valuable, yet has only recently become appreciated by archaeologists. This is principally due to the very impermanent and fragile nature of textiles, as most are completely destroyed by the natural taphonomies of most archaeological sites. However, in some extreme conditions, whether frozen, desiccated, waterlogged or even buried in highly alkaline soils, some textiles and other organics do survive rather well. In these rare situations, there still remain manifold problems, both with regard to discerning the way in which different textiles were made, and to the materials and tools used in the process. This paper is a discussion of the analysis of some textiles discovered at Tepe Dasht, a satellite site of Shahr-i Sokhta in Sistan, to identify some of the spinning and weaving methods used. Textile remains are exceedingly rare in archaeological sites. When compared to artifacts of a more durable nature, such as ceramics, seals or metal objects, the survival of textile objects is uncommon. Textile fragments discovered from Tepe Dasht, though somewhat ravaged by time and the elements, have enormous potential to reveal information about ancient life and the local environment in the third millennium BC in Sistan.

Keywords: *Bronze age, Textile, microscopic analysis, Tepe Dasht, Sistan*

Introduction

Tepe Dasht was a ceramics manufacturing site during the mid- to late third millennium BC. It is located 3 km southwest of Shahr-i-Sokhta, situated on the right side of Zabol-Zahedan highway, about 68-km south of Zabol (fig.1). The archaeology, and in particular the chronology, of Shahr-i-Sokhta is therefore critical to further understanding this manufacturing site. An Italian team led by Maurizio Tosi, conducted the first thorough excavations of Shahr-i-Sokhta in the late 1960s and 1970s (Tosi 1983). A preliminary chronology was drawn up after the completion of the fourth season in 1970. It separated occupation into four periods: I (between 3200 and 2900 BC), II (between 2900- 2600 BC), III (between 2600 and 2100 BC) and IV (between 2100 and 1800 BC) (Tosi 1975: 141). It has been argued that period II lasted longer than period III, because deposits of period II (3-4 m) were thicker than those of period III (1-2 m) (Bovington et al. 1983: 351). Although a revision of radiocarbon dates from the site has increased the clarity of the site development, it is still provisional (Tosi 1983: XVI). Laneri and Vidale have indicated further changes to the chronology of Shahr-i-Sokhta based on new radiocarbon dates and enhanced ceramic studies linked to material from the Mehrgarh-Nausharo region. They suggest the following new dates: period I (between 3100 and 2900 BC), period II (between 2900 and 2700 BC), period III (between 2700 and 2500 BC) and period IV (between approximately 2500 and 2300 BC) (Laneri and Vidale 1998: 225). According to this updated chronology, the time frame of occupation at Shahr-i-Sokhta has changed, but the periodization remains the same. There are still four periods, including eleven phases between 0 and 10.

* Corresponding author. E-mail address: mmor_2002@yahoo.com

The Sistan Basin

The basin of Sistan is located in the northern part of the modern province of Sistan and Baluchistan in southeast Iran. To the south of the basin, the mountain mass gradually declines to a single ridge or neck that lies between Nehbandan and Nusratabad. East of this ridge lies a more developed lowland zone or basin, called the Sistan Basin (Fisher 1968: 76). The Sistan basin, which is located east of the Dasht-i-Lut (desert), has a long history of floods, droughts and fluctuating water supplies (Piperno and Tosi 1975: 186). The variability of the Sistan environment mostly depends on two major environmental factors, wind and soil. The salinity of the surface increases due to the substantial evaporation of water from the soil, which is a result of the continental climate and wind action; therefore fruit trees cannot be grown without preservation in walled orchards (Costantini and Tosi 1978: 172). This large basin, which supplies the Hamun-i-Hilmand, covers an area of about 350,000-km and forms the easternmost part of the Iranian plateau. It is oval with a south-east/north-west axis. The highest areas, more than 5000 m above sea level, are to be found to the north east and compose the first western buttresses of the Hindu Kush (Costantini and Tosi 1978: 167); while the deepest depression, as low as 500 m in the Gaud-i-Zirrah, lies to the southwest (Jux and Kempf 1983: 7). The Iranian part of Sistan, the main location of third millennium BC settlements such as Shahr-i-Sokhta, Rud-i-Biyaban and Tepe Dasht occupies the central and southern parts of the terminal lake basin, at the southwest end of the Plio-Pleistocene sediments (Costantini and Tosi 1978: 167).

