

## Textiles

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### INTRODUCTION

The textiles and related organic artifacts recovered from Zeugma are unusual in their very existence.<sup>1</sup> Unlike the majority of comparable sites within the region, every fragment found at Zeugma is carbonized, most probably as a result of charring in the absence of oxygen.<sup>2</sup> All the material recovered came from burnt layers — the majority dating to the mid-third century A.D., with a lesser number from earlier deposits. This burning coincides with the looting and subsequent partial destruction of the city by Shapur I, in A.D. 252/253, or with one of the numerous great wars that followed in the latter part of the third century A.D.<sup>3</sup> From this we can be certain the finds here date to the latter part of the first half of the third century, almost exactly contemporary with Dura-Europos, a Roman garrison town further south on the Euphrates, which fell during the same campaigns.<sup>4</sup>

The excavators found 12 groups of fiber in two trenches. Together these comprised 170 individual fragments, 115 textile, 50 rope or cord, and 5 shoe sole, representing a probable minimum of 27 artifacts. All finds are fragmentary, with the largest fragment recovered being just 7.0 by 8.0 cm. The research potential of this assemblage differs greatly from other sites in the region, in that the limitations on handling and studying carbonized material mean that it cannot always be assessed in the same way as archaeological textiles from noncarbonized deposits. The absence of wool is an indication that the assemblage is not fully representative of the textiles in use at the time; nevertheless the material allows us an insight into the clothes that people wore and the textiles they used in their everyday lives in a prosperous Roman border town on the banks of the Euphrates.

### METHODOLOGY

The assemblage was examined in its entirety at  $\times 20$  magnification using a binocular light microscope. All fragments were assessed for quantification, condition, type of object, dimensions, weave, weave density (thread count per cm), thread form (spin, ply), thread diameter, technical features, and evidence of use-wear.

Nine fiber samples were taken for examination at higher ( $\times 70$ ) magnification to aid material identification. Dye analysis was not attempted because of the carbonized state of the material and because further sampling from the small fragment size would have put the assemblage at risk.<sup>5</sup>

### TEXTILES

The carbonized textiles from Zeugma represent a unique resource within their geographical area. Analysis of the material has shown it all to be bast fiber, probably linen, in marked contrast to the other sites with published textiles in the region where wool predominates: At-Tar, Dura-Europos, Khirbet Qazone, Masada, Mons Claudianus, and Palmyra.<sup>6</sup> Although fully carbonized wool remains have been recovered from northern Europe, only the superficial pattern of the weave survived, and the fibers in the yarn itself were heavily distorted.<sup>7</sup> In comparison, wood- and plant-based material has a better chance of surviving a conflagration, and this may be why linen is unusually dominant in the archaeological record at Zeugma.<sup>8</sup> Most of the textiles in the assemblage are coarse and probably locally produced, however some fragments of extremely fine cloth suggest imported luxury items were being traded in from the coast. Unusual weft-faced linen fragments may indicate an adaptation of wool techniques to another fiber. This is another clue to the existence of wool at Zeugma, despite its absence from the found remains.

The largest group of textiles represented were the coarse, weft-faced, simple tabby fragments. Linen from other sites in the region tends to be warp-faced or fairly even tabby, mainly because the yarn characteristics mean linen warps can be placed much closer together on the loom than is possible with wool.<sup>9</sup> The weft-faced predominance is unusual, and this may represent a local style or be the work of a weaver more accustomed to working in wool. The pairing of warp threads and the crossed threads notable on TX18 suggest a tapestry weave, with the warps being grouped in preparation for a band or other area of decoration. This construction is common in wool and is found in linen textiles with wool inserts and decorations, where the reduction of warp thread numbers is desirable.<sup>10</sup> Tapestry weave with grouped warp threads was most commonly found on tunics, mantles, and other clothing with integral woven bands. However, given the thickness and the relative density of weave, which would have made some fragments rather inflexible, TX4-7, 10-11, 15, 18, and 20 may also have been fragments of some kind of blanket or furnishing fabric.

