7. Textile Production at Tell 'Abū al-Kharāz, Jordan Valley
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ABSTRACT
Excavations at Tell 'Abū al-Kharāz in the Central Jordan Valley produced substantial evidence of textile production from the Early Bronze Age IB to the Iron Age II, viz. from roughly 3100 to 600 BC. Looms, spindle whorls, loom weights, awls and other textile-production-related tools have been found in large numbers. Outstanding amongst these finds are the remains of two wooden, vertical, warp-weighted looms and numerous textile-production-related tools from a burned down house from EB II, i.e. from around 3000 BC. The interior of this house offered a 5000-year-old snapshot of the activities which were going on just before the house was destroyed: after removing the collapsed roof we could expose two looms with the loom weights in situ inside the frame of one of the carbonized looms, spindle whorls and other tools, and a number of complete, locally produced and imported, ceramic vessels. The importance of textile production and the differences in textile-production-related tools between the three main periods at the site are discussed.

1. Introduction
Tell 'Abū al-Kharāz, “The Mound of the Father of the Beads”, lies in the ancient landscape of Gilead in the Central Jordan Valley north of the perennial Wadi al-Yabis (Fig. 1). According to the Palestine Grid Coordinate System the coordinates of the summit, which lies 116.00 m below mean sea level, are E 206 196.54 and N 200 623.07. The area occupied by the tell is approximately 300 m (north-south) by 400 m (east-west). From the summit plateau of Tell 'Abū al-Kharāz large parts of the Jordan Valley and the Samarian hills can be overlooked. These include the hills around Nazareth, Mount Tabor, Beth Shean, the eastern Jezreel Valley, large parts of the West Bank and the area north of Tell al-Sa‘idiyyeh. To the east are the rising hillocks of western Gilead, which are the outcrops of the Transjordanian plateau further east. The distance between Tell 'Abū al-Kharāz and the Mediterranean Sea is approximately 80 km. Six km to the north is Tabaqat Fahl (Pella of the Decapolis) and Tell Deir 'Allā is approximately 35 km to the south.

Thirteen seasons of excavations and surveys took place at Tell 'Abū al-Kharāz under the direction of the author between 1989 and 2009. Walled towns flourished during EB IB-II (Fischer 2008), the end of the Middle Bronze Age and the LB I-II (Fischer 2006a; 2006b) and IA I-II (Fischer forthcoming). Textile-production-related tools were found in all periods.

2. Early Bronze Age
The findings from the Early Bronze Age at Tell 'Abū al-Kharāz which is divided into three phases (Phases I-III) and six sub-phases (Phases IA-B, IIA-B and IIIA-B), belong to the conventional EB IB-II. At Tell 'Abū al-Kharāz this occupational phase corresponds in absolute terms to 3150-2900 cal BC according to 16 radiocarbon dates (Fischer 2000, 222-24; Fischer 2008, 323-27, 381-82).

The excavated objects which can no doubt be classified as related to textile production are 82 in number. There are the remains of two wooden looms from Phase IIB, 48 spindle whorls/loom weights (from all phases), one spindle whorl with the wooden shaft still attached (from Phase IB) and 31 awls/shuttles of bone (from all phases). Other, multifunctional, tools which were certainly used during the textile production process, for instance needles and knives of various materials, are not described in detail in this study.

2.1 Looms
There is a room (L316 and 328) in Trench XXIX, Area I, which is ascribed to Phase IIB, around 3000 cal BC, which contained the remains of two wooden, vertical, warp-weighted looms of approximately the same
size (Fig. 2, C and D; Fischer 2008, Fig. 37). One of them (Fig. 2, C) was in the process of being prepared for weaving prior to the catastrophe which destroyed the house, judging by the eight loom weights of basalt which were found lying in a row as they fell when the fire destroyed the attached warp threads (Fig. 3). It may be, considering the position of the fallen loom weights, that the loom weights were aligned with each other by means of, for example, a wooden stick. It is also possible that the wooden stick was used when weaving halted or when a new weaving arrangement was prepared. The distance between the vertical side beams is approximately 1 m and the total height is somewhat more than 1 m. There seem to have been forks on the upper ends of the side beams on which the top beam rested but the evidence was not altogether clear from the faint outlines of the burnt-down wooden structure. Strings might also have been used in order to align the top beam with the side beams. The transversely positioned, faint, carbonized outlines inside the loom frame might derive from a heddle or a shed rod (see a reconstructed warp-weighted loom in Fig. 4). Our warp-weighted loom type has a number of advantages compared with, for example, the simpler horizontal ground loom: it is portable and does not need much space when in use or during transportation; the weaver can also produce lengths of cloth longer than the actual height of the loom (cf. Friend 1998, 4). As a result, greater quantities of cloth could be produced in shorter periods of time than with other types of looms.
In addition to the eight loom weights the following finds are associated with the two looms and the production of textiles: two more spindle whorls/loom weights of basalt, several bone shuttles, and an awl and a knife, both of copper. Examples of weaving tools of bone can be studied in Figure 8. The piled mudbricks to the left of one of the looms may belong to the weaving array. A number of elegantly produced complete jugs and other ceramic vessels, both locally produced and imported from Cisjordan and Lebanon, belong to the find repertoire of this room (Fischer 2008, 49-69).
2.2 SPINDLE WHORLS AND LOOM WEIGHTS