Palaeoclimate in the Sistan Basin

The relationship between the local human population and the landscape of the Hilmand region during the third millennium BC was in part predicated by geographic variables- with a strong emphasis on opposition between the highlands and the alluvium. The foothills of the Hindu Kush contain important mineral resources, and the Sistan Basin was an area of optimal agricultural potential in the narrow mountain valley between Lut and Sistan (Mariani 1980: 15). Although Raikes believes that it is difficult to reconstruct ancient environments (Raikes 1983: 61), it has been suggested that climate conditions in protohistoric

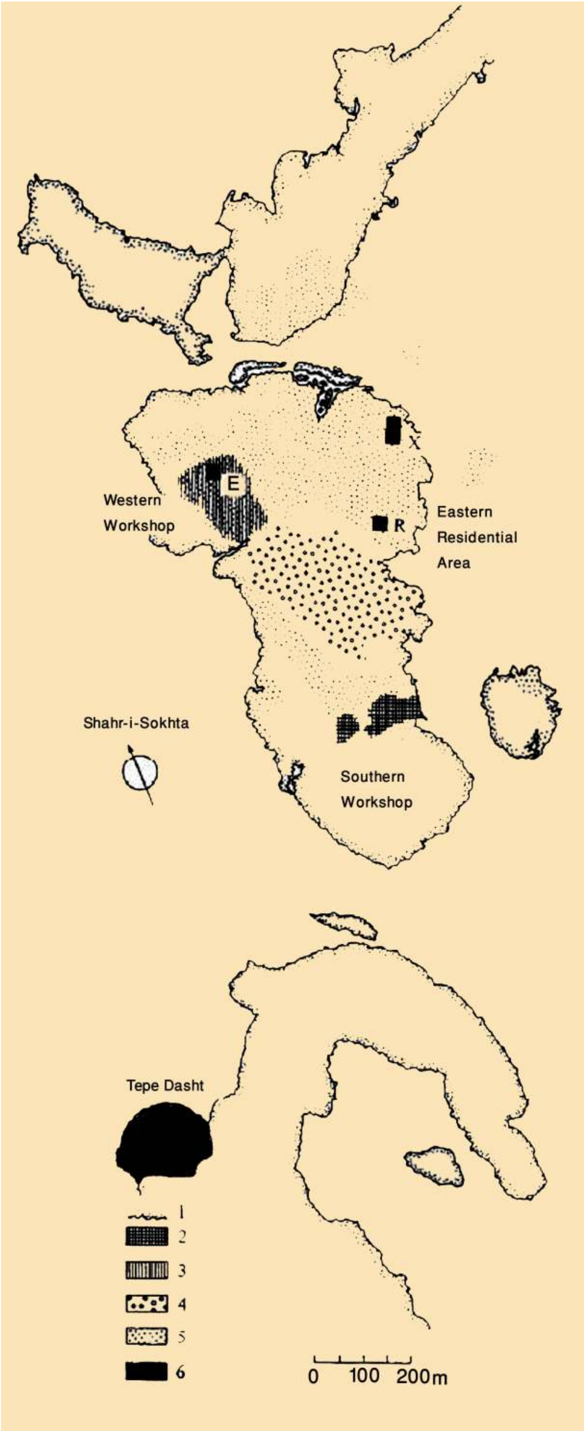

Fig. 1: *Location of activity areas at shahr-i-sokhta in relation to other main utilizations of the settlement space: 1- . Limit of the Plio-Pleistocene terrace; 2- maximum surface extension of southern workshops; 3. Western workshops; 4. Graveyard; 5. Presumed residential areas; 6. Factory at Tepe Dasht (After: Tosi 1984: 34).*