The warp-faced tabbies are more representative of the bulk of linen finds at other sites in the region. Given their diverse use for clothing, bed linen, furnishing, and even sacking, it is unlikely that we will ever be able to pin a usage on any of the fragments recovered from Zeugma. Because textiles tended to be woven to the shape and size dictated

by their intended use, TX14 with seamed selvages would probably have been clothing.<sup>11</sup> It could also be argued that the two extremely fine textiles from Trench 2 (TX1 and TX2) were clothing as well, and most probably imported (their high quality and fine weave make it unlikely they were intended for domestic use). The practicalities involved in the weaving of such high-quality cloth make it more likely to be the product of one of the coastal centers for textile production, such as Tyre or Sidon, rather than local manufacture.<sup>12</sup>

The remaining simple tabbies (TX3, 8–9, 12–14, 16–17, 19, and 21–22) are again unlikely to be identified. The more unevenly woven fragments suggest hand weaving — especially when the weave is open or loose. The clumped fragments (TX21) were unusual — the density of their compaction and their incoherent structure suggest that they were discarded while wet, or wetted shortly after, because they show no more advanced decomposition than any of the other finds. This being so, it is conceivable that they were being used as rags at the time of the Sasanian destruction.

The fragment of charred wood with textile attached (TX12) is most likely a decorative element from a piece of furniture — possibly a chair back. There is no reason why these textiles could not have been furnishing fabrics rather than clothing, although the archaeological context does not rule out the possibility that they were fused to the wood by chance, perhaps during the conflagration.

### CORDAGE

The excavators recovered fifty fragments of cordage as three separate artifacts, all made from twisted plant fiber, and all of the same zS<sup>2</sup> construction (two Z-spun threads, S-plied together). The cord has great variance in thickness and tightness of weave over a single fragment, but little sign of wear. The largest and most interesting fragment is a hank of rope (TX25), probably formed by winding around a hand. In particular, the front shows a splice where two pieces have been joined together. Given that the main fiber is narrower and more compact towards the end, it may well have been broken during use and later repaired.

### SHOE SOLES

Five fragments of shoe sole were recovered. All are woven vegetable fiber of a similar structure, and probably came from the same sandal. Knowledge of Roman footwear is limited to information from art historical sources and from archaeological finds in leather, and this is mainly due to the paucity of fiber evidence outside Egypt.<sup>13</sup> The closest structural parallels I have found are from a fourth-century tomb in Hawara, Egypt. TX26 is more similar to these sandals, which are formed by coiling.<sup>14</sup> The folding technique exhibited by TX27 would have made the sole less flexible.

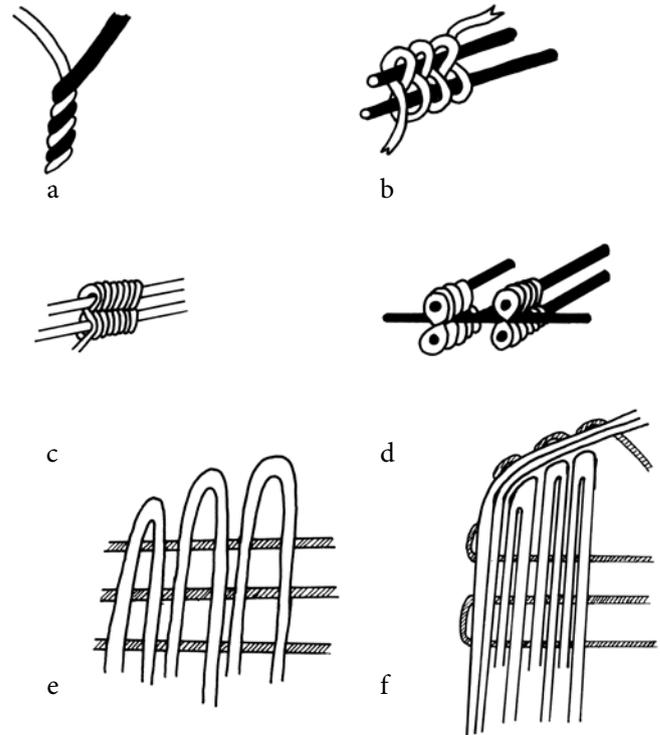


Figure 1. Systematic drawing showing the stages of manufacture of the shoe soles. Author's drawing.

