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# The Unwound Yarn
## Birth and Development of Textile Tools Between Levant and Egypt

Chiara Spinazzi-Lucchesi

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## Abstract

This book reviews certain of the most important archaeological finds of textile tools, in order to draw a picture of the spinning and weaving technologies adopted in the Levant and Egypt from the Neolithic to the Persian period. A brief description of the objects found at several sites is provided to highlight differences of materials and tool design in order to better understand developments in weaving technology across this region. Textile tools housed in the Museo Egizio di Torino are also examined here for the first time. These include spindles and spindle whorls, bone spatulae and needles, which for the most part originate from Schiaparelli's excavations at the Workers' village of Deir el-Medina. A general analysis is provided, which compares these objects to the tools known from other sites in Egypt, as well as a catalogue, which provides further description and exact measurements for each object of the collection.

**Keywords** Spinning. Weaving. Levant. Deir el-Medina. Museo Egizio.

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# 0 Introduction

The idea for this work arose from the observation of the extraordinary state of conservation of Egyptian materials linked to textile production and the fact that very few studies have been devoted to these remains. Interestingly, areas possessing climates that are less conducive to the preservation of organic materials have been the subject of extensive and far-reaching studies on the subject of textile production: these studies today form the methodological basis for the field.

One of the great benefits of working on textile-related items is the extraordinary homogeneity that has characterised these tools for millennia, across different areas and contexts. Despite major technological differences, mainly as pertains to looms, the basic instruments of spinning and weaving have remained unchanged until the present in certain parts of the world, and allow for interesting ethnographic comparisons to be made. With these assumptions in mind, the decision was made to consider two archaeological areas with very different traditions of textile studies in order to integrate, where possible, the various available data.

The present work presents a study of a group of Egyptian artifacts held at the Museo Egizio in Turin (henceforth Museo Egizio), in an attempt to integrate them into the general discussion of the spinning and weaving techniques of Ancient Egypt. The results of this study are compared with material from the Levant, an area that is similar to Egypt in many respects, but with the advantage of a longer and more intensive tradition of textile studies. The order of the following chapters develops from a general description of the state of ancient Near Eastern textile-production studies, surveys the archaeological sources available from both Egypt and the Levant, and ends with an assessment of the material housed at the Museo Egizio.

The great advantage of studying the Egyptian remains is undoubtedly the preservation of organic materials, which are difficult to recover from most archaeological contexts. In fact, outside of Egypt, it is extremely rare to find preserved textiles; although textile imprints on terracotta or mineralised fragments adhered to metal objects may be recovered in limited instances. In the same way, wooden spindles and spindle whorls, looms, fibres, threads and balls of yarn are rarely preserved, which sometimes creates difficulty in identifying the function of particular objects. This is true in the case of spindle whorls, which are sometimes confused with

beads, and the class of bone and ivory rods used in the Levant throughout the Late Bronze and Iron Ages whose function as spindles, distaffs or pins is still under discussion.

The study of well-preserved Egyptian materials may aid in assessing the function of certain of these objects – some technical differences across different geographic areas being recognised – and may grant new insights upon the designation of certain objects as belonging to the textile sphere. The chronological context chosen for this study is wide; it includes Neolithic and Chalcolithic periods, the entire Bronze Age, and the first half of the first millennium, taking the onset of Persian domination in the Levant as its end point, as the Persian period saw the introduction of different materials and weaving techniques into the areas under discussion.

It was decided to limit research to the archaeological sphere, albeit with an awareness of the amount of information contained in textual sources; it would not have been possible, however, to carry out an in-depth analysis of the written record related to textile production for both Egypt and the Levant over such a chronologically vast period. It was also not possible to offer a reconstruction of the social and symbolic situation of textile production in this work, nor discuss the questions of domestic or palatial production and the use of female or male labour.

The methodology used in this work closely follows that highlighted in recent studies by the Copenhagen Center of Textile Research (CTR), wherein the study of archaeological and philological material is combined with experimental research. Due to this recent research it is now possible to approximate with confidence the quality of thread used, and thus, the type of fabric produced, based solely on the spindle whorls and loom weights recovered from various archaeological sites. In addition, the systematic study of artefacts and their re-creation in practical experiments has made it possible to debunk certain long-held assumptions (e.g. that the minimum weight of a spindle whorl is 4 g), these experiments have also better defined the role of certain classes of objects whose relation to textile production was in doubt.

The experimental-archaeological research approach of the CTR, by its transversal nature and by its coverage of textile production across the Mediterranean area and Northern Europe, provides the methodological basis on which the study under consideration can be set. The materials analysed by the CTR (i.e. primarily wool, terracotta and stone), however, limit the application of their study on the objects under examination, most of them made of flax and wood (as they are almost exclusively preserved in Egypt) and, thus, certain parameters provided by the CTR cannot be applied to all the materials under examination.

In ancient societies, textiles were extremely important, not just as necessary objects for dressing and furnishing, but also as markers of social distinction. Colored fabrics woven with decorative motifs or enriched with

precious materials made it possible to distinguish the importance of a person at a glance, along with other status symbols such as jewelry. The demand for precious fabrics and rare materials was, therefore, one of the first drivers of long-range contacts and trade, and with time the textiles themselves became a currency of exchange. The finest fabrics were worn by kings, queens and nobles; they were offered as gifts to the gods and used to pay the tribute demanded by the most powerful sovereigns. Individuals of the lower classes also needed to supply themselves with textiles, often through household production on the level of their own family.

Therefore, in the past an incalculable amount of fabric was produced for items such as garments, curtains, bedding and shrouds for funeral use, but of this massive quantity almost nothing has survived. The fragile organic fibres from which textiles were composed tend to disintegrate with time, except in rare circumstances such as very dry environments, glacial ice, charred contexts, or total submersion in anaerobic environments; some textile fragments might be preserved in the form of clay imprints or mineralised on metals.

Of all the wealth once represented by these materials, today only tiny fragments remain, often too decomposed to allow an interpretation. The tools with which these fabrics were manufactured (especially spindle whorls, needles and loom weights) have proven to be more durable, but a dearth of archaeological finds and the difficulty of interpreting many of the tools used in textile manufacture have long undermined our knowledge of this once thriving and widespread activity.

The first textile studies of the ancient Near East and Egypt began with the publication of artefacts used in weaving by W.M. Flinders Petrie (1890; 1917). This was carried forward by C.H. Johl (1924), A. Braulik (1900) and especially by G. Crowfoot (1931; 1937) works, which further defined the methods and instrumentation in use in ancient times, drawing from both archaeological and ethnographic data. After this wave of initial studies, only a few new elements were added to the discussion, and otherwise materials related to textile production were often relegated to a subordinate position in site reports, or even left unpublished.

The situation began to change in the early ’90s due to E. Barber’s study *Prehistoric Textiles*, which not only reconsidered the archaeological data but also combined it with interesting textual and social observations. During the last quarter century a large-scale re-evaluation of weaving studies has been carried out and several substantial publications have allowed great progress in the analysis of ancient textiles. The work of L. Peyronel (2004) that treats Syria and the Levant, that of G. Vogelsang-Eastwood (2001) covering Egypt, and C. Breniquet’s (2008) book dealing with the evidence from Mesopotamia deserve honourable mentions. In spite of the proliferation of these comprehensive works and of numerous shorter studies, analyses of ancient Near Eastern and Egyptian weaving lag behind

those of other areas of the Mediterranean, particularly behind those of the Aegean and Northern Europe, for which several large study centres have developed (e.g. The Centre for Textile Research of Copenhagen and The Textile Research Centre of Leiden).

Several articles drawing on Mesopotamian and Levantine documents have been published in recent years and constitute a fundamental corpus for reconstructing the operating chain and the social organisation via which fabrics were made. We are lucky to possess hundreds of cuneiform texts dealing with textiles, including Sumerian lists of spinners and weavers employed in palatial and temple institutions, Old Assyrian texts from the merchant's *karum* at Kultepe, documents regarding textile production from the Syrian sites of Mari and Ebla, as well as the mention of precious textiles in the Amarna archive.[1] Textual information from the Southern Levant is comparatively meagre, except for certain hints in a text from Hazor (Horowitz, Wasserman 2004, 335-40).

Egypt has preserved an immense quantity of textile-related archaeological material and a large number of documents of all kinds, but the information these documents provide for textile production in this area is not remotely comparable to that from the ancient Near East. There are very few Egyptian texts that directly refer to textile production, and even fewer that list workers related to the production of fabric. Instead, textile workers appear frequently in models and funerary representations. When compared with the long lists of named people involved in textile production in the Sumerian sources, for example, it seems unlikely that a similar level of detail will ever be known regarding the situation in ancient Egypt; however, the archaeological evidence preserved from Egypt may serve to fill in the gaps that remain, particularly as pertains to our understanding of the actual technology of textile manufacture.

**1** A wide information on these sources is provided by Waetzold 1972 (Neo-sumerian texts), Pasquali 1997 (Ebla), Durand 2009 (Mari) and Matoïan, Vita 2009 (Ugarit). Moreover, an in-depth discussion on lexical data can be found in the volume *Textile Terminologies* edited by C. Michel and M.-L. Nosch. For Egypt see Kemp, Vogelsang-Eastwood 2001.

# 1 The Ancient Fibres

**Summary** 1.1 Flax. – 1.2 Hemp . – 1.3 Wool. – 1.4 Silk. – 1.5 Cotton. – 1.6 Other fibres.

## 1.1 Flax

Flax is a fibre extracted from *Linum usitatissimum* and it consists of 70% cellulose. Common flax belongs to the family Linaceae and descends from the Linum bienne (*Linum angustifolium*) plant (Baines 1989, 13-14), which grows naturally in coastal areas of the Mediterranean Sea and the Atlantic Ocean; it grows in the Mesopotamian area only in winter. It is a perennial plant, standing between 1.0 to 1.30 metres tall on a slender stem; it branches out at the topmost section of its stem and has lanceolate leaves and blue flowers. Several other species in the genus *Linum* are similar in appearance to *L. usitatissimum*, including some that have similar blue flowers, and others with pink, white or yellow flowers. Egyptian Old Kingdom tomb scenes generally depict flax fields covered with blue blossoms (Kemp, Vogelsang-Eastwood 2001, 25).

Flax fibres are extracted from the bast beneath the surface of the stem of the flax plant. They run from the root of the plant to the tip of its stem. An outer bark protects the bast, inside which the fibres occur in 'bundles' embedded within pectinous gums, waxes and non-cellulosic substances. Each stem contains between fifteen and thirty-five bundles (Baines 1989, 14), each containing between ten to forty individual fibres (Kemp, Vogelsang-Eastwood 2001, 25). Under magnification fibres show regular horizontal rings where their cells overlap. Flax fibres possess a natural 'S' twist, due to the positioning of microfibrils inside each fibre (Breniquet 2008, 83).