There are 48 objects which are classified as spindle whorls / loom weights: 24 from Phase I, 23 from Phase II, and one from Phase III. The outer diameters of these doughnut-shaped objects, the vast majority of which are of dense, quite heavy, basalt which was most likely imported from the Golan Heights,\(^1\) vary from 3.2 cm to 5.1 cm and the diameters of the centred holes vary from 0.9 cm to 1.5 cm.\(^2\)

These doughnut-shaped textile production tools can be divided into two groups: Group 1 includes those with a cross-section which is circular and which are excellently balanced (Fig. 5, 1-3). They have a smooth finish and are most often but not always smaller and lighter than those of the second group. Their weight is between roughly 20 g and 60 g. The objects of Group 1 were no doubt used as spindle whorls but certainly also as loom weights. There are examples from Early Bronze Age contexts at Tell 'Abū al-Kharāz where these objects were found solitary with wooden sticks still attached, suggesting use as spindle whorls (Fig. 6). Another context shows *in situ* finds of similar objects which were linearly arranged as they fell during a conflagration, rather suggesting their double function as loom weights (see Fig. 3). In conclusion, Group 1, which predominates, were used as spindle whorls and, because of their low weight, as loom weights for warps of thin thread.

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1 There are a just a few of these objects which are of limestone, for example, N908 from L93, Area 9 East, Phase IIA (see Fischer 2008, Fig. 314.7; see here Figs. 3 and 5).

2 Their individual weights are recorded in Fischer 2008, 31-244, 353.
Group 2 are also doughnut-shaped and shows a cross-section which is still roughly circular but more irregular than that of Group 1 (Fig. 5, 4-5). They have a poor finish and are most often larger and heavier than those of Group 1. Their weight is up to roughly 90 g. These objects are not usable as spindle whorls: tests have shown that they wobble considerably when brought into a rotating motion. They have therefore served solely as loom weights. It may be that the desired object at the end of the production line of these items was one that could serve both as spindle whorl and loom weight but that those of poor quality could be used only as loom weights, either because of inferior properties of the basalt or because of production faults. Unfinished objects prove that there was an on-site production of spindle whorls and loom weights (Fig. 5-6). It is reasonable to assume that spinning and weaving cannot have taken place simultaneously; consequently these objects could have served both activities in the same household or works.

There is evidence of the production of relatively fine textiles (Fig. 7; see also Möller-Wiering 2008, 399-400). Impressions of such a textile of the “plain tabby type” are visible on the outer surface of a hand-made EB I storage jar which, however, derives from another context, i.e. not from the “loom-room”, and is from the preceding phase. It shows approximately 12 warp threads within 1 cm of the impression on the surface of the fired clay jar. Even considering a theoretical maximum shrinkage of 12% during the drying process of the jar (Rice 1987, 71), it would still give at least one warp thread for each mm. It does not seem that this jar was standing on the textile during the drying process before firing because the impressions are spread on the outside of the body of this jar. Instead, the impression seems to be caused by the cloth which the potter was wearing when producing the jar, or with which the vessel was covered during the production / drying process.

2.3 SHUTTLES AND AWLS

They are 31 in number (some examples in Fig. 8). The difference in shape between the shuttles and the awls lies in the choice of the type of bone. The shuttles are manufactured of split rib bones, viz. half ribs, which were sharpened to a tip against a lithic tool at one end and with perforations at the other, rounded, end which is not usually preserved in our material. The awls are of indeterminate diaphyses which were sharpened against a lithic tool to form a point (cf. Cristiani 2008, 401-03).