Another feature of the Hawara sandals is that several have fine wooden splints threaded through the soles, parallel to the cord used to hold them together. During manufacture these would have served as an invaluable aid to keeping all the coils/folds in position but again would have stiffened the soles during wear — this time in a transverse direction (fig. 1). However, as these sandals were part of a collection of grave goods and show no evidence of wear, it is possible that the splints were simply intended as an aid to manufacture and were left behind unintentionally.

Soles of this type were made in a variety of ways and locations over the last five millennia, and their absence from most sites is related to their advanced rate of decomposition.<sup>15</sup> All fragments from Zeugma show advanced signs of wear, and this suggests that the sandal may have been discarded prior to deposition.

### CONCLUSIONS

As a whole, the assemblage is small and not fully representative of the organic material culture used by the inhabitants of Zeugma at the time of its deposition. On the other hand, the material presented here provides a microscopic view of a class of items that are found only rarely in Turkey and even less frequently published.

The textiles demonstrate that Zeugma was part of a trading network and that goods such as fine linens were imported, probably from the West. The fashion for tunics

with decorative wool bands was Roman in its origins, and the earliest examples at Palmyra date from the mid-third century.<sup>16</sup> Zeugma, like Palmyra and Dura-Europos, was a Romanized city, with a population that would have assimilated styles from both Rome and from the East.<sup>17</sup> The predominance of the single-ply, S-spun linen thread suggests a textile tradition with its roots in the West and Egypt. But the linen threads show no sign of the splicing of fibers typical of Egypt at this time, and this suggests they were being drafted (pulled past each other using a board studded with spikes).<sup>18</sup> The crossing of warp threads visible in TX18 has been demonstrated to be a technique only possible on a loom that was not warp weighted: most probably the two-beam upright loom, still in use in North Africa today, which began replacing the warp-weighted loom in the Near East during the first and second centuries A.D.<sup>19</sup> In the discussion of the loom weights elsewhere in this volume, the finds suggest the warp-weighted loom may still have been in use in Zeugma in the third century, but the textile finds demonstrate that another form of loom was also being used at this time, and that the two techniques may have persisted side by side for an unspecified period of time.<sup>20</sup> Further research is needed in order to clarify this point.

There is increasing evidence of textile trade along the silk route. Excavations at Palmyra have recovered imported Chinese silks made in a Han damask weave, which local weavers adapted in wool, and figured silks that have been found with comparable motifs in both Palmyra and Lou-Lan in China. Evidence of trade eastwards has also been evidenced in recent wool tapestry finds in Sampula, Lop county, and Lou-Lan in the same region of China. Both pieces are figural—the fragment from Lou-Lan depicting Hermes (second/third century A.D.), and the Sampula tapestry depicting a centaur and a warrior (third/fourth century A.D.). Both are thought to come from Bactria or Gandhara.<sup>21</sup>

The absence of wool from the Zeugma assemblage is particularly interesting given that in most of the comparable sites, wool is by far the most common fiber represented. The relative rarity of plant fiber remains outside of carbonized contexts may be responsible for wool being seen as the predominant fiber in the region. The more complex weaves (absent here) have been traditionally made from wool, as the ease of dyeing it gives greater scope for decorative work. Another factor that has been cited regarding the differential decay of plant fiber is that acidity is a major cause of decay. In contrast, animal fiber is itself acidic, and where the two fibers are combined acidity may be a factor in the relatively poor condition of the plant fiber.<sup>22</sup> Unfortunately, the use of wool in Zeugma will have to remain a question mark for the time being.