Flax was a highly exploited crop in antiquity due to its versatility: its seeds are edible and also provide oil suitable for consumption and lighting fuel), while the bast fibres were used for basketry and matting.[1] The extraction of flax fibres for spinning and weaving is a complex multiple-step process. It is not possible to obtain from one plant both seeds and

1 Recently, Breniquet (2008, 89) questioned this theory, suggesting that the domestication of flax occurred primarily for textile purposes and that the alimentary and medicinal uses of the plant were of secondary importance.

excellent fibres for weaving. If the flax was being grown for use in textiles, the seeds were sown close together so that stems grew tall but branches could not proliferate (Baines 1985, 3-4). On the contrary, if the plant was being cropped to provide seeds, it was sown with larger distances between individual plants, resulting in shorter plants, which expended more energy growing long branches.

Once the plant was fully grown, its stems were plucked out of the ground, not cut, to preserve the fibres at their maximum length. The highest quality of fibres was attained by harvesting flax when it was not completely ripe and still greenish. The strongest fibres were obtained from ripe half-yellow plants, while plants completely ripe (notable by their dark yellow colour) produced strong and highly-resistant fibres, desirable for weaving ropes and cords (Gleba 2008, 91). After harvesting the crop, stems were gathered in bundles, tied up and left to dry for about two weeks (Baines 1985, 4). Seeds were removed manually or with the help of a comb and the stems had to be retted[2] to free the fibres from the pectinous substance that bound them together.[3]

The retting operation could be conducted in soft-water streams or in pools over the course of ten to fifteen days,[4] otherwise it was possible to lay the flax out in thin layers on the grass (dew-retting), allowing natural humidity and dew to aid in the decomposition of the pectinous substance (Baines 1989, 15; Baines 1985, 4). If there was not enough dew, the flax needed to be manually watered to provide enough moisture. The process required continuous supervision of the fibres to prevent their weakening and destruction. It was possible to speed up the process using shallower pools, which are easily warmed by the sun, as decomposition is faster at higher water temperatures (Gleba 2008, 92). After retting, stems were dried again, hit with a mallet to break the wooden outer part and then 'scutched' to fully remove the stem casing; alternatively, this process could be accomplished by scraping fibres between two sticks held in one hand. Finally, the flax was 'hackled' with a series of combs (wooden or metal) to remove small remains of straw and to separate shorter fibres from the longer and better quality fibres.

Linen textiles have the advantage of being easy to clean and whiten, without requiring further chemical treatments; however, they are extremely difficult to dye, as colorants cannot penetrate deeply inside linen fibres,

2 It is the general method employed but it is not necessarily the one used in ancient Egypt or the Levant (Kemp, Vogelsang-Eastwood 2001, 30).

3 The process is represented on the walls of the tomb of Urarna in Sheikh Said dated to the Vth dynasty (Davies 1901, pl. 16), Zau in Deir el Gebrawi dated to the 12th dynasty (Davies 1902, pl. 6), and of Paheri at El Kab of the 18th dynasty (Tylor 1895, pls. 3-4).

4 Modern Sardinian flax workers, however, report that they used to leave the stems in water just for a couple of days.

so any colours applied fade quickly with laundering. In Ancient Egypt, textiles were generally bleached rather than dyed, but during the New Kingdom more coloured textiles began to be used.

The first archaeological evidence for linen fabric dates to the Pre-Pottery Neolithic B and comes from Naḥal Ḥemar Cave in Israel. From this context came also other examples of cords, basketry, fibres and fabric (Schick 1986, 96), some of vegetable fibres, some certainly of linen. These textiles date to between 6900-6300 BC and, notably, the linen examples were prepared, spun and plied to produce threads, but they were not woven: the fabric fragments preserved at Naḥal Ḥemar were created by looping and knotting strands into a type of netting (Shamir 2014, 147). Other caves in Israel such as Naḥal Mishmar and the 'Cave of the Warriors' have also provided evidence of Chalcolithic-period linen textiles.

Charred textiles made of vegetable fibres dating to the end of the seventh millennium were recovered from funerary contexts at the site of Çatal Höyük in Turkey (Helbaek 1963, 39-46; Ryder 1965, 175-6).[5] Even if fragmentary and burnt, they provide a great deal of information pertaining to the use of different techniques for producing fabrics, which involve both weaving and knotting netting.[6]

Flax was the first fibre to be used for producing textiles, later followed by wool. Both linen and wool continued to be used during the Bronze and Iron Ages, with wool predominating in the Levant and linen in Egypt. In Egypt flax does not occur in its wild form and it was likely introduced from Asia at an early date; remains of flax fibres are known in Egypt since at least the fifth millennium BC. In the Neolithic and Predynastic periods Egyptians appear to have experimented with all vegetable and animal fibres available to them, including reed, grass, papyrus, palm and esparto,[7] but the extensive cultivation and use of flax in the Pharaonic period reduced these others to a secondary role, for use in basketry, matting and cording, not proper textiles.

A similar process seems also to have occurred in Mesopotamia, where wool and linen represent the great majority of textual references to textiles. Wool is certainly the most common fibre and appears to have replaced flax as the principal fibre in Mesopotamia from the fourth millennium BC onward, although linen remained the cloth reserved for gods and kings (McCorriston 1997, 534). J. McCorriston, in her well-known article "The Fibre Revolution", analysed the social effects of the transition from flax cultivation to sheep breeding and linked it to the relationship between

**5** For a reassessment of the matter see Breniquet 2008, 84.

**6** Fibres were combed before spinning. They are z-twist and s-plied (Burnham 1965, 170).

**7** Forbes 1956, 61-2; Lucas, Harris 1962, 134-5. More cautious is Vogelsang-Eastwood 2000, 269.

women and textile production from that moment onward. The introduction of wool certainly played a major role in the social organisation of urban Mesopotamia, but other factors might have contributed to create a textile industry that employed high numbers of female personnel, such as the possibility of paying them lower wages than male workers, and fewer difficulties in physically controlling them (especially if textile-working women were drawn from captured populations).

It should be emphasised that the situation of textile-creation in Mesopotamia was not necessarily mirrored in the Levant, where more differentiated patterns of labour organisation may have developed, and which may have also varied between the northern and southern Levant.

Also natural geography likely played a role, as Liverani commented in response to McCorriston's article (McCorriston 1997, 537). Liverani noted that the different choice of raw fibres for textile production in Mesopotamia and Egypt might not be due only to climatic necessity (i.e. warm wool clothing is required for at least part of the year in Mesopotamia), but also to the agricultural potential of the landscape. In fact, sheep breeding requires marginal lands not suitable for agriculture, which are widespread in the Near East but not in Egypt, centred on its highly productive floodplain. Furthermore, transhumant pastoralism fits perfectly into Mesopotamia's schedule of winter cereal crops, which leaves fields free for grazing sheep in summer, but is completely in contrast with the summer Nile flood.

## 1.2 Hemp

Hemp (*Cannabis sativa*) is another vegetable fibre important for textile production; it can grow three times as tall as flax plants and produces coarser fibres. It is usually employed to make ropes, sacks and sails rather than garments (Barber 1991, 15). Individual hemp fibres may measure between 1.5 and 3.5 m high and are extracted from the stem by means of a process very similar to that performed on flax. Furthermore, flax and hemp share a similar structure and it is not always easy to immediately recognise one from the other. In some cases, fibres from both plants were combined in order to strengthen yarn, and identifying secondary fibres requires sophisticated analysis (Murphy 2011, 2579).

Hemp was in use in the Levant from at least the Chalcolithic period as recent DNA analysis carried out on samples from the Christmas Cave in the West Bank have proved (Murphy 2011, 2580). The cave was used as refuge only in the Chalcolithic and Roman Periods. Among the numerous finds from the cave are woollen and linen textiles and ropes dating to the Chalcolithic period. One of the analysed textiles showed significant traces of hemp DNA as well as flax DNA, proving both the antiquity of the utilization of these fibres and the existence fibre-combining within single fabrics.

As of yet, there have been no specific studies on hemp cultivation nor on its use in ancient Egypt, but its history probably parallels that of flax, as hemp appears in certain Predynastic textiles (Tata 1986, 41). It is likely that a thorough study of the preserved Egyptian textiles and cordage result in an increase in the number of known cases in which it was employed.

## 1.3 Wool

Wool is a natural fibre that is obtained from sheep and some types of goats, rabbits, camelids and llamas. With a microscopic analysis it can be noticed that, longitudinally, wool fibres have small scales covering their outer surfaces, while in section it is circular. Wool fibres are made up of a protein substance, keratin, and a fatty substance, lanolin. They measure between 2 and 90 mm in length and possess numerous elastic ripples, which is the origin of the typical crimp. This structure gives the wool softness, elasticity, hygroscopicity and highly thermal insulation.

Wool is removed from the animal through plucking, shearing or cutting off the animal's coat. Plucking is likely the oldest method, since efficient shearing requires iron scissors, which did not come into use until the first millennium BC;[8] shearing can also be done with the aid of a knife, although the result is less uniform than with the use of scissors. However, both shearing and cutting provide the potential for two wool-harvests per year (Andersson Strand 2010, 11). Plucking, conversely, occurs during the animal's natural moulting season, a period when the rougher fibres are not present in the fleece, allowing easier selection of the softest fibres. The plucking process, however, is more time-consuming and can be done only once a year.

The fineness (or diameter of individual fibres) is the most important element for assessing the quality of wool and, such as the length of each fibre, depends on the part of the animal from which it is harvested (from the hips, belly, shoulder area, etc.). The quality of a fabric mostly depends on how carefully the fibres are selected and prepared. Criteria for the fibre selection process may be colour, fineness, length, strength, crimp or texture. These qualities are mostly contingent upon the animal's sex, health and age (Gleba 2008, 98). Sheep fleece has three qualities of fibre: underwool, which is the finest part of the fleece, hair, which is the easiest type to spin, especially if mixed with finer underwool, and finally the rough fibre, called 'kemp,' which is thicker and more difficult to spin on its own

8 The first clear evidence for the use of scissors in the ancient Near East comes from a Neo-Babylonian text (Forbes 1956, 8). Breniquet believes that the introduction of clipping with scissors can be traced back to at least the 2nd millennium, based on the few mentions of sheep being washed (Breniquet 2008, 107-8).

(Peyronel 2004, 40; Barber 1991, 21). In the past, sheep fleece was different from that of today's sheep, because composition of modern fleece is the result of a long genetic selection process. Primitive sheep' fleece had a mix of the three types of fibres and higher percentages of kemp (Barber 1991, 22) than nowadays fleeces.[9]

Although wool can be spun immediately after being removed from an animal, it is usually first combed and carded. Carding and combing enable impurities to be released, fibres to be disentangled and re-aligned in parallel, which in turn allows for the subsequent spinning operation. Carding pushes air into the fibres, which is useful for the production of stronger threads (Gleba 2008, 98). In some cases, wool can be spun without having been washed, because lanolin might aid the spinning process. However, it is usually washed before spinning both to remove impurities, which can represent up to 40% of the total weight of the wool, and if it must be dyed before the spinning process. Wool is a much more elastic fibre than linen and from this arises some technical issues in the weaving process (Barber 1991, 21). Furthermore, unlike linen, wool dyes thoroughly and easily, and is also naturally available in different colours.