Micro use-wear analyses demonstrate that most of the shuttles have been used for a long time. The distribution of the functional traces, i.e. striations, polish and rounding, suggests that the shuttles have performed longitudinal and transversal movements. The comparison between the archaeological use-wear and traces experimentally produced suggests that our bone tools have really been used as shuttles, in contact with animal fibres, i.e. the wear is very similar to traces produced by experimental work with wool. It should also be pointed out that use-wear traces are mainly located on the superior surface and in particular in the mesial part of our shuttles.

Micro-wear analyses of the awls show that they have been used with transverse movement for piercing a soft and elastic material such as fabric and leather.
3. THE MIDDLE AND LATE BRONZE AGES

Material from Phases IV1-2 belongs to the late Middle Bronze Age, viz. MB III in conventional terms, and that from Phases V-VIII is ascribed to LB IA-C and the beginning of LB II, or in absolute terms from around the 17th century to approximately 1300 BC (Fischer 2006a, 362-74).

The number of textile-production-related finds from the Middle/Late Bronze Ages is much smaller than from the Early Bronze Age, although the durations of occupation during these two periods are approximately the same. There are 15 finds: five spindle whorls, four loom weights, two shuttles and one awl; three objects are classified as buttons but their use as small spindle whorls for the production of thin thread cannot be ruled out.

3.1 SPINDLE WHORLS AND LOOM WEIGHTS

There is one spindle whorl of stone from Phase IV/2, one of stone from Phase IV-V, one of stone and one of a reused/perforated piece of the base of a ceramic wheel-made juglet from Phase V, and finally one of stone from Phase VI. None of the spindle whorls is of basalt, instead, all are of limestone and calcite. The spindle whorls of stone are fairly standardized: their diameters are around 3 cm and their weights are between 20 g and 25 g. Their average weight is therefore comparable with those in the lowest range from the Early Bronze Age, viz. they are on average much lighter than their Early Bronze Age counterparts. The three “buttons” are of ivory and bone and of excellent finish (Fig. 9). They might as well have had the function of spindle whorls and are also fairly standardized in shape and weight, i.e. they are between 2.1 and 2.3 cm in diameter and from 0.6 to 0.7 cm in height, and all are fairly close to 3 g in weight.

Four loom weights are of limestone and one of a reused/perforated piece of the base of a ceramic wheel-made jug. The loom weights of limestone are from Phases IV-V (3) and VII (1). The ceramic loom weight is from Phase VIII. The loom weights of limestone are around 10 cm in diameter and roughly 4 cm in height. All weigh above 100 g.

In conclusion, it seems that the spindle whorls from the Middle and Late Bronze Ages at Tell ‘Abū al-Kharāz were mainly used for the production of thinner threads in comparison with those from the Early Bronze Age. Another interesting observation is that basalt was not used for spindle whorls and loom weights: this may point to limited access to the basalt sources from the Golan Heights or a change in production technique and equipment design. One may notice a certain contradiction to this hypothesis because basalt was still in use during this period as material for pestles, millstones, potters’ wheels, bows, mortars and various other tools.

3.2 SHUTTLES AND AWL

There are two shuttles and one awl. All are of bone. The pointed shuttles of split rib bone are from Phase IV-V contexts, and the awl of a sharpened diaphysis is from a Phase VII context.

4. THE IRON AGE

The material from the Iron Age, which starts with Phase IX, is not completely processed (Fischer forthcoming). Therefore the report on this material is preliminary and does not contain any detailed statistics nor any
exact temporal or phase-wise distribution of the textile-production-related finds. The majority of the textile-production-related tools, however, mainly belong to the second part of the Iron Age and, more precisely, to the conventional IA IIB/C.

4.1 Spindle Whorls and Loom Weights

The finds of spindle whorls from Iron Age II contexts from the excavations in 2008 may serve as “representatives” for comparable finds and contexts from earlier seasons. There are three spindle whorls which are most likely residual finds: one is of doughnut-shaped basalt (weight 43 g) which is identical with spindle whorls from the Early Bronze Age; the second is of the “button-type” of ivory (weight 4 g) most likely from the Late Bronze Age; and the third, quite damaged and only partly preserved, is of calcite and is expected also to be from the Late Bronze Age. The remaining six are all of limestone (4) or fired clay (2). The dominating shape is the cone and they weigh between 33 g and 58 g (see Fig. 9 right).