The shoe soles and cordage are significant mainly for their existence; they prove what has only been assumed for many years. The sandal in particular preserves technology that was used in Egypt and as early as the Neolithic in Spain. This also demonstrates that people used materials

easily accessible to them and that their rarity due to preservation should not be seen to indicate their absence.<sup>23</sup>

In contrast, the cordage was all Z-spun and S-plied together, like vegetal fiber cordage from other archaeological sites, but distinct from all the textiles.<sup>24</sup> The use of one direction for the spin and another for the ply is normal as it holds the strands together naturally, but it is interesting that the base spin opposes that of all the textile finds. Rather than by traditional spinning, the coarser Z-spun cords could have been produced by rolling the fiber, suggesting a differentiation in technique and possibly the identity of the people who produced the two commodities.

## CATALOGUE

### The Textiles

TX1<sup>25</sup> (SF 450a, context 9138)<sup>26</sup>

**Linen (?)**

Ten pieces of one textile, largest piece 1.5 × 2.0 cm

Warp face extremely fine and even. Warp majority no visible spin, occasional threads loose Z-spin, 54 ends per cm. Weft tight S-spin, 20 picks per cm.

Weave extremely dense, one fragment flattened. Break edges suggest that the textile had been folded tightly at time of deposition.

TX2 (SF 450b, context 9138)

**Linen (?)**

Twenty pieces of one textile, largest piece 3.0 × 1.8 cm

Warp face extremely fine and even. Warp no visible spin, 80 ends per cm. Weft tight S-spin, 13 picks per cm.

Weave extremely dense, heavy wear on folds. As TX1, probably all one folded piece when deposited.

TX3 (SF 459, context 9177)

**Bast fiber, probably linen<sup>27</sup>**

Four pieces of one textile, largest piece 0.8 × 0.4 cm

Tabby. Warp S-spun, 16 ends per cm (7 in 0.4 cm). Weft S-spun, 12 picks per cm (6 in 0.5 cm).

Textile flattened, folded, and twisted. Deformed by tension—possibly used as a tab or belt.

TX4 (SF 2046, context 2007)

**Bast fiber, probably linen**

One piece 3.8 × 3.0 cm

Simple weft-faced tabby. Warp loosely S-spun, seven ends per cm. Weft loosely S-spun, 16 picks per cm.

Individual threads of uneven thickness.

TX5 (SF 2050a, context 2007)

**Bast fiber, probably linen**

One piece 4.0 × 1.5 cm

Simple, weft-faced tabby. Warp S-spun, six ends per cm. Weft very loosely S-spun, 12 picks per cm.

TX6 (SF 2050b, context 2007)

**Bast fiber, probably linen**

One piece 2.8 × 1.8 cm

Simple, weft-faced tabby. Warp S-spun, eight ends per cm. Weft very loosely S-spun, 14 picks per cm.

TX7 (SF 2143, context 2043)

**Bast fiber, probably linen**

Six pieces of one textile. Largest piece 3.0 × 2.0 cm

Simple weft-faced tabby. Warp S-spun, five to six ends per cm. Thread dense and compact. Weft very loosely S-spun, 13 picks per cm.

Weave irregular, occasional paired warps. Pieces too small to gauge frequency of pairing.

TX8 (SF 2144a, context 2035)

**Bast fiber, probably linen**

One piece, 2.5 × 2.5 cm

Extended tabby 2/2 (basket weave). Warp and weft indistinct; both eight pairs of threads (16 ends) per cm.

No visible spin on the majority of threads, but one thread is markedly Z-spun.

TX9 (SF 2144b, context 2035)

**Bast fiber, probably linen**

Eleven pieces of one textile, largest piece 3.0 × 2.0 cm

Tabby. Warp and weft indistinct, all S-spun. Weave density irregular; between five and nine threads per cm in each direction.

All heavily compressed and wadded together; one piece three layers thick is less than 0.1 cm total thickness, demonstrating great compression.

TX10 (SF 2144c, context 2035)

**Bast fiber, probably linen**

Nine pieces of one textile, largest piece 5.8 × 3.2 cm

Simple weft-faced tabby. Warp only visible in section, spin not visible. Eight ends per cm. Weft very loosely S-spun, 16 picks per cm.