The earliest use of wool as a textile material is still debated; while it is clear that it must be a result of the domestication of sheep, which occurred during the Neolithic age, it is not possible to distinguish between the remains of sheep used for food purposes or those used for textile production (Barber 1991, 22; Breniquet, Michel 2014, 4). In theory, the presence of castrated rams within particular flocks would suggest that those herds were bred for the wool production, since they did not produce milk and the best wool derived from their fleece. Unfortunately, the quantity and state of preservation of sheep bones from the Neolithic does not permit such detailed observations (Barber 1991, 26).

The first wool fabric found in archaeological contexts is seen in Egypt and dates to the fourth millennium BC (Petrie, Quibell 1896, 24), replacing the previous identification of Çatal Höyük as the site from which the earliest wool samples come (Ryder 1965, 175-6; Barber 1991, 25).[10] Wool certainly had a long history of use in Egypt, as early dynastic finds from Naqada and Helwan prove (Saad 1951, 44), as well as some fragments from the Amarna workmen's village dating to the New Kingdom (Vogelsang-Eastwood 2000, 269). Wool, as it is described by Herodotus (Book 2, 82), was considered impure by the ancient Egyptians, but this prescription probably concerned mainly the priestly classes and funerary contexts, but

9 For an archaeometric and evolutionary study on some textile samples see Gleba 2012, 3660.

10 Ryder, as a matter of fact, definitely excluded that textiles from Çatal Höyük were made of wool, as it was previously claimed. However, certain of these fibres show typical wool scales, although it is not possible to determine which kind of animal they come from (Peyronel 2004, 36 fn. 13); of the same opinion is Breniquet (2014, 57).

not the common sphere of everyday life (Forbes 1956, 5). However, wool findings in Egypt are extremely rare for the whole Pharaonic period.

In the Near East, wool seems to have been in wide use from the late Chalcolithic period onward. At Arslantepe (Frangipane et al. 2009, 12), a decisive increase in the percentage of sheep and goat bones within the animal bone assemblage was noted, as was a change in the diameter of spindle-whorls in the IV a-b period, which might together indicate the adoption of wool as the main textile fibre at this site. Aside from sheep's wool, it seems that goat hair was also used, as suggested by the discovery of a mineralised textile from Arslantepe phase VIb, dating to the beginning of the third millennium (Frangipane et al. 2009, 19-20). Despite the fact that few traces of woollen fabrics survive from ancient Near Eastern contexts, due to the climate and the chemical composition of the soil, texts have provided a description of the intensive exploitation of wool in Mesopotamia, Syria and parts of Anatolia, beginning in the fourth millennium and increasing in the third and second millenniums.[11]

## 1.4 Silk

Silk is a natural protein fibre secreted by certain insects of the Lepidoptera order and by some types of spiders. However, the silk used for textiles is generally obtained from the *Bombyx mori* species. It is extracted from the cocoon of this insect, which is made up of an extremely fine bave, a substance that solidifies in contact with air and produces silk filaments, which vary in length between 300 and 900 m. These insects, commonly known as 'silkworms,' must be reared in captivity in order for their developmental stages to be controlled. If their metamorphosis is allowed to be completed (the worm transformed into a moth), the adult insect will break the cocoon to exit, damaging the filaments from which it is made (Barber 1991, 31). The cocoon is therefore collected and boiled before the insect reaches maturity, both to kill the worm inside and to dissolve an additional layer of sericin protein, which acts as a glue holding the filaments together. The first evidence for silk cultivation comes from China and dates to the Neolithic period: it consists of a cocoon of the *Bombyx mori* species that was artificially cut, but actual silk textiles are documented only from the onset of the Early Bronze Age (Barber 1991, 31).

The archaeological record cannot provide much comment on the beginnings of silk production in the ancient Near East and Egypt, as the creation of silk as a textile does not require tools different from those used for wool

**11** For a general presentation see Breniquet, Michel (2014, 6-7). For reference about textual sources see Waetzold (1972), for Ebla (Pasquali 1997), for Mari (Durand 2009) and for Ugarit (Matoian, Vita 2009).

or flax. Until recently, silk was known in Greece and Western Europe from only the second half of the fifth century BC, and these fibres were probably extracted from wild species of insects, native to the Mediterranean area (Peyronel 2004, 40). Outside of China, the other earliest archaeological evidence of silk fabric also dates to the fifth century BC and comes from a kurgan tomb in Pazyryk, in the Altay Mountains; this fragment, however, is of Chinese origin.

In recent excavations at the House of the Ladies at Akrotiri a silk cocoon was recovered from a level of LM IA (Van Damme 2012, 166), which suggests the utilization of this resource long before previously thought. As previously mentioned, silk textiles in the Mediterranean area are known from mid-first millennium, but appear in Egypt only after the 5th century AD (Rutschowskaya 1990, 25). It might seem strange, given the huge amount of textiles preserved in that country, but Egypt was a rather closed country in antiquity; it is possible that silk circulated in the Mediterranean without reaching the Egyptian market. The textual, iconographical, and now even archaeological hints at the ancient exploitation of silk make potential future finds of the remains of silk cultivation or textiles from the Bronze and Iron Ages less incredible than they once were.

## 1.5 Cotton

Cotton is obtained from hairs that cover the seeds of plants of the genus *Gossypium* (family *Malvaceae*). It is a species that appears to be native to India, where cotton fibres dating back to 2500 BC have been found at both Mohenjo Daro and Harappa (Forbes 1956, 43-5; Peyronel 2004, 33-4). In the Near East the first attestation of cotton is generally considered a royal inscription of Sennacherib (705-681 BC) who is quoted stating that he planted gardens in Nineveh with “trees bearing wool” (Forbes 1956, 45; Oppenheim 1967, 245). However, cotton was known and used before that date since it was found in some garments of the Assryian Queens’ Tombs at Nimrud, dating to the 8th century, and probably arrived from Babylonia.[12]

In ancient Egypt cotton is not attested until the 1st century AD (Vogelsang, Eastwood 2000, 268), although species of cotton plants are also native to Nubia. Cotton fibres are known from the site of Dhuweila in Jordan, and they have been carbon-dated to the final Chalcolithic period or the beginning of the Early Bronze Age (Betts 1994, 493), preceding the first evidence from India and slightly also those from Nubia. Since cotton is not native to Jordan, it has to be arrived either from Nubia or from India, but today the regional provenience of these fibres is still unknown.

12 For an analysis of the term used see Gaspa 2017, 157-8.

Preparing cotton for spinning is very simple, since it only requires the 'ginning' process that separates the fibres from the seeds and removes other impurities. Similarly, the spinning of cotton fibres is notable for requiring extremely light whorls, often made of shell or vitreous paste, because otherwise the short and thin cotton fibres would break.

## 1.6 Other fibres

Nettle fibres (in particular *Urtica dioica*) can be used for the production of textiles, although in East Asia the species 'ramia' is mainly used (*Boehmeria ramia* and *Boehmeria viridis*) (Peyronel 2004, 32). The woody stems of mature plants were soaked, dehydrated and beaten, resulting in fibres that can be separated by hand and woven into fabrics similar to those produced from hemp or linen. Recent discoveries and archaeometric studies have shown that, at least in Europe, nettle was used more broadly than was thought until a few years ago. These discoveries also questioned the generally accepted concept, derived from textual sources, of the cessation of wild-plant exploitation for textile production, in favour of linen and wool cultivation.

The earliest physical evidence of nettle, dating to the Mycenaean period, is found within a textile made of several other fibres: warp made from a vegetable fibre, probably flax; the weft made from an animal fibre, likely goat hair; and a third type of thread, sewed in the band, has been identified as nettle (Moulherat, Spantidaki 2009, 8-15). A second piece of evidence for the use of nettle comes from Denmark and dates to the late Bronze Age, between 900 and 700 BC (Bergfjord 2012, 2). It was identified by means of a new methodology. Nettle fibres (like flax) have a natural 'S twist', while hemp fibres have a natural 'Z twist'; moreover, hemp and nettle contain calcium oxalate crystals, while flax does not. The fabric showed calcium oxalate crystals under microscopic examination and the orientation of the fibrils corresponded to an S-twist, therefore proving its identification as nettle.

Esparto grass is obtained from *Ligeum spartum L.*, a perennial plant typical of the Mediterranean; it is rich in durable and tenacious fibres and is thus used mainly for mats, rugs, cordage, baskets and fishing nets. Esparto was known in Mesopotamia and used by the ancient Egyptians for rope production (Peyronel 2004, 33), but there is no evidence regarding its cultivation.

Finally, certain molluscs of the *Pinna nobilis* family produce 'byssus' silk or 'marine silk'. In the mollusk's foot there is a gland that secretes a semifluid substance, which solidifies upon contact with water and forms a bundle of filaments used by the animal to fasten to a support. The byssus fibre of the *Pinna nobilis* can be woven into a soft, silky fabric of a natural

golden brown colour with greenish hues.[13] Silk of a marine origin seems to have been known in the Near East since at least the 1st millennium BC, although its use could be much older.[14] The difficulties in its preparation combined with its scarcity and the high-quality of its finished fibres made this fabric the reserve of privileged groups.

**13** This is the description of fibre preparation given by the last Italian byssus weaver, Chiara Vigo: "Silk needs to be desalted for a period of 25 days, taking care to change fresh water repeatedly until complete desalination. The fibre is then drained in shadow until it is perfectly dry. It is immersed in a bath made of various natural elements, which make it elastic and ready to be woven. After this treatment it is lustrous, and has a beautiful amber colour. The fibre is dried in a ventilated and shady place so to not dehydrate too much. For carding, a very small card with pins is used to separate the fibres from any tiny algae still present. For spinning, it is essential to use a small spindle with a head not exceeding 3.5 cm in diameter and with a rod no longer than 20 cm. Spinning is very complex since it must concatenate fibres no longer than 2 or 3 cm. The weaving of textiles made with nails [...] runs on linen warps and the beating can only occur with the use of cane reeds" (Authors's translation).

**14** Breniquet proposes identification with the term *busu* in Akkadian (2008, 101).

# 2 Archaeological Evidence from the Levant

**Summary** 2.1 Spinning. – 2.1.1 Spindles. – 2.1.2 Spindle Whorls. – 2.1.3 Spinning Bowls. – 2.2 Weaving. – 2.2.1 Loom Weights. –2.2.2 Perforated Stone Discs. – 2.2.3 Other Tools Linked to Textile Production: Spatulae.