Sistan were much the same as today, although the tall-treed riparian forest, which was then more extensive, may have mitigated considerably the detrimental effects of the heat and winds (Costantini and Tosi 1978: 173). The site of Shahr-i-Sokhta, which is located in the west part of the Sistan Basin, is thought to have had a continental climate (Tosi 1975: 130), with hot dry summers and cold wet winters (Costantini and Tosi 1978: 167). It had an identical climate to today, because the Hilmand River discharged into the Hamun-i-Hilmand lake along a delta arc extending from Shahr-i-Sokhta to Ram-Rud (Raikes 1983: 68).

A plethora of small prehistoric sites dating back to periods II-IV of Shahr-i-Sokhta's sequence were located in this fertile region (Biscione et al. 1974: 13). Plants here today are characterized by those with a high tolerance of surface salt and capable of forming a fairly good coverage instantly after the first rains, such as *Aeluropus, Phalaris*, *Lamarchia and Schismus (*genuses of grass in the POACEAE family). These species provided forage for which sheep and goats (Costantini and Tosi 1978: 177). There is also evidence for the presence of cultigens including legumes, *cucurbitae* and even flax (Costantini and Costantini Biasini 1985: 21).

Contextual Associations of the Textile Fragments

The history of cloths and weaving technologies is extremely long. It is argued that during the upper Palaeolithic period textile and fibrous materials were already known. The earliest indication of textile product, which is dated back to 20000 BC, is the carved bone figure of Venus wearing cloth in the form of a fringe of twisted strings of fiber (Soffer et. al 2000). Ancient textiles, in contrast to stone or ceramic evidence, are recovered intact only under special conditions. Environments that are more or less stable (i.e., extremely dry, extremely cold, or extremely wet) retard the decay and disintegration of textiles and other perishables by the exclusion of intermittent moisture, oxygen, bacteria, or a combination of these agents of destruction (Adovasio 1977: 2).

There are several forms in which archaeological textiles can be recovered. They range from actual fiber objects and clothing to chemically degraded pseudomorphs, fibre residues in soil, to imprints in clay and plaster. Information about textiles can also be obtained from patterns found in ancient art and texts (Good 2001; Cybulska and Maik 2007: 188). The textile fragments from Tepe Dasht were discovered in layer 114, are intact textile fragments (figs 2 & 3). Archaeological textiles sometimes withstand thousands of years of humidity, extreme temperature, fungi, mould and microbes, damp heat, stagnant air and contact with vegetable matter if they are rapidly buried and are protected by a microenvironment that offers protection from biochemical change (Good 2001; Cybulska and Maik 2007: 186). The textile evidence from Tepe Dasht was recovered from the layer 114, depth 88 cm, east of T-USB and North West of the kiln (figs 4 & 5) (Mortazavi 2009). Layers 100, 102, 109, 111, 114, 115, 118 and 127 were included a concentration of ashes, charred floral, fragments of animal bones, shreds, and animal dung. The ashes, textile fragments, a small clay figurine of a pregnant female, 2 bulls, within the remains of a very small temporary kiln are the most important evidence of layer 114. Ceramic fragments (which number about 1700 sherds), can be stylistically bracketed with Period III of the Shahr-i-Sokhta sequence (Mortazavi 2009).