Every third warp paired, producing a slight rib effect.

TX11 (SF 2144d, context 2035)

**Bast fiber, probably linen**

Two pieces of one textile, larger piece 3.0 × 2.0 cm

Simple weft faced tabby. Warp loose S-spun, four ends per cm. Weft, no visible spin, 16 picks per cm.

TX12 (SF 2226a, context 2117)

**Bast fiber, probably linen**

Five pieces of one textile, largest piece c. 4.0 × 2.0 cm FIG. 2

Simple uneven tabby. Warp tightly S-spun, four ends per cm. Thread diameter less than 0.1 cm. Weft loosely S-spun, three picks per cm.

Warp threads very decayed. Four pieces unraveling. Thread loose and flattened, approximately 0.3 cm at widest point. This textile was found as two pieces fused together with threads at right angles to each other. The textile was fused to a piece of carbonized wood — preserving the remains of a carved design.



Figure 2. Carved wooden element with textile (TX12) attached.

TX13 (SF 2226b, context 2117)

**Bast fiber, probably linen**

One piece 3.5 × 1.8 cm

Simple warp-faced tabby with selvedge. Warp loose S-spun, 20 ends per cm. Weft no visible spin, three picks per cm.

Three returns (six rows) visible as selvedge. Surface originally obscured by a large fragment of iron corrosion, but textile still carbonized rather than mineralized.

TX14 (SF 2226c, context 2117)

**Bast fiber, probably linen**

Six pieces of one textile, largest piece 7.0 × 6.0 cm

Simple tabby, slightly uneven. Warp loosely S-spun, five ends per cm. Weft loosely S-spun, seven picks per cm.

The largest fragment shows two selvages made into a flat seam by overcasting.

TX15 (SF 2226d, context 2117)

**Bast fiber, probably linen**

One piece 2.5 × 2.0 cm

Simple weft-faced tabby with selvedge. Warp loosely S-spun, six ends per cm. Weft loosely S-spun, 10 picks per cm.

**TX16** (SF 2226e, context 2117)

**Bast fiber, probably linen**

Fifteen pieces of one textile, largest piece 3.2 × 3.5 cm

Simple tabby. Warp S-spun, seven ends per cm, thread diameter 0.1–0.5 cm. Weft S-spun, four picks per cm, thread diameter 0.2 cm. Several folded pieces.

**TX17** (SF 2226f, context 2117)

**Bast fiber, probably linen**

One piece, 1.0 × 0.5 cm

Simple warp-faced tabby. Warp no visible spin, 16 ends per cm (eight ends in 0.5 cm). Weft no visible spin, three picks per cm.

**TX18** (SF 2226g, context 2117)

**Bast fiber, probably linen**

Six pieces of one textile, largest piece 7.0 × 8.0 cm FIG. 3

Simple weft-faced tabby. Warp S-spun, six to seven ends per cm. Weft loosely S-spun, 20 picks per cm.

Warp paired for bands with crossed threads: warp grouping 1:1:1:1:2:2:1:1:1:1.<sup>28</sup>

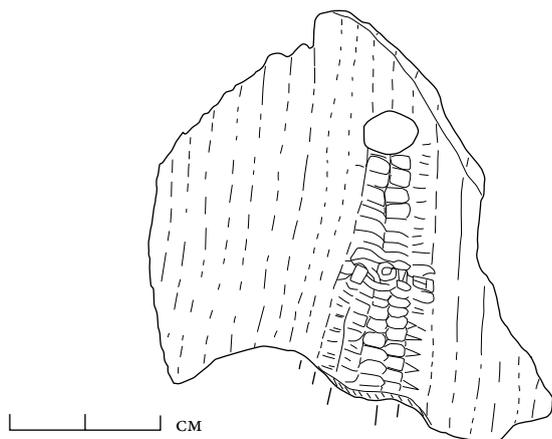


Figure 3. Textile (TX18) showing area of crossed threads and separation of paired warps.