## 2.1 Spinning

Spinning is the process by which fibres are stretched and twisted together in order to obtain a single and continuous yarn. Twisting can be performed both in a clockwise or counterclockwise direction, and the resulting yarn is generally defined as an s-twist or z-twist type.[1] As mentioned in the above section, vegetable fibres possess particular types of natural twist; linen and nettle are both of s-twist type and cotton and hemp are z-twist, but animal fibres such as wool do not have a natural twist and can be spun in either direction.[2] The final thread spun into a yarn tends to lose its twist (e.g. s-twist), which requires it to be joined to a second yarn spun in the same direction as itself. The two threads are therefore 'plied' by twisting them together in the opposite direction of the individual threads (in fig. 1 they are spun in s-twist, and plied in Z direction, to secure the twist).

Spinning is usually performed using a spindle, which is essentially a rod (made of wood or other materials, as discussed below) to which the fibres to be spun are attached, while the rod is rotated manually to twist the fibres. A spindle whorl, a disc in its basic form, attached to the spindle, may also be added to increase the speed and regularity of the spinning. The size and heaviness of the spindle, as well as the diameter and weight

1 This nomenclature refers to the direction of the spirals of the thread when held in a vertical position: if these spirals have the same shape as the central part of the letter S, they have an s-twist. Otherwise, if the spirals follow the same direction as the central part of the letter Z, they are defined as z-twist.

2 Most wool yarns appear to have a z-twist. According to Peyronel (2004, 45) it may depend on the probability that most of the spinners were right-handed, with the minority of s-twisted fibres having been spun by left-handed people. It could also depend on different methods of spinning.

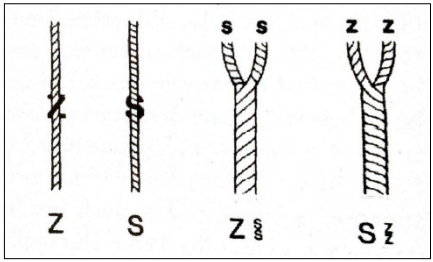



Figure 1. Spinning directions (Gleba 2008, fig. 17)

of the spindle whorl, determine the thickness of the yarn obtained, as several experiments by the CTR in Copenhagen have proved.

Generally, a smaller and lighter spindle whorl creates fine yarns, while heavier spindle whorls are required for thicker yarns. The natural characteristics of particular fibres can also determine the choice of spindle whorls. For example, wool, which is an elastic fibre, usually requires a heavier weight during spinning than vegetable fibres, which require large but light spindle whorls. Spinning cotton requires extremely light and quite small spindle whorls, otherwise the thin and short fibres would break.

The first spinners probably used their fingers to twist the fibre, but the need to keep the yarn in tension and to wrap it somewhere soon led to the use of a stick manually rotated. Spindle whorls were introduced after the spindle itself and this innovation lead to a significant decrease in the time needed to spin a yarn. There exist various spinning techniques, which relate to how the spinning instruments are used (Crowfoot 1931, 9-43; Forbes 1956, 152-4; Barber 1991, 42-51; Peyronel 2004, 41):

- hand-held spindle: a simple rod with a spindle whorl is rotated in the right hand while the left controls the supply of wool (Forbes 1956, 154);
- grasped spindle: a slightly twisted (or spliced) yarn is passed through a ring or a forked stick and spun on a large spindle rotated with both hands. This method is represented in some paintings found on the walls of Egyptian tombs of the 12th and 18th Dynasties (Forbes 1956, 153);
- suspended spindle: the fibres are attached to the spindle and unrolled regularly while the spindle is rotated by turning it between the fingers. The spindle can rotate free on the ground, in a bowl, or hanging in the air. This method allows the length of the yarn to increase, along with the momentum of the spindle. The yarn produced is uniform, durable and thin. This method works well for the spinning of long fibres, which would be difficult with a hand-held spindle (Forbes 1956, 154; Peyronel 2004, 41);
- drop spindle: similar to the previous method. The spinner pulls fibres through her hands and then turns the spindle on her thigh to twist

> the fibres and to give speed to the spindle, which is left turning in the air. The speed is quite fast and the resulting yarn is thin, as the twisting and stretching actions are performed contemporaneously (Forbes 1956, 154).

In addition to these different techniques, spinning can also be classified on the basis of the location of the spindle whorl on the spindle shaft. It is believed that the Egyptian and Mesopotamian cultures (the latter with some degree of uncertainty) used a spindle whorl placed near the upper edge of the spindle (high-whorl spindle). It appears that cultures of the Western Mediterranean and parts of Anatolia, however, normally attached spindle whorls at the bottom of the spindle shaft (low-whorl spindle) (Cecchini 2011, 198; Sauvage 2013, 208).[3] Although these seem to have been the most common practices, there were probably other traditions, which may have varied across populations and time periods.[4] The choice of the position of the spindle whorl does not affect the qualities of the resulting spun yarn, therefore the position is simply culturally determined. However, certain techniques of spinning or plying might prefer various traditions of spindle whorl placement (see fig. 2).

Splicing is a method for producing a continuous thread from separate fibres, simply by twisting them together at the points of junction. It consists of arranging bundles of linen fibres, of about 60-65 cm long, one alongside the other with the edges overlapping by a few centimetres (about 7-8 cm) (Barber 1991, 47; Vogelsang-Eastwood 2000, 73). Then, the ends of these are twisted so they remain joined to each other, allowing for the creation of a continuous yarn. This twist can be created by rolling the fibres in the palms of the hands or on the thighs. Then, they can be spun to add an extra twist, or joined to another yarn and spun together, making certain that the two yarn junction points, which are rather weak, fall in different segments and do not overlap. It is therefore not spinning proper, but rather twist-

**3** In support of this hypothesis, there are few iconographic proofs: a panel from Mari (Barber 1991, 56; Breniquet 2008, 292), a fragment of relief from Susa of the Neo-Elamite period (Porada 1965, 68, fig. 43) and some Syro-Hittite reliefs, in which it is shown that the spun yarn is wrapped around the upper part of the spindle. *Contra* see Peyronel 2004, 45.

**4** Today in Morocco, for example, two different spindles and two very different techniques are used, depending on whether a thick or a thin yarn is desired. To obtain a thin yarn, a smaller spindle (33 cm, max. 1.1 cm, weight 43 g), which has a spindle whorl at the top and a hook for fixing the fibres, is used; it is turned on the thigh and allowed to rotate in the air (drop spindle). Often a second small spindle whorl is added to the centre of the rod to increase the moment of inertia until enough yarn is wound around the spindle. To obtain a thicker yarn a larger spindle is used (50.5 cm, max. 1.3 cm, weight 41 g). It is pointed at both ends, with the spindle whorl(s) attached to the lower part of the spindle. The spindle is rotated by hand on the floor. As we see in this case, the weight is not a decisive factor for yarn quality but rather the technique used is.

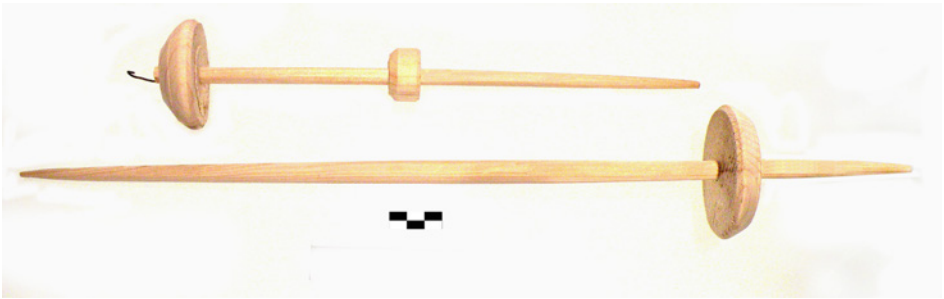


Figure 2. Moroccan spindles for the spinning of wool

ing that makes the spliced yarn more resistant. To adhere to each other, the junction points, in addition to twisting, require a 'glue' that can be obtained by simply wetting the linen with saliva. Human saliva, together with the pectin present in the fibres, forms a collagen and provides a better adhesive than plain water.

Splicing is a technique typically used on flax (or hemp) due to the remarkable length of the fibres provided by these plants, which are too long to be spun without the aid of a distaff, which was not introduced into Egypt until Roman times (Crowfoot 1931, 29; Kemp, Vogelsang-Eastwood 2001, 70). The length of flax and hemp fibres makes splicing a convenient method for their preparation, but it is not a necessary or convenient technique for the much shorter wool fibres. The method of splicing is generally linked to Ancient Egypt and was carefully studied and illustrated first by Barber and then by Vogelsang-Eastwood (Barber 1991, 44-9; Vogelsang-Eastwood 2000, 68-81). The first example of linen fabric that preserves evidence of the splicing technique is a fragment from the Fayum dating to the fifth millennium BC (Caton-Thompson, Gardner 1934, 46; Barber 1991, 48). In recent years, evidence for splicing has also been found in some preserved samples of Neolithic European fabrics, which suggests that this technique was more widespread in antiquity than has been so far been imagined.[5]

The process of splicing may be represented in the spinning scenes preserved on several tombs from Middle Kingdom period Egypt. For example, in the tomb of Daga (Davies 1913, 28, pl. XXXVII; Barber 1991, 46; Kemp, Vogelsang-Eastwood 2001, 70) the figure on the left is probably crushing the fibres by making them pass through two wooden sticks and piling them in a stack in front of the second figure. The second person involved seems to be joining two fibres by making them rotate with her hand on her thigh.

5 Several Italian fabrics were examined by M. Gleba, who noted the presence of this technique. See Rast-Eicher 2005, 121.

A third figure, poorly preserved in the painting, seems also to be joining fibres together but only turning them between the palms of her hands. A spinning scene follows this process where the spinner is standing up, with a folded leg, and is probably plying the yarns coming out of a spinning bowl, whose supply is controlled by the last figure, seated behind the spinner.

A similar process is also seen on the walls of the tomb of Khety in Beni Hasan (Newberry 1893a, 47, pl. XIII; Barber 1991, 46) and on those of Djehutyhotep of el-Bersheh (Newberry, Fraser 1893a, 34-8, pls. XXIV, XXVI; Barber 1991, 46; Vogelsang-Eastwood 2000, 70-1). This last one is particularly interesting, even if badly preserved, as it includes a scene similar to that on the tomb of Daga, as already described. Djehutyhotep's tomb, however, includes one more figure, a woman (on the left side) crouched down in front of a large ball of yarn, preparing it by carrying the thread through her mouth. The thread obtained from this ball of yarn is inserted into a spinning bowl and is then spun by a second figure. It seems a reasonable interpretation to see the figure on the left as splicing the fibres by wetting them with saliva to make them sticky and make their joints stronger. Furthermore, a wooden model from the tomb of Meket-Ra shows three women sitting on the floor engaged in this operation, rotating the fibres on their left knees with their hands (Winlock 1955, 29-33, 88-9, pls. 24-27, 66-67).