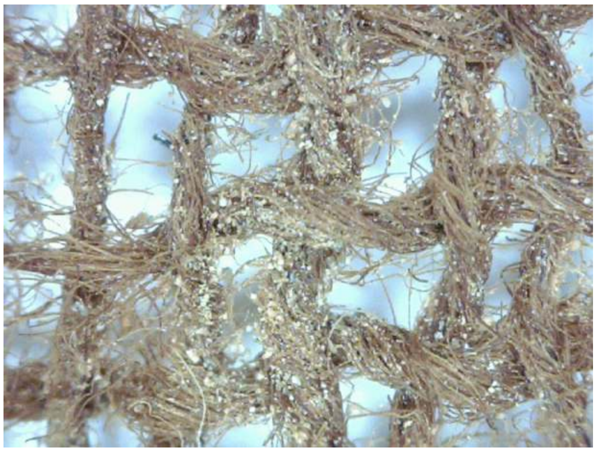

***Fig. 2:** Plain weave textile*

Technical Attribute of the Textile Fragments

The earliest textile used for cloths was possibly vegetable. Carbonized evidence of textiles, dated to around 6000 BC and discovered from Turkey, were made from flax fibers. Similar fabric evidence was discovered from the Alkaline Lake mud of Robenhausen and Iregenhausen. These two Neolithic lakeside settlements, which are dated to about 3000 BC, are located in Switzerland (Cybulska and Maik 2007: 186). Neolithic flax textile evidence was also found in Egypt. For example, a fragment of linen fabric, which is dated back to about 5000 BC, was seen in a small pot discovered from a site in Faiyum (Barber 1992). Using Protein fibers was the beginning of the use of dyes, because animal fibers can be dyed much easier than flax. It is argued that from around 3000 BC dying techniques were well established in China. However scientists still can not determine when exactly the dyeing of textiles began (Cybulska and Maik 2007: 186).

The textile fragments discovered from T-USB, layer 114 were first carefully removed from the ground and put in special storage. These samples were subjected to both optical and scanning electron microscopy (SEM). The goal is to first distinguish between two different fiber classes, vegetal (fig. 2) vs. animal (fig. 3). Simple chemical analysis or crude 'burning' test cannot distinguish between hemp from cotton, for example, because both are composed of cellulose. Therefore optical microscopy and SEM were applied. Vegetable fibers are generally more challenging to identify than animal fibers (Good 2007). Most plants contain fiber cells, usually in the leaf or steam (bast), but sometimes as seed components. Animal fibers are self contained, whereas vegetable fibers are derived from a small part of a plant, and may or may not be completely processed. Many other plant cells may be present in the sample, such as cork or outer (cambial) cell layers. These extraneous cells may or may not be diagnostic though their presence informs us of the level of fiber processing (Good 2007: 171).

The identification of the textile fibers from Tepe Dasht is preliminary. The two groups are designated here as A and B. The vegetal fibers of the A group was 'Z' spun (fig. 6), with a thickness of 0.7-1 mm for each yarn. The number of fibers in each yarn was estimated between 50-65 fibers. Figure 7 shows cross section of sample analyzed by optical micrograph, while figure 8 shows SEM image of the same sample.