**TX19** (SF 2226h, context 2117)

**Bast fiber, probably linen**

One piece, 1.5 × 2.0 cm

Simple tabby, warp and weft indistinguishable. Four to five warps/wefts per cm. Weave irregular.

**TX20** (SF 2245, context 2197)

**Bast fiber, probably linen**

Six pieces of one textile, largest piece 4.0 × 3.5 cm

Simple weft-faced tabby. Warp no visible spin, six ends per cm. Weft loosely S-spun, 18 picks per cm.

Some warp pairing. Very compact and densely woven. Two square perforations pushed between adjacent threads, the central thread pulled to a peak, suggest a button or a pin had been pushed through at some point. No corrosion products present, however.

**TX21** (SF 2254a, context 2238)

**Bast fiber, probably linen**

Six pieces of one textile and three compacted textile clumps, largest piece 5.7 × 3.6 cm

Open tabby. Warp medium S-spun, uneven thickness, one overspun thread, approximately seven ends per cm. Weft loose S-spun, thread flattened, approximately four picks per cm. The clumps appear to be the same textile, but are compacted in a way that suggests they may have been wet when deposited.

**TX22** (SF 2254b, context 2238)

**Bast fiber, probably linen**

One piece 1.5 × 0.8 cm

Warp-faced tabby. Warp approximately seven per cm (five ends in 0.8 cm), no visible spin. Weft three picks per cm. Threads flattened and wide (0.3 cm). Weave fairly compact.

### Cordage

**TX23** (SF 2254c, context 2238)

**Cord.**

Six fragments of twisted plant fiber cord, longest piece 4.0 cm

Fibers zS<sup>2</sup>, initial spin very loose, diameter variable (average 0.5 cm), inconsistent turn length (0.7–1.3 cm per complete turn).

**TX24** (SF 2255, context 2242)

**Cord**

Fourteen fragments of twisted plant fiber cord, longest piece 8.0 cm

Fibers zS<sup>2</sup>, initial spin very loose, diameter variable (average 0.5 cm), inconsistent turn length (0.7–1.3 cm per complete turn).

One fragment displays extreme thinning of one thread from the pair, resulting in a core of a single thread with a second wrapped around it in a spiral.

**TX25** (SF 2259, context 2242)

**Cord**

Thirty fragments of one hank, c. 11 × 8 cm in size FIG. 4

Fibers zS<sup>2</sup>, initial spin very loose, diameter variable (average 0.5 cm), inconsistent turn length (0.7–1.3 cm per complete turn).

Splice visible on upper surface of hank (fig. 2) showing the

main body of cord compacting and narrowing, and a separate single ply thread being twisted in around it. A third thread is inserted further along the cord.

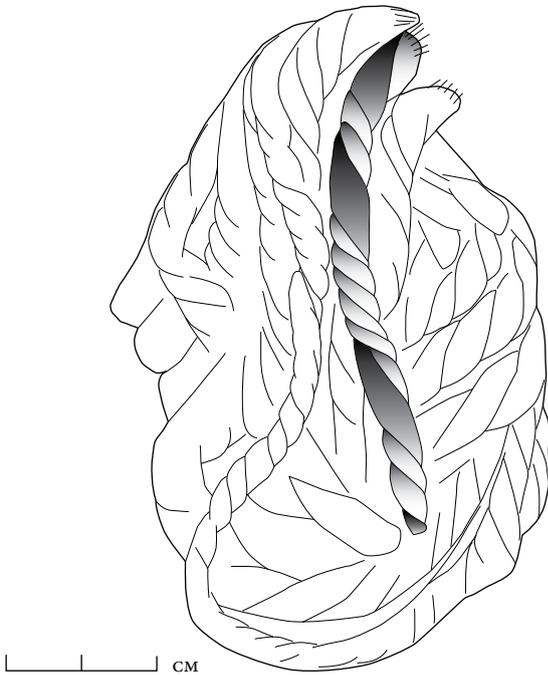


Figure 4. Hank of rope (TX25) with splice indicated.