The junction points, as noted by Vogelsang-Eastwood, are extremely difficult to recognise, as they can easily be confused with a plied yarn.[6] In Egyptian materials, which are characterised by advanced techniques and of a uniformly high quality, the effects of splicing are difficult to see. If Egyptian fabric is carefully analysed, however, certain points where the thread appears more tightly twisted than otherwise occur at regular intervals; these areas suggest junction points. Studied under an electron microscope, these points are characterised by compact fibres, whereas, in a regular thread, fibres appear irregular and separated. Another feature visible under magnification that may signal the use of the splicing technique is the presence in the yarn of dark fragments of the outer bark, which was usually removed from the fibres but which probably aided cohesion.[7]

**6** I would like to thank M. Gleba for her kindness in helping me learn to identify *splicing*.

**7** M. Gleba, personal communication.

### 2.1.1 Spindles

Spindles[8] are very rarely preserved in the archaeological record as they were generally made of perishable materials. In fact, spindles made of precious materials such as bone, ivory or metal are almost exclusively recovered. Many of these objects come from graves; spindles made of rare materials were probably status symbols rather than being tools of everyday use. In the Near East, the first documented spindles date to the third millennium BC and are made of precious metals such as gold, silver, copper and an alloy of gold and silver.[9] A single wooden spindle, with the yarn still coiled around it, comes from Troy and is dated to the Bronze Age, while other two, made of bone and ivory, come from Layers VI and VII (Götze 1902, 340, 390, 400; Balfanz 1995, 107-9; Völling 2008, 257-8).

In the 2nd millennium, especially in the Late Bronze Age, spindles made of ivory and bone, often decorated on one end with the shape of a pomegranate, were used throughout the Levant. Some of these were formed by a sequence of perforated cylinders – such as one example from Megiddo (Loud 1948, 168, pl. 197: 2) – while others consisted of several elements held together by a tenon joint and a mortise; however, most spindles were formed from a single piece of material. Generally, these objects have rich geometric decoration on the shaft, divided into stripes with lattice or chevron motifs, or with parallel incised strips. Two more spindles have been found at Megiddo in addition to the one already mentioned. The first one, from Tomb 1122 (Guy, Engberg 1938, 170, pl. 81: 1, length 20.2 cm), has two spindle whorls inserted on the tenon that unites the two halves of the object; the second one, from a domestic context, exhibits two spindle whorls placed toward the thinner end (Lamon, Shipton 1939, pl. 95: 38, length 25.2 cm).

The site that has brought forth the largest number of bone and ivory spindles is Ugarit (modern Ras Shamra). In total, four spindles have been found (none of which are intact) with domed or discoid spindle whorls. The first one is a rod made of ivory[10] with one end broken and the other one flattened (Gachet-Bizollon 2007, 115-16, 120, 260, pl. 19: 136; Gachet 1987, 251-2, 263 no. 39; 1992, 87 fig. 4g; Xella 1984, 99). This is decorated with two groups of horizontal and parallel incisions, which surround a

8 Only shafts found with spindle whorls are considered as such. There is no certainty that every preserved rod was used as a spindle. Sauvage (2013, 207-9; 2014, 186-90, 205) proposes to designate similar objects as part of a 'spinning kit', including staffs that could have be used as spindles or distaffs by adding or removing the spindle whorl.

9 See in particular those from Kish (Mackay 1925, 168, pls. XL: 3.3, LVIII.1), Abu Salabikh (Postgate, Moon 1982, 131, 134, pl. Vc), Alaca Höyük (Koşay, Akok 1951, 168-9, pl. 124), Horoztepe (Özgüç, Akok 1958, 45, 51-2, 54, figs. 25-6, e.g. VIII), Karataş-Semayük (Mellink 1969, 323, pl. 74.23), Tepe Hissar (Schmidt 1937, 119-20, 137, 406, pl. XXIX H 2171)

10 L. 22.1 cm, diameter between 0.85 cm and 1.27 cm.

broad band with a lattice pattern. At about one-third of the way down the length of the spindle, close to the intact end, there is a dome-shaped spindle whorl, which is decorated with oblique incisions enclosed in a frame. This spindle date to LB II.

The second spindle is a smooth rod made of ivory with a flat horizontal end that is decorated with carved horizontal lines and is hollow lengthwise to form a mortise (Gachet-Bizollon 2007, 115-16, 120, 260, pl. 19.137; Gachet 1987, 250, 263 no. 40; 1992, 87 fig. 4h; Xella 1984, 99). The other end bears a tenon in which the shape of pomegranate is carefully carved. A spindle whorl in the shape of a flattened disc is positioned half-way down the rod, however, the part normally inserted into the mortise is missing, so the original length of the spindle is unknown. The preserved object measures 22.1 cm, with a maximum diameter of 1.35 cm. This spindle is also datable to the LB II as it comes from the same deposit as the first, which may have been a grave unidentified by Schaeffer (Sauvage 2014, 187).

Remains of another spindle were found in Lattakia (Gachet-Bizollon 2007, 115-16, 120, 261, pl. 19, no. 139). This consists of a small rod, perhaps of ivory, broken into five fragments, of which it was possible to reconnect three pieces. The thicker end was decorated with a series of horizontal and parallel lines, like a section of the rod, while the other end was decorated with two groups of horizontal lines and by a band, partially missing, of lattice decoration. The spindle whorl was set close to the thicker end and is dome-shaped (length 13.3 cm, diameter 0.5 cm).

Aside from the few examples that still preserve their spindle whorls on the shaft, small rods very similar to spindles in form, material and decoration are attested in the Levant[11] throughout the Late Bronze and Iron Ages. They mostly have diameters between 0.7 and 1.3 cm, are decorated with geometric patterns on the shaft, and in some cases have a pomegranate-shaped end. As no spindle whorl has been found attached to the shafts of these objects, it is possible that they could alternatively have served the function of pins or distaffs (Peyronel 2004, 55, 329; Cecchini 1992, 9; Sauvage 2014, 205).

The various types of rods can be divided into three basic categories (Peyronel 2004, 315):

1. single small rods with or without carved ends, the shaft appearing with or without incised geometric patterns;
2. small rods with a separate upper carved end attached to the shaft by a tenon, with or without carved decoration;

**11** For a detailed analysis of bone and ivory spindles and small rods see Sauvage (2014, 184-226).

3. small composite rods made up of two or more pieces joined together by tenons; with or without separate ends; the ends either carved or left uncarved.

The site that has produced the largest group of these rods for the Late Bronze Age is Ugarit and its harbor Minet el-Beida, with more than a hundred rods and rod fragments. The simplest type is composed of a single piece, the shaft of which is left entirely smooth except for two rings carved at both flat ends (Gachet-Bizollon 2007, 20, 145). It is generally not a perfect cylinder, but rather a short rod that tapers towards each of the ends. The decoration is more developed on certain examples, which are carved at one end, but these cases are not so numerous and, as most of the rods are incomplete, we do not know if both ends were originally decorated. Usually decorations consisted of geometric or 'lattice' patterns, oblique lines or the motif of 'overlapping scales,' and were normally divided into bands surrounded by groups of ring lines (Gachet-Bizollon 2007, pl. 21: 170, 181; pl. 22: 190, 194). From this site come also numerous pomegranate-shaped ends, which were attached to the rods by the mortise and tenon system (Yon et al. 1983, 212e; Gachet-Bizollon 2007, 118). At Ugarit, rods were found in graves as well as in domestic contexts, and they were frequently associated with other materials related to textile activity (Sauvage 2014, 204).

The Palestinian area has also produced numerous 'sticks' of bone, from both graves and domestic contexts. For example, Megiddo testifies to the production of all types of rods, from the simplest ones to the most elaborate ones, comparable to the assemblage from Ugarit. There are smooth rods with some ring carving at their ends (Loud 1948, pl. 197: 1), some with similar carving along the shaft, others are decorated with lattice-patterned bands. Decoration is often composed of oblique and zigzag lines, arranged either all over the body of the instrument (Loud 1948, pl. 197: 7, 8, 9; Guy, Engberg 1938, pl. 95: 50) or just at the ends (Loud 1948, pl. 197: 4, 5, 13), which are generally flat and left undecorated. No pomegranate-shaped rod ends have been discovered in Bronze Age contexts in Palestine, but there are examples dating to the Iron Age. Only one rod from this area bears evidence of a tenon, via which one of its ends must have been attached (Guy, Engberg 1938, pl. 156: 13).

Several well-preserved rods have been excavated at Lachish, many of which have a carefully carved pomegranate-shaped or cylindrical top. There are also simple rods, similar to those already described at Megiddo and Ugarit, decorated with circular carved lines, lattice motifs and with flat ends. Most of these were found in the storage rooms of the LB II temple (Tufnell 1940, pl. XX: 23-28), others were recovered from grave contexts (Tufnell 1958, pl. 28: 15, tomb 501; pl. 28: 7, pl. 54: 2, tomb 216). They measure between 13.2 cm and 23.7 cm in length.

In the Iron Age, there was a general decline in the quality of the execution of spindles in the Palestinian area, while the products of Syria

remained richly decorated and abundant. The city of Hama has produced many of these rods, some of them intact, most broken.[12] Some rods were found in the city's destruction layers, dated to the middle of the eighth century BC. Several fragments of these objects were found in Building V, along with spindle whorls and loom weights (Riis, Buhl 1990, 207-8). Many textile-related instruments come from the tombs, which held cremated remains; the necropolis was in use during all four phases of the site occupation. The shafts of these rods tend to taper to one end and their length varies between 21.2 and 24.8 cm. None of these objects have been found with a spindle whorl still in place. Some of the examples have a carved end in the form of a pomegranate (Riis 1948, 173), while others exhibit the remains of both tenon and mortise, which indicate that other elements were once attached. The carved decoration is often extensive and features the same decorative motifs that were used in the Late Bronze Age period, such as the alternation of patterned bands with bands of oblique lines, or a series of incised rings. The central part of the shaft is usually left devoid of decoration. This style of spindles and pins is not restricted to the Near East, but it is spread throughout the Mediterranean area, first making its way to Cyprus and the Italian peninsula, and then, appearing to a lesser degree in the Aegean area and in Egypt.[13]

The objects here examined were probably related to textile production or were found in close association with spindle whorls or loom weights. Their use as spindles is, however, not certain, as there were no spindle whorls preserved upon these shafts. In levels III-IV of the necropolis of Hama the rods were not associated with spindle whorls, unless the whorls were made of perishable materials. It seems, therefore, that some of these instruments could have been used for other functions. Certain examples with tapered tips could have been employed as pins, and it is possible that certain rods might have been used as distaffs, as proposed by Cecchini (1992, 9-10) and Sauvage (2014, 222-3). The presence of distaffs in Syria during the Iron Age is evidenced by certain Syro-Hittite stelae, which make this hypothesis quite reasonable.[14]

**12** Riis, Buhl 1990, 205, 207, 208, 210-13, 215-17, 222-3, 228, 230, 235-40, 242, 244-7, 249, 252, 254, 256, figs. 96, 97 and 99; Riis 1948, 34, 35, 148, 173, 178, figs. 17, 21 and 227; Fugmann 1958, 167, 219, 220, 225, 254-8, figs. 188, 245, 268 and 325; Ingholt 1940, 77, 103-4, pl. XXVI.