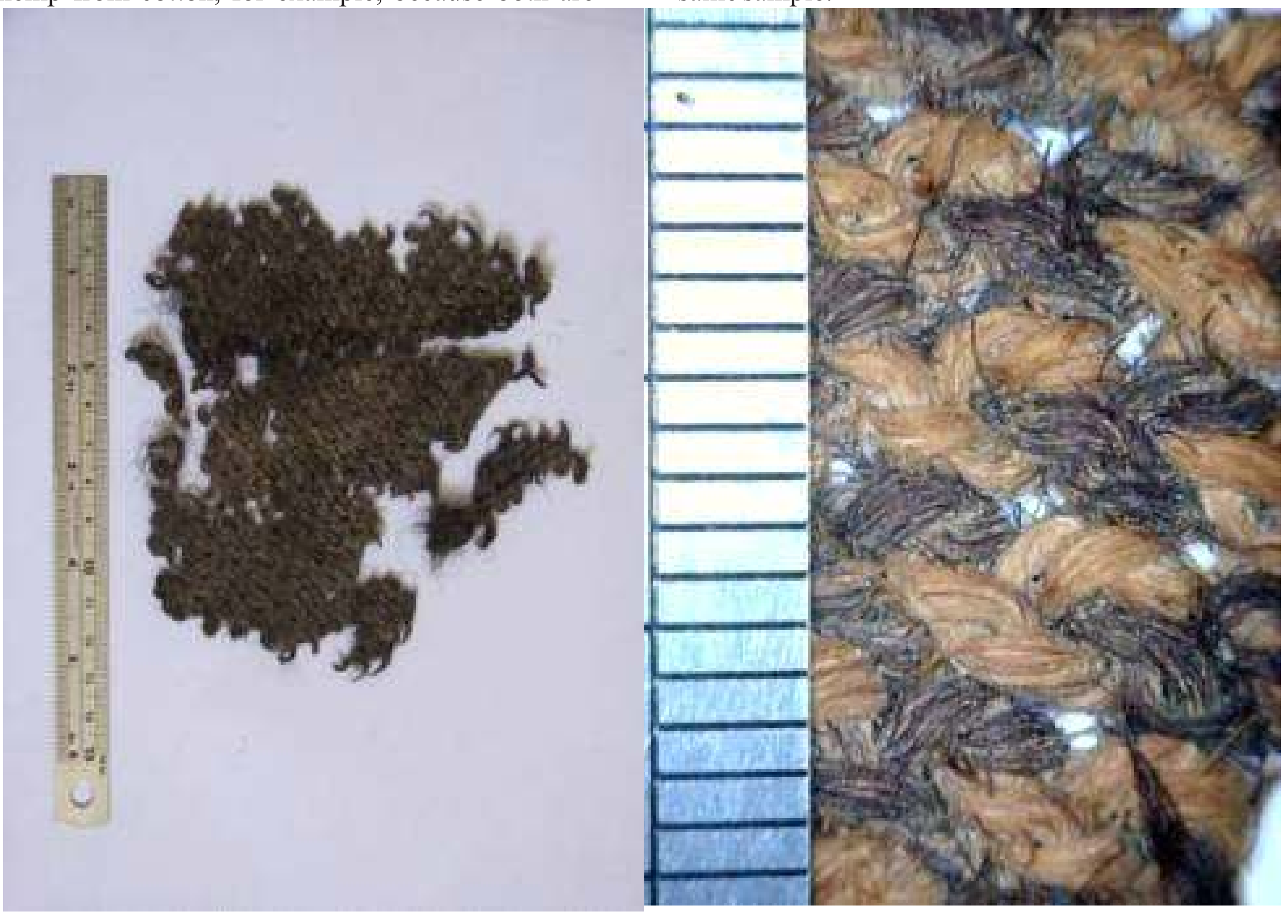

Fig. 3: Left*: Monochrome textile made of ovi- caprid fiber.* ***Right****: Two- tone textile of ovi-caprid fiber.*

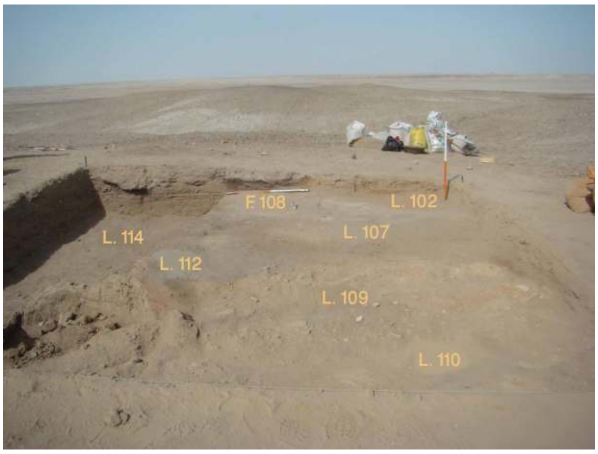

Fig. 4: Profile with view of layer 114 in T-USB, facing North (photo: M. Mortazavi).