**Shoe Soles**

TX26 (SF 2254d, context 2238)

**Shoe sole**

One vegetal fiber sole fragment 4.1 × 3.8 cm

FIG. 5

The sole consists of two bundles of twisted vegetal fiber (a woody stem of some sort), each bundle diameter 0.2 cm, bound together with flat monocotyledonous fiber in a figure-eight pattern, making a flat strap approximately 0.8 cm thick. This strap was coiled around itself, and its shape held together by passing a thick cord (zS<sup>2</sup>, 0.3 cm diameter) through the center of each strap, in the interstices formed by the figure eight between the two “core” layers. The sole shows signs of heavy wear on one surface, with the figure-



Figure 5. TX26.

eight binding worn through to the core on one side (fig. 1a and b).

NB: This item has deteriorated since excavation.

TX27 (SF 2272, context 2252)

**Shoe sole**

Four fragments of vegetal fiber sole, largest piece 5.2 × 3.1 cm

The sole consists of two bundles of twisted vegetal fiber (a woody stem of some sort), each bundle diameter 0.2 cm, bound together with flat monocotyledonous fiber in a figure-eight pattern, to make a flat strap approximately 0.8 cm thick. The center of the sole was formed by folding the straps back to back repeatedly (three complete folds preserved); this was held in position by passing a thick cord (zS<sup>2</sup>, 0.3 cm) through the center of each strap, between the interstices formed by the figure eight. The outer edge of the sole was made by wrapping concentric layers of strap (minimum four still present) around the edge of the folded area and sewing these together, again with thick cord, between the two “core” layers. The fragments all show signs of heavy wear on one surface.

NB: This item has deteriorated since excavation.

**NOTES**

1. I would like to thank PHI for funding and supporting this project through all its stages, and OA for its help both in the field and during the postexcavation study period. For laboratory and microscope assistance, I would like to thank Dr. Clifford Price and James Hanes, both of the conservation department at the Institute of Archaeology, University College London. I thank Hugh Kilmister of the Petrie Museum of Egyptian Archaeology for access to materials on display and in the reserve collection. For her invaluable advice and help on issues raised during the preparation of this manuscript, I would like to thank Hero Granger-Taylor, whose time and patience was greatly appreciated. Finally, I would like to thank Michel Feugère for setting me in the right direction. Drawings are by Oxford Archaeology unless otherwise noted.
2. While many published textiles are described as partly carbonized, this is mainly a chemical oxidization, often related to the materials' exposure to body fluids during burial: Cooke 1990, 9–13. The most comparable group of wholly carbonized material from nonburial deposits may be from Pompeii and Herculaneum, but at the time of writing these were not yet published.
3. Wagner 1976, 288; Kennedy 1998, 11. For further comment on chronology see Aylward, Butcher, Kenrick, and Tobin, elsewhere in these volumes.
4. Pfister and Bellinger 1945, 1.
5. Until the invention of synthetic dyes, linen textiles were rarely dyed, as the yarn does not take color well. Linen was occasionally bleached, or dyed blue with indigo: Shamir 1999, 92; Baginsky and Shamir 1995, 23, 29; Stauffer 1996, 425.
6. E.g., Khirbet Qazone (Granger-Taylor 2000, 155): only 3 from more than 40 textiles are linen. Dura-Europos (Pfister and Bellinger 1945, 2): 27 linen, more than 230 wool. Masada (Sheffer and Granger-Taylor 1994, 156): 12 linen, 105 wool. Only at Palmyra, where sheep's wool is the predominant fiber, is linen described as abundant: Stauffer 2000, 249.
7. Wild 1988, 10–1.