**13** For example see the very good article of Borgna (2003, 524-42). As for Egypt, there is the case of Gurob (Barber 1991, 65).

**14** For example see the stela from Bonatz 2000, C21, C22, C23, C24, C25, C26, C27; also Pritchard 1969, 633 and Orthmann 1971, pl. 43i.

### 2.1.2 Spindle Whorls

A spindle whorl is a perforated disc that allows a shaft to be inserted through it, extending the rotary movement of the spindle, and providing greater moment of inertia. Spindle whorls can be of different shapes and materials, according to the type of yarn that is desired. A small and thick disc rotates faster than a wider and thinner one, but the movement continues for a shorter time. The weight must also be taken into account: a stone disc will weigh more than a pottery, bone or wooden disc, which will have a different effect on the fibres that will be obtained. In general, in order to achieve a very thin wool yarn, the spindle whorl should weigh between 10 and 30/35 g, while it may range between 50 and 100g when spinning thicker threads or for plying yarns (Peyronel 2004, 46).

Recent experimental tests carried out by the CTR have shown how objects weighing only 4 g can be used as spindle whorls[15] (Andersson Strand 2010, 208-9). Though these measurements do not themselves put an end to the 'spindle whorl/bead' debate, they help to expand the corpus of textile-related objects and tools, on the basis of experimental evidence. In order to distinguish between a beasd and a spindle whorl, it is useful to consider the diameter of the hole in the preserved object, which, in the case of spindle whorls, must be large enough to allow for the insertion of the spindle. This is not a piece of decisive evidence however, as beads may have had quite wide holes too. On the other hand, spindle whorls could have been mounted through a tenon/mortise system (not directly onto the shaft),[16] which decreases the minimum diameter of the required aperture. In general terms, a spindle whorl is an object pierced by a hole with a diameter between 0.4 and 1.5 cm, but these measurements are only guidelines.

Spindle whorls were made in various shapes, from simple perforated discs to cylinders, cones, truncated cones and so on. There are even cross-shaped spindle whorls attested, which nevertheless produced the desired effects. Due to the scope of this work, which considers spindle whorls included in an array of different excavation reports, it has been decided to use a very simple typology to describe the shapes of the spindle whorls

**15** As for flax, which typically requires very large spindle whorls in order to create a long-enduring and rotating movement, there has not been enough experimental data gathered as yet.

**16** This type of spindle has been found in the tombs of Megiddo (Guy, Engberg 1938, pl. 84).

attested across the Levant.[17] Seven main types can be distinguished:[18]

1. Discoidal: This category includes all spindle whorls having a disc shape, including most of the spindle whorls made from re-used ceramic fragments.
2. Lenticular (or flattened globular): thicker than the discoidal type, with typically convex edges.
3. Cylindrical: a spindle whorl whose height is equal to or greater than its diameter, with a straight or convex profile. This group covers most of the Egyptian spindle whorls, even if they could also be included in the discoidal category.
4. Dome-shaped: flat-based spindle whorls with dome-shaped tops. This category also includes variations of this type; in addition to the classic 'high' dome-shaped type there exist more flattened examples.
5. Conical: spindle-whorls with flat bases and straight edges that tend to narrow toward the top. It is not always easy to distinguish these from certain dome-shaped examples, with less-curved edges. Inserting spindle whorls into this type rather than in another is, sometimes, a subjective choice. Under this category is also included a typical Late Bronze Age artefact that is conical in shape but with a concave profile, which is generally called a 'button' in site reports.
6. Truncated Cone: similar to the Conical type, but with a flat top.
7. Biconical: spindle whorl whose maximum diameter is about half of its height and which supports two symmetrical cones.

**17** This work does not intend to provide an exhaustive analysis of all archaeological reports and related publications from the Levantine area in order to find all evidence related to textile production. It aims to outline the chronological development of spinning and weaving techniques, which allows us to build a model with which it is possible to compare the Egyptian evidence. In order to accomplish this, certain sites of the Syrian and Palestinian areas have been taken as 'representative', selected on the basis of their publication history and related studies of their textile instruments. Notice that evidence for the older periods is rare and scattered, while the Iron Age is fairly well-documented, especially for sites of the Southern Levant. To the selected sites, some in-depth studies will be added, such as Peyronel (2004) and Shamir (1996), which allow for a more widespread view of the situation.

**18** The typology proposed by Gleba (2008, 105) is here adopted but slightly modified to fit the different geographic context.

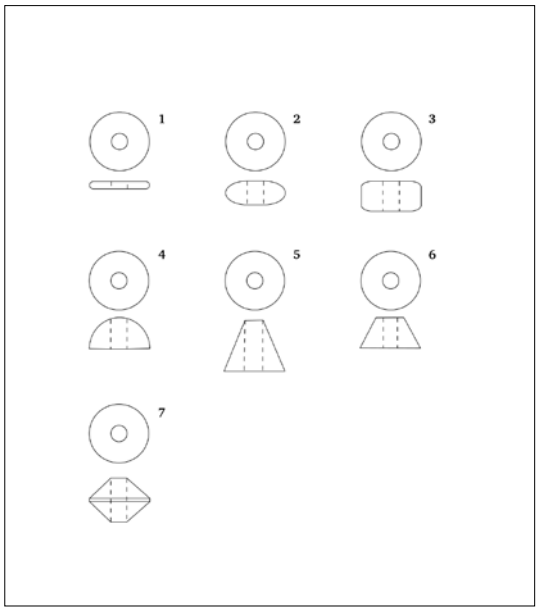



Figure 3. Spindle whorls typology

The first spindle whorls appeared in the Neolithic levels of Near Eastern sites such as Jericho, from where two stone spindle whorls came (Wheeler 1982, 626) of discoidal and lenticular shape, dating to the Pre-Pottery Neolithic (PPN). In the Pottery Neolithic (PN) levels, clay spindle whorls began to appear. At Jericho, only nine pottery and two stone spindle whorls have been found, all of discoidal type. 18 additional discoidal objects made from re-used ceramic fragments[19] were also recovered, appearing at first to be variously buttons, jar stoppers or even toys.[20] The function of these objects continues to be much debated, although some experiments conducted by Shamir (1996, 146) have proved that many of these objects could have functioned as spindle whorls.

**19** In the Aegean the situation is comparable, as the first traces of spindle-whorls are attested already around the seventh millennium BC, some made of perforated and flattened stones, and later obtained from rounded pieces. Clay and stone spindle whorls, as well as those made from reused sherds were found in the Neolithic levels of Sesklo, Dimini, Tsangli, Tsani and other sites in Thessaly, as well as at Knossos (late Neolithic levels), at Sitagroi and in the Cyclades at Saliagos. The use of spindle whorls obtained from rounded and perforated sherds continued throughout the prehistoric period in Greece, even though they were less frequent than in the initial stages (Barber 1991, 54 fn. 10; Carington Smith 1975, 119).

**20** For a more detailed discussion, see Della Lena Guidiccioni, Fiorelli (forthcoming) with related bibliography.

A similar situation has been attested in Ugarit level VB, where several spindle whorls made from reused ceramic fragments have been found, with only a single example of a purpose-made spindle whorl formed of clay (De Contenson 1992, 136, fig. 163). In the following level (VA) were found 20 spindle whorls made from reused sherds and only 6 biconical clay spindle whorls (De Contenson 1992, 137-8). Unlike Jericho, however, it is only at this stage that stone spindle whorls, usually of a discoidal or dome shape, begin to be attested (De Contenson 1992, 99-103, fig. 129). The peak in the use of reused ceramic fragments at Ras Shamra is in the Chalcolithic Age, with 44 examples from level IV C, 61 from IV B, then declining in IV A with only 4 examples. Conversely, purpose-made clay spindle whorls number only 8 across all time periods at this site, but these take a wide variety of forms: lenticular, biconical, conical and dome-shaped. Alongside clay examples were used good-quality, but not numerous, stone spindle whorls, several made from steatite (De Contenson 1992, 107-13, fig. 137).

#### 2.1.2.1 Early Bronze Age

### Syria

The evidence of Early Bronze Age Ugarit shows a strong continuity with its prehistoric levels, as the production of spindle whorls from reused pottery sherds continued, contrary to the developments in other Syrian sites. In fact, the oldest level (IIIC) produced 23 reused pottery sherds (De Contenson 1992, 140-1, fig. 58), while 18 were found in the most recent level (IIIB) (De Contenson 1992, 145, fig. 161). Purpose-made clay spindle whorls were still present (11 in the IIIC and 5 in IIIB), but their forms do not show a great variety, since most of the examples have a lenticular shape and only in some cases biconical, discoidal or conical shapes. There are no truncated cones or cylindrical shapes, which appear frequently in this period at Tell Mardikh (ancient Ebla) and Hama (Peyronel 2004, 120). The production of stone spindle whorls in Ugarit continued, but in smaller numbers: there are 8 spindle whorls from throughout the Early Bronze Age, all disc-shaped and all made from limestone and steatite (De Contenson 1992, 118-21).

From the levels at Hama dating to before the fourth millennium (L3-L2) comes evidence for clay spindle whorls being used beside those made of stone (all limestone and biconical in shape) (Fugmann 1958, 16-17, fig. 13). In the following Bronze Age phases, in which private residential contexts were excavated, many types of spindle whorls made from various materials are attested, suggesting the production of stone and clay whorls in fairly equal numbers. In phase K, at level K8 (EB) spindle whorls made from

reused pottery fragments have been found (Fugmann 1958, fig. 37), but always in small quantities. Spindle whorls of reused materials are present until the Iron Age levels at Hama, but seemingly in fewer numbers when compared to other contemporary sites.[21] The most common whorl shapes in the Early Bronze Age were the dome and biconical, in both clay and stone. From the later phases of the Bronze Age at Hama (Level J) (Fugmann 1958, 54-75) all shapes increased in number, dome-shaped spindle whorls continued, but to these were added biconical, truncated cone, lenticular, cylindrical, and conical shapes. The most common were the truncated cone or almost cylindrical shapes. Production in clay continued to coexist with that of stone, especially steatite and limestone, and only rarely calcite and quartz (Fugmann 1958, 71). From at least level J8 (EB IV A) (Fugmann 1958, 54, fig. 58), some bone spindle whorls started to appear, but they do not seem to have been particularly numerous until the Iron Age levels.