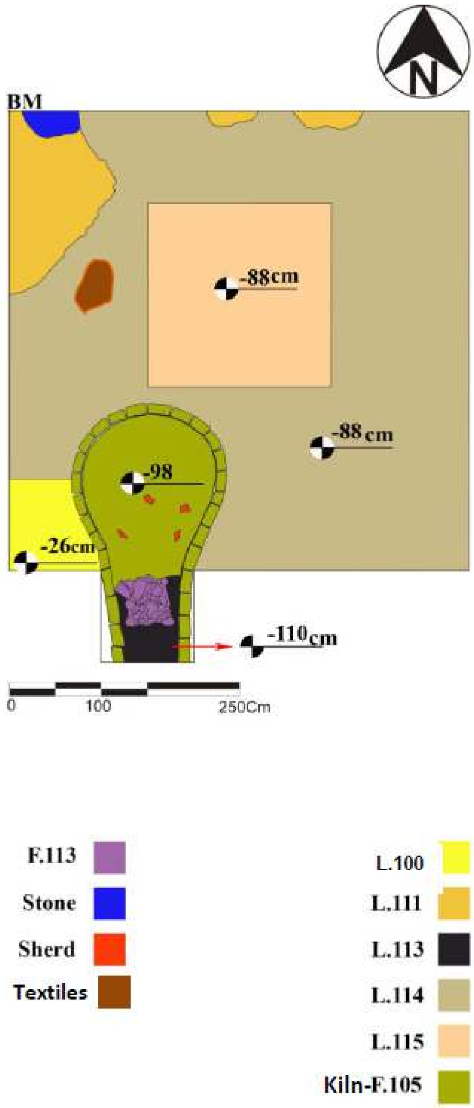

Fig. 5: General view of T-USB, finds and features

Group B is divided into two samples including two-tone (some pigmented) animal fiber and unpigmented animal fiber. Both of these samples were 'S' spun (fig. 3). The yarn of the two-tone sample was between 1.3 and 1.6 mm, while the monochrome sample was thicker, with a thickness between 1.6 and 1.8 mm. The number of fibers in each yarn for both samples is roughly similar, 65-80 for the two-tone and 70-80 for the monochrome samples. SEM and optical micrograph shows deteriorated surface of fiber and surface mineral particle deposits, which can inhibit further identification (fig. 9). Fibers of group B are better preserved than those in group A, because animal fibers are made mainly of protein and therefore are more resistant to decay than vegetable fibers, which are composed of cellulose. Flax and cotton are much more susceptible to attacked by bacteria under humid condition and seldom survive in archaeological environment.Susceptibility or resistance of textiles to bio-deterioration depends on the content of cellulose, lignin and other organic constituents. For example, cotton is less susceptible to micro-organisms than flax. Although animal fibers, such as silk and wool, are not as susceptible to deterioration as vegetable, they can be attacked by micro-organisms if they are stored under warm and humid conditions (Sibley and Jakes 1984).

Weaving Techniques

The first evidence of weaving could be dated to about 7000 BC. This evidence comes from impression of textiles stamped on two little clay balls found in Mesopotamia. Fragments of simple linen burial cloths could confirm that weaving flax existed around 6000 BC in Catal Huyuk, a Neolithic site located in the Konya Region of Anatolia. It has been reported that evidence of woven cloth dated back to about 7000 BC have been discovered from Jarmo in northeast Mesopotamia, while in Nahal Hemar in the Judean desert there is evidence of woven cloth around 6500 BC (Cybulska and Maik 2007: 186). The study of textiles from Shahr-i-Sokhta indicates that all were plain woven, yet represent a wide variation in thread spin and gauge, as well as in density of weave (Good 1999). Many textiles were in the form of cordage and nets of vegetable fiber