8. Cooke 1990, 12, fig. 36. Well-preserved carbonized cotton from Soba, Sudan.
9. Predominance of warp-faced tabby linens: Masada: Sheffer and Granger-Taylor 1994, 163; Dura-Europos: Pfister and Bellinger 1945, 2; Cave of the Letters: Yadin 1963, 252–3; Palmyra: Pfister 1934, 19–28.
10. The reduction of warp numbers is desirable when wool is being substituted for linen as a weft. Linen threads are more slippery and can be packed down more closely than wool, which is more “hairy” and does not slide so well: Pritchard and Verhecken-Lammens 2001, 21–4, fig. B; Pfister and Bellinger 1945, 2, and figure 4 this chapter. Examples in wool found at Masada: Sheffer and Granger-Taylor 1994, 163, 192.
11. Pritchard and Verhecken-Lammens 2001, 21; Granger-Taylor 2000, 157.
12. Flax was grown throughout Cilicia, and Tyre and Sidon were renowned centers of production for luxury textiles and dyes; see Stauffer 2000, 249. The recently discovered sarcophagus from Antakya (ancient Antioch) contained dissociated linen and gold threads, which are also most likely to be an import from the coast. The sarcophagus has been dated to A.D. 268 by Kiliç (2000, 103). The sarcophagus and contents are displayed at Hatay Müzesi, Antakya, accession number 18153.
13. Goldman 1994, 101, 107.
14. Petrie 1889, 13, pl. 21. Petrie museum accession numbers UC 28288, 28289, 2830iii, 28302, 28303, 28308. From a single tomb dated by a “coin of a son of Constantine I” to approximately A.D. 340.
15. Fiber soles dating to the Neolithic in Spain: Alfaro Giner 2000, 132, fig. 1. Sandal from Grotte des Murciélagos, Albuñol, Grenada, 14C dated to approx 3450 B.C. The structure appears to be of plaited vegetable fiber, coiled laterally then sewn together through the central voids. Espadrilles and other rope-soled shoes persist through to the present day.
16. Pfister and Bellinger 1945, 6, 15. Pritchard and Verhecken-Lammens 2001, 28.
17. Goldman 1994, 163–79; Vogelsang-Eastwood 2001, 73.
18. Barber 1991, 17–24, figs. 2.8, 2.9.
19. Sheffer and Granger-Taylor 1994, 231.
20. Parton, this volume.
21. Sakamoto 2001, 61; Stauffer 1996, 425–30.
22. Sheffer and Granger-Taylor 1994, 159.
23. Goldman 1994, 107.
24. Shamir 1999, 105, 108. ‘En Rahel, an early Roman site (second century B.C.) records 130 fragments of plant fiber cordage, of which all but one were Z-spun, then S-plied.
25. The textiles described as “Linen (?)” were extremely fine and in a worn state of preservation. The fibers examined looked like fibrillated linen, but the thread compaction made this difficult to tell. H. Granger-Taylor (pers. comm., May 2003) suggested that silk should also be considered a possibility in textiles of this fine a weave. Silk is a proteinaceous fiber, however, and it would be extremely unusual for it to survive in a carbonized context. Other bast fibers include hemp and stinging nettle, of which hemp is the most coarse fiber, making it unlikely here, while stinging nettle has much shorter fibers and its use has not been noted in this region (Wild 1988, 21–2).
26. The numbers in parentheses immediately following the catalogue numbers refer to Small Find numbers assigned in the trench, as they were excavated. When these groups of finds were analyzed, the fragments were identified as being from different artifacts, and letters (a, b, etc.) were used to differentiate between these.
27. Bast fiber, probably linen: Without cell maceration it is difficult to say precisely from which plant a fiber may have originated, but flax is the most commonly used and therefore the most likely. Carbonized fiber is not appropriate for this technique.
28. This grouping was identified by Hero Granger-Taylor from a digital photograph taken at the Birecik depot. I am extremely grateful for her input on this fragment. Crossed warp threads grouped for bands have been noted in wool at Masada (Catalogue 96(G) 1264–1957/1, figs. 74–6) although the number of threads picked for grouping is not the same as in the Zeugma textile (Sheffer and Granger-Taylor 1994, 192–3). Also from at-Tar in Iraq (Fujii, Sakamoto, and Ichihashi 1989, 113), with no specification of fiber type. Also see Pritchard and Verhecken-Lammens 2001, 23–4, who describe a linen tunic with crossed, grouped warp threads at the edge of wool tapestry decorations.

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