At Ebla, 39 spindle whorls were found in the Early Bronze Age layers, of which almost all are made of stone, except for three made of terracotta and two of bone (Peyronel 2004, 104; 2016, 190). Stone spindle whorls are, in general, most often fashioned from a greyish stone of the gabbro-diorite family; but limestone, steatite and, more rarely, basalt examples are well documented. The strong presence of stone spindle whorls, as compared with ceramic examples, seems to have been a common trend in the Syria-Palestine area during the Bronze Age; this is the reverse of the contemporary situation in Cyprus and the Anatolian region (Peyronel 2004, 105).[22] The two bone spindle whorls found at Ebla are large and dome-shaped, obtained using the natural shape of the proximal ends of the humerus or femur bones of selected animals (Peyronel 2004, 106). All EBA spindle whorls from Ebla have a dome-shaped form with straight or convex edges and a weight between 6 and 20 g (Peyronel 2004, 111-12), which shows a preference for light spindle whorls and, thus, fine yarns. Two spindle whorls made of precious materials come from a tomb of the royal necropolis, giving evidence for the use of spinning equipment as funeral offerings since this time (Peyronel 2007, 27).

**21** The total count of spindle whorls obtained from reused ceramic fragments is unfortunately not a reliable number because it depends on the interpretation, particular to the excavator, provided for this category of objects. At many sites, their apparent absence might be attributable to a decision regarding which finds 'deserve' publication, which could have excluded them.

**22** Ugarit seems to have therefore closer points of contact with the Anatolian world and above all to Cyprus, than with the Syro-Palestinian area.

## Palestine

In the Early Bronze Levels of Jericho a large number of spindle whorls, with those made of stone predominating, were found: 49 stone whorls, 12 of terracotta, 16 made of reused sherds, two of unspecified materials and 2 of bone. The most widespread type is the discoidal form (in cases of both reused sherds and those made of other materials); there are a few cylindrical spindle whorls and one dome-shaped example made of bone. The tombs at Jericho have brought forth spinning tools, used as grave goods already in the EBA, although not many in number. There are discoid spindle whorls made of bone from Tomb G57, a terracotta spindle whorl made from ceramic fragments from G58, and a truncated-cone spindle whorl made of stone from grave D12, associated with two other perforated stone discs (Kenyon 1960, 124-5, fig. 40).

The Early Bronze levels of Megiddo have not produced numerous examples of spindle whorls, but most of those that exist are of either terracotta or stone, especially basalt and limestone (Loud 1948, pl. 171: 10). The attested forms are cylindrical, dome-shaped and lenticular for both materials; there is also one whorl made from a reused pottery sherd and one dome-shaped spindle whorl made of bone (Sass 2000, 376).

In the EB Ib level at Beth Shean there were two different types of spindle whorls, both quite controversial. The first type is made from reused pottery fragments perforated in the middle; 6 of these have been found complete and 3 with incomplete perforations, alongside a handmade terracotta ring that showed evidence of burning (Mazar, Rotem 2012, 350). The second type consists of circular stone weights, 27 of which have been found in the Early Bronze level IB, but are notably completely absent in the later levels of Early Bronze Age III. These weights were mostly produced in basalt, to a lesser extent in limestone and only rarely in tuff. Another group of objects from Beth Shean consists of even smaller limestone weights with an average diameter between 3.3 and 4 cm and with a perforated hole, the diameter of which measures between 0.5 and 0.9 cm. The excavator considered these objects to be spindle whorls, while for the larger examples mentioned above suggested a multifunctional solution, as whorls and/or loom-weights (Mazar, Rotem 2012, 378, fig. 9.9).

Tell ʻAbu al-Kharāz (Fischer 2008, 112, fig. 6) produced a cylindrical spindle whorl made of basalt that dates to BA II, with a fragment of the spindle shaft still attached. It is likely that many similar small objects made of basalt should be recognised as spindle whorls, but this issue will be discussed further in the section dedicated to perforated discs made of stone.


Figure 4. Spindle from Tell Abu al-Kharaz (Fischer 2009, 112, fig. 6)

#### 2.1.2.2 Middle Bronze Age

### Syria

The Middle Bronze Age levels of Hama are less well-preserved than the Early Bronze Age levels at the site, nevertheless they have produced a large number of steatite spindle whorls (specifically Area H, square F11, which contained 31 dome-shaped and conical spindle-whorls); they are usually domed or cone-shaped but also of discoidal shape. Most of them are made of clay or bone, but there are also attested one bone disc-shaped spindle whorl and one from a reused sherd (Fugmann 1958, 89, 104, 108, figs. 109, 127, 132 and 139), demonstrating the persistence of this type of artefact despite its rarity.

Middle Bronze Age spindle whorls from Ebla are not very numerous (55) and form a fairly homogeneous group of types and materials (Peyronel 2004, 161). Most of these whorls are made of stone (steatite or basalt, fewer in limestone), many of bone and just a small number of clay, two of which are made from reused fragments. These latter specimens confirm that this category was not very extensive at Ebla. Bone spindle whorls began to appear at Ebla in quite large numbers, as in other contemporary Levantine contexts, and were mostly flat and dome-shaped (Peyronel 2016, 191) although pyramidal, truncated, and cylindrical spindle whorls also exist.

## Palestine

Spindle whorls from the Middle Bronze Age layers of Megiddo are slightly more numerous than in older phases. They are made of clay and stone, and from this period onward, also of bone. The most common shape is the domed one, but there are also some truncated conical and discoidal spindle whorls as well as two examples made from perforated sherds (Loud 1948, pl. 171; Sass 2000, 374). Some bone spindle-whorls have geometric decoration on the domed surface (Loud 1948, pl. 171). The frequent presence of spindle whorls or objects related to textile sphere in the tombs at Megiddo must be noted. The first spindle whorls from graves are dated to MB II and are made of clay and could be biconical, lenticular or ovoid in shape. Generally, each grave contained one or two spindle-whorls at the most, but some held more numerous examples (Guy, Engberg 1938, 170). The most common material for spindle whorls found in tombs is bone and the most common shapes are domed and conical.

The Middle Bronze Age town levels of Jericho are very much eroded and, consequently, spindle whorls come, in many cases, from tombs. There are 7 stone spindle whorls, 10 made of clay, 9 obtained from reused sherds, 6 made of bone and 3 of wood (Wheeler 1982, 626). The last ones are very important because they give evidence for the use of wood to make these artefacts and remind us that the amount of spindle whorls at each site is always underestimated, as wooden ones are almost always lost. All three wooden whorls come from graves, where particular environmental conditions have allowed the preservation of organic materials. Two are dome-shaped and one is conical (Kenyon 1965, 223, 462, fig. 102). The other spindle whorls of this period have a discoidal shape and in some rare cases a biconical shape, while those made of bone have a dome-shape and all come from tombs (Kenyon 1965, fig. 102).

Spindle whorls at Hazor are attested from the Middle Bronze Age to the Hellenistic period. From the Middle Bronze Age, almost exclusively dome-shaped spindle whorls are known, which are more or less flat, all of which are made of bone (Yadin 1958, pls. CII, CLX; 1960, pls. LXXIX, CXXVI; 1961, pl. CCXCIX). Lenticular and truncated-conical spindle whorls are very rare at the site. To these may be added various single-hole ‘buttons’, also made of bone, noted in the site report but for which measurements and weights are not provided; therefore, their function can only be hypothesised. Most of the spindle whorls come from scattered contexts and are associated neither with each other nor with other textile-related instruments. One exception to this is provided by an excavated room dating to MB II with two infant burials under the floor where two dome-shaped bone spindle whorls and two bone ‘buttons’ were found (Yadin 1960, pls. CXXVI: 19-21, CLXXIX: 19, 21). The absence of clay or stone spindle whorls at Hazor is noteworthy, except for some of the perforated stone discs, which will be discussed later.

Several spindle whorls have been recovered from the Middle Bronze Age levels of Beth Shean. These are made from perforated sherds, two of which are incomplete (Yahalom-Mack 2007, 661-2). There are also several fragments with two holes, which have been interpreted as 'buttons' or weaving tablets, but this latter explanation seems quite unlikely. Several stone spindle whorls, in particular 9 from the MB II layers are also attested. Basalt and limestone are the materials used, and calcite in one case. Most of the Beth Shean spindle whorls are disc-shaped, but there are also some cases of biconical shape. To these examples must be added 6 very light dome-shaped bone spindle whorls/buttons (between 6 and 12 grams) (Yahalom-Mack, Mazar 2006, 496-7).

#### 2.1.2.3 Late Bronze

##### Syria

The Late Bronze Age levels of Hama have returned few spindle whorls: those found are generally dome-shaped and made of limestone, basalt or clay. There are no spindle whorls made of bone recovered at Hama (Fugmann 1958, 131, fig. 161).

From the Late Bronze Age private dwellings of Ugarit, 51 stone spindle whorls have been excavated; they are almost exclusively made of steatite, except for one made of gabbro (Elliott 1991, 41-5). The whorls are dome-shaped or conical with concave sides (buttons), as is typical of the Late Bronze Age, as stated above (Peyronel 2004, 178). Furthermore, a wide production of bone/ivory spindle whorls that are generally dome-shaped and sometimes have a decorated surface is attested at Ugarit (Gachet 2007, 260-75). Sauvage (2013, 189) has recently studied 11 of these spindle whorls. They are made of bone or stone; one of them notably is inscribed in Ugaritic with the word 'spindle'. They lack information regarding their context of provenance, but more likely they all come from domestic or funerary Late Bronze contexts. The shapes are mainly domed and conical – these latter being largely convex (button) – and show signs of their manufacturing and turning. Many of these whorls have a hole that narrows slightly towards the top, with a difference of about 1 mm between the base and the top end of the hole. Most of these stone spindle whorls are made from steatite, some from serpentinite and a few from limestone. Some spindle whorls show a geometric decoration on the top cap, both radially and circular. No clay spindle whorls have been identified so far at Ugarit. It is possible that some of the so-called 'pearls' made out of faience were actually used as spindle whorls, as they have wide diameters (up to 6 cm) (Sauvage 2013, fig. 11:9).

## Palestine

Spindle whorls from Late Bronze Age Megiddo are definitely more numerous, predominantly made from bone and stones such as limestone, rarely from clay. Spindle whorls obtained from perforated ceramic fragments are not attested at Megiddo. The prevailing form is always the dome shape, but there are also examples of biconical whorls and an example with concave/convex walls (Loud 1948, pl. 172; Sass 2000, 374, 377). Certain examples have engraved decorations such as concentric circles, while others have one or two radial (deep) incisions on the dome, which do not appear to be decorative, and which might have been added for maintaining the position of thread during the spinning phase. Many spindle whorls were found in funerary contexts at Megiddo. Most of them are to be attributed to LB II levels, with a notable increase in quantity as compared with the previous levels (Guy, Engberg 1938, 170). The most common material is still bone, but stone and terracotta spindle whorls are also attested; the most frequent shapes are domed, button and conical. It should also be noticed that a bone spindle with two spindle whorls attached to the shaft was found in a tomb, with numerous other bone fragments, which may also once have been spindles (Guy, Engberg 1938, 84). Some of the tombs at Megiddo can be very interesting for the association of different types of textile-related material.