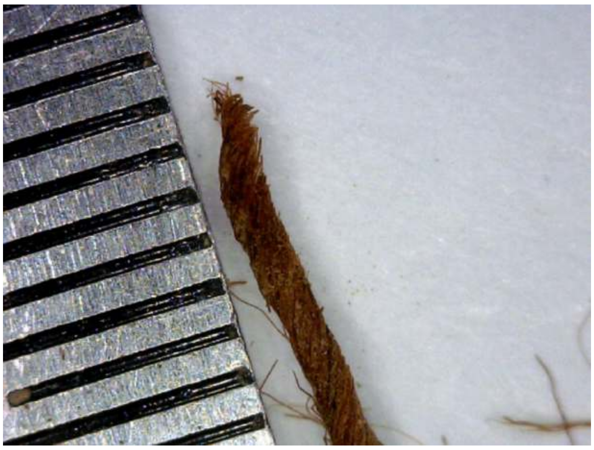

Fig.6: *Photomicrograph of thread made of vegetal fiber, Z-spun.*

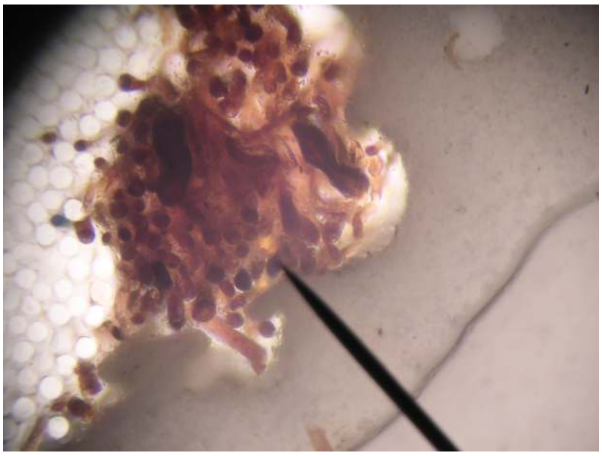

***Fig**. **7:** Transmission light micrograph of thread in cross-section (10x).*

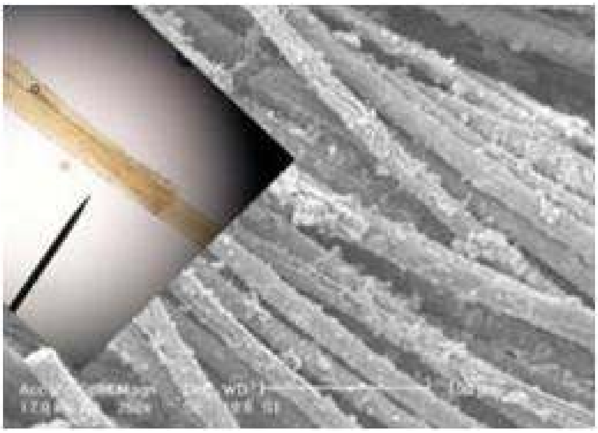

***Fig**. **8:** Scanning Electron Micrograph of vegetal fibers (x250).*

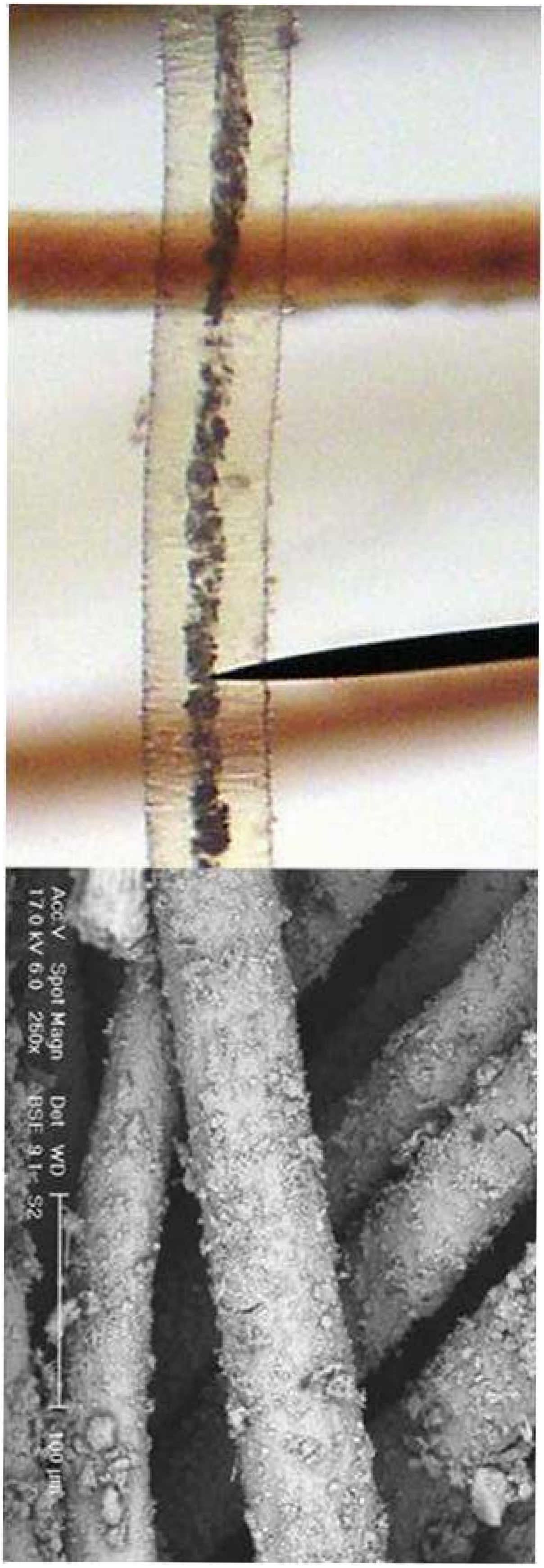

***Fig. 9: Above:** Transmission micrograph (x400) of ovicaprid fiber.*
***Below:** Scanning Electron Micrograph of ovicaprid fibers (x260)*

(Good 2007: 171). The textiles were from several distinct contexts, ranging from burial to refuse pits and were from all four periods of occupation. Most of the textiles recovered date to periods II and III (Good 1999; Good 2007: 170).

The textile fragments from Tepe Dasht are from a context that dates stylistically to period III of the Shahr-i-Sokhta sequence. In this period (phases 4 and 3, between 2600 and 2100 BC), Shahr-i-Sokhta reached its maximum size of about 80 hectares and (Tosi 1975: 142). At Tepe Dasht fiber was spun into thread using a drop-spindle with attached whorl. During excavation, a small disc-shaped clay spindle whorl was discovered from layer 120 (fig 10a;10b), which is similar to the pear-shaped vessel bottom-sherd whorls discovered from periods II and III Shahr-i-Sokhta (Good 1999: table IV.xxi).

Fig. 10a: *Clay spindle whorl from T-USB, layer 120*