The loom weights from Iron Age Tell ‘Abū al-Kharāz are several hundred in number. They are in general of spherical shape and of unfired, sun-dried, clay (see Fig. 10). They are usually much heavier than those from the preceding periods. The short field season in 2008, which exposed a limited area of 140 square metres, for instance, produced 64 loom weights (Rinner forthcoming).

There are three groups of loom weights in our material from 2008 which to a large extent is comparable to material from previous seasons: they are roughly from seven to ten centimetres in diameter, the average being eight to nine centimetres (cf. the evidence from Tell Deir ‘Allā in van der Kooij and Ibrahim 1989, 57, Fig. 72, 98, No. 68 demonstrating an average size of eight to nine centimetres in diameter and a weight between 275 to 470 g)(Fig. 10). The lightest range from 189-272 g, the medium-heavy group from 305-388 g and the heaviest and largest group from 413-640 g. It is clear that heavier loom weights can only be used for the production of weighty textiles like rugs, wall hangings, blankets or storage bags.

The variations in weight within this group are considerable, which has also been observed by Boertien (2004, 312) as a common phenomenon in the material from Tell Deir ‘Allā (see also van der Kooij and Ibrahim

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3 This does not of course exclude their re-use in the Iron Age but the choice of material and their shapes point to an earlier production date.

4 See also Friend (1998) for an overview of the loom weights from Tell Taannek.

5 The weight of the loom weights was assessed after a couple of days which allowed for drying the humid clay.
It is likely that the number of threads tied to each weight was not always the same and it was therefore not necessary to make each loom weight identical in weight. More warp threads could have been tied by means of a heavier loom weight while a lighter one was tied to fewer threads. The relatively high number of loom weights from the Iron Age of Tell ’Abū al-Kharāz point to a substantial textile production at the site.

4.2 SHUTTLES AND AWLS
The 2008 season did not produce any shuttles or awls of bone. It is therefore likely that these items did not survive because they were of perishable material, for instance, wood: at least shuttles must have been used in this part of the settlement where textile production was intense.

5. CONCLUDING REMARKS
It has been stated in previous publications that the main source of the obvious prosperity of the populations of Tell ’Abū al-Kharāz from the Early Bronze Age over the late Middle and Late Bronze Ages to the Iron Age was horticulture and cattle-breeding (e.g. Fischer 2006a, 339-49) but that the trade in handicraft products certainly also contributed to the people’s wealth. These include vessels of earthenware, which were produced in the vicinity of the town according to the petrography. Other goods for whose presence there is evidence in the town and which might also have been traded include beadwork, basketry, spinning, textile production and needlework on fabric and rawhide, stoneworking and woodworking. It is of course not possible to determine if, for example, textiles were produced only to satisfy the need of the people of the town or if surplus from textile production was traded: nevertheless, the remains of looms of the warp-weighted type as early as in EB II, around 3000 BC, and the quite large amount of textile-production-related tools such as spindle whorls, loom weights, shuttles, awls and needles, suggest textile production on a larger scale resulting in an expected surplus. This surplus was no doubt of economic significance as a medium of exchange for coveted goods, mainly copper and/or copper alloys, “exotic” ceramics from southern Lebanon, Egypt and Cyprus, and other luxury commodities such as cosmetics. Textiles were always in demand: they were not only used to provide warm clothing and protection against the elements, to store and transport goods but also as adornment and to demonstrate wealth and power.

There are clear differences between our three main periods as regards design and choice of material of textile-production-related tools and - as a consequence - most likely also the final products. Whereas compact basalt dominates amongst the spindle whorls and loom weights in the Early Bronze Age, this material was essentially not used in connection with textile production in the Middle and Late Bronze Ages and the Iron Age, at least not at Tell ’Abū al-Kharāz. It has been suggested that this may point to limited access to the basalt sources from the Golan Heights or a change in production technique and the design of the weaving equipment. The evidence from the study of shape and weight of spindle whorls from the Middle and Late Bronze Ages at Tell ’Abū al-Kharāz, which were made of limestone, calcite, ivory and bone, points to the production of thinner threads in comparison with the Early Bronze and Iron Ages. The latter period also stands for an “innovation”, namely, inexpensive and fairly heavy loom weights of sun-dried clay.

BIBLIOGRAPHY


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