Photo: H. Hossain Zadeh

Summary

Optical and scanning electron microscopy studies of the textile fibers from Tepe Dasht have shown two main fiber types, A (vegetal) and B (animal) fiber. In group B, two different fibers were seen, monochrome and two-tone fibers. Two different spinning techniques were identified including Z and S spun threads. Although excavation at Tepe Dasht is not extensive, and the site itself is small in size, surface finds and material discovered from T.USB testify that this auxillary site functioned as an important manufacturing center for ceramic

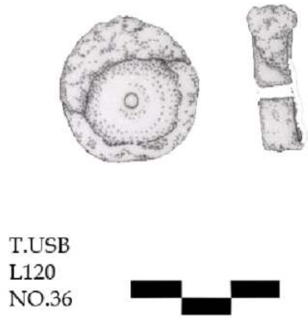

Fig. 10b: *Clay spindle whorl from T-USB, layer 120*
Drawing: H. Hossain Zadeh

production during the third millennium BC. During systematic survey, we observed traces of pottery production including a number of kilns, deformed ceramics, burned soils and bricks measuring 7×10×7 cm (Mortazavi 2009). These traces indicate that Tepe Dasht was in operation during the mid- to late third millennium BC. There is no evidence for residential occupation at this site. We hypothesize that the craftsmen of Tepe Dasht were residents of Shahr-i-Sokhta. It takes 30 minutes on foot to go to Tepe Dasht from Shahr-i-Sokhta. Strong similarities between the textiles from Shahr-i-Sokhta and those from Tepe Dasht support this hypothesis.

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