Tomb 1122 (Guy, Engberg 1938, 20, pl. 84)
1 spindle+ 3 bone rods
Two dome-shaped spindle whorls on a bone spindle
12 dome-shaped and 'button' bone spindle whorls
1 dome-shaped steatite spindle whorls
1 bronze pin

Tomb 877B1 (Guy, Engberg 1938, 95)
1 bone rod
4 dome-shaped and 'button' bone spindle whorls
4 ivory spindle whorls

Tomb 979 C1 (Guy, Engberg 1938, 100)
2 bone rods
1 dome-shaped steatite spindle whorl
6 dome-shaped bone spindle whorls
Bone pomegranate element (perhaps once mounted on a spindle shaft)[23]

**23** For a discussion of these themes see Sauvage 2014, 214-15.

Another very interesting context at Megiddo is Room 2012, where three caches were found, each wrapped in a cloth bag with silver and personal items. In one of these bags, 9 bone spindle whorls were found (Paice 2004, 368).

Two dome-shaped spindle whorls made of bone are attested in the LB I layers at Hazor. This type has already been shown to have been the most prevalent type of whorl at this city in the earlier periods.[24] There are at least 7 dome-shaped bone spindle whorls and one of lenticular shape in the LB II levels.[25] A multiple-tomb context of LB II has produced three dome-shaped spindle whorls made of bone (Yadin 1960, pl. CXXXVII: 26-8). Aside from the bone examples, three dome-shaped stone spindle whorls and one of ceramic (made from a reused fragment) are also attested.[26] A spindle whorl was found in a domestic context at Hazor, in the same locus as a needle, which is a clue that various fabric-related activities were performed in the same room (Yadin 1961, B 5011, pl. CC: 28).

In general, the Late Bronze Age layers at Beth Shean have produced few spindle whorls. Several spindle whorls obtained from reused pottery fragments come from the LB I levels (Yahalom-Mack 2007, 661-2). Stone spindle whorls are rarer at this site, as there is only one example for LB I and one for LB II: one has a discoidal shape and the other a biconical shape. Just one bone spindle whorl comes from the LB I layers, while the LB II layers revealed five. Four of these five were found in Area Q and have domed or biconical shapes (Yahalom-Mack et al. 2006, 496-7).

#### 2.1.2.4 Iron Age

##### Syria

In the urban Iron Age levels of Hama numerous spindle whorls made of stone, especially limestone and steatite, have been found; clay and bone examples also appear, but to a lesser degree (Fugmann 1958, 138, 176, figs. 165, 216). The main shapes seen are the domed and the conical types. It is worth mentioning that from *Batiment* V there are several elements linked to the textile sphere, namely seven stone spindle whorls, three bone whorls, 34 cylindrical weights and a rod/spindle made of bone (Fugmann 1958, 248-51, fig. 325). In the contemporary levels of the necropolis (FE I-III) there are numerous spindle whorls, 84 in total, sometimes associated with bone rods (Riis 1948, 171-2, figs. 208-216; Peyronel 2004, 340-2).

**24** Yadin 1958, pls. CXLII: 19, CLXVI: 15; 1960, pls. CXXVI: 28, CLXXIX: 22.

**25** Yadin 1958, pls. CX: 13, CLX: 9, LXXXVI: 21, LXXXIX: 17; 1960, pls. CXXXVII: 26, CXXXVII: 28; 1961, pl. CC: 29.

**26** Yadin 1958, pl. XCV: 19; 1960, pls. CXXVII: 34, CXLVI: 30.

Most spindle whorls are made of bone, but there are also some pottery and stone examples (particularly of steatite). The most archaic shapes are the domed type with a groove at the base, alongside the conical and lenticular shapes that appear only in Period I, while the discoid type appears in Periods I-II. The dome-shape type and its variations is certainly the most widespread and the longest enduring type. All periods of the Hama necropolis are represented by tombs containing spindle whorls, usually small quantities, one or two, except G IX 169, which has produced 12 spindle whorls made of bone.

At Tell Afis different types of spindle whorls are attested for the Iron Age levels, especially for Iron Age levels II-III. Most of the spindle whorls are made of stone, especially steatite, but also of limestone and basalt (Mazzoni 2008, 54, fig. 3). Terracotta spindle whorls are fewer than those made of stone and only rarely are bone spindle whorls attested (Cecchini 1998, 280-1, 291, 293; D'Amore 1998, 373). The domed type predominates, but there are also rare truncated conical samples. Some pieces of perforated sherds are also present (Degli Esposti 1998, 246), albeit in smaller quantities compared to contemporary Palestinian sites.

From the Iron Age levels of Ebla come 84 spindle whorls, with 61 examples from the following Persian period (Peyronel 2004, 331). The Iron Age spindle whorls are almost all made of steatite/chlorite, although a small number are made of limestone, basalt and gray bituminous stone with a single example made of sandstone. In two cases, the spindle whorls have not been completed; both are perforated, roughly cut and only partially smoothed, which allows us the rare chance to study the type and the processing sequence used. There are also five clay spindle whorls. The domed type in varying sizes is the dominant shape for this period but there is a biconical example, which remains the only one of its kind at the site and is dated to Iron Age III, as well as one of the discoid type. Many spindle whorls bear incised geometric marks and decorations (Peyronel 2004, 334).

In the Iron Age levels of Tell Mishrifeh/Qatna spindle whorls have been found, which should probably be dated to the Iron II-III (Besana 2005, 117, pls. XXXI-XXXII). Most of the spindle whorls are made of stone, especially of steatite/chlorite as at Ebla, together with examples of calcarenite and a specimen made of basalt. Clay spindle whorls are also well represented, both purpose-made and those obtained from reused pottery fragments. The shapes are various although there is a clear predominance of truncated conical and conical shapes; there are two dome-shaped forms, two discoidal examples and one globular/biconical spindle whorl.

### Palestine

As previously noticed, at Hazor the most common type of spindle whorl from the Middle Bronze Age down through the Iron Age is the dome-

shaped, more or less flat type. In the Iron Age levels II-III the dome-shaped bone spindle whorl, of which several samples are attested,[27] continues to prevail. Other types do appear in bone, such as conical, discoidal and truncated cone spindle whorls.[28] The same types appear in stone spindle whorls, especially limestone, and there is even an example made of hematite (Yadin 1961, pl. CCXVI: 22). Compared to the previous levels it seems that a larger variety of shapes was present during the Iron Age for both stone and bone whorls.

Stone spindle whorls from the Iron Age are particularly numerous at Megiddo, especially limestone and steatite examples,[29] and more rarely calcite, alabaster and basalt. Also frequent are clay and bone spindle whorls, the latter in particular during phases IV (1000-800) and III (800-650). The most common types are, as usual, the dome-shape as well as lenticular, cylindrical and conical. It is possible to observe a remarkable preference for the dome-shape in bone and the conical-shape in steatite. Spindle whorls made from pierced sherds are also common in this period (Sass 2000, 376), but still quite rare when compared to other sites like Beth Shean. From the Iron Age levels at Megiddo came spindle whorls with engraved decorations, such as lower radial lines (M 3279) (Lamon, Shipton 1939, pl. 93: 2), others with lateral engravings (Lamon, Shipton 1939, M5145, pl. 95: 38), one of which has three engraved lines (Lamon, Shipton 1939, M 922, pl. 95: 38).

Tell Abu al-Kharaz has produced a quite remarkable number of spindle whorls for the Iron Age, especially for IA II. Stone spindle whorls have been found in wide numbers, particularly in limestone and, to a lesser extent, in basalt. Sandstone and calcite examples are rarer (Fischer 2013, 40, 58, 82, 89, 338). Pottery, bone and ivory spindle whorls are not common (Fischer 2013, 161, 190, 247, 338), although spindle whorls made from reused pottery fragments are frequently found (Fischer 2013, 259, 360). The most attested types are the lenticular and conical forms, while the domed ones come in second place at al-Kharaz, although they are very common at other sites, such as Hazor. Only one example of a bone spindle whorl of biconical shape is attested (Fischer 2013, 341).

**27** Yadin 1958, pl. LXXIV; 1960, pl. LXXVIII: 28, e.g. PS: 32, CLXXXVI: 12; 1961, pls. CLXXXVIII: 14, CCCLXI: 8.

**28** Yadin 1960, pls. CV: 31, CLXVI: 7; 1961, pls. CLXXXVIII, CLXXIII: 10, CCCLIX: 17.

**29** Lamon, Shipton 1939, pls. 93-95; Peyronel 2004, 351; Sass 2000, 374-7, figs. 12: 17-19.

## Conclusions

This brief presentation of the main published examples of spindle whorls makes it possible to draw some conclusions. First, spinning with spindle and spindle whorl is attested at least from the Pre-Pottery Neolithic Period, as evidenced by the production of stone spindle whorls. Later, with the introduction of ceramics, clay spindle whorls appear, as do those made from perforated ceramic fragments. The production of spindle whorls from ceramic fragments is particularly common during the Pottery Neolithic Period in northern Syria (and Anatolia), and on a smaller scale in Palestine. Although the making of spindle whorls from broken pottery continues to be attested in a minor way in the Middle and Late Bronze Ages, it sees a resurgence during the Iron Age in many Palestinian sites.

Stone spindle whorls remain widespread throughout the Early Bronze Age, especially those made of steatite/chlorite, limestone and, more rarely, basalt. It is not possible to trace a clear line of development for stone spindle whorls because the archaeological sites taken into account show extremely variable situations in Syria: at Ugarit they are very rare, whereas at Ebla stone is the predominant material and Hama is in an intermediate position. In Palestine, however, stone whorls absolutely predominate over other materials. In later phases, stone spindle whorls continue to be the most attested, except at Hazor where they are clearly outnumbered by those made of bone. It is possible that the choice to use stone spindle whorls rather than ceramic ones, especially at Ebla, is linked to the technical requirements of fabric production, and depend on the fineness of the desired fibre or yarn.

Bone spindle whorls began to appear in the Early Bronze Age levels of Hama, Ebla, Jericho and Megiddo and were of discoidal and domed types. Starting from the Middle Bronze Age, the production both in Syria and in Palestine increased and the domed type became the most frequent shape, while in the Late Bronze Age, the concave/button profile type also appeared frequently. Many of these spindle whorls have been found in burial contexts, where bone is definitely the predominant material.

Pottery spindle whorls are generally rarer than those made of stone, but they are still present in all periods and are characterised by a great variety of shapes. In the Early Bronze Age, ceramic spindle whorls are quite numerous at all sites, where they equal the production of those made of stone. In Syria, during the Middle Bronze Age a decline in clay whorls is attested, but not for Palestine; in Jericho they are prevalent compared to those made of stone. In Late Bronze Age, there are definitely fewer ceramic examples than those made of stone, while they seem to be numerous again in Iron Age levels in both Syria and Palestine.

The three spindle whorls made of wood preserved in tombs from MBA Jericho remind us that wood likely played a significant role in the material

culture of ancient textile work. Unfortunately, it is not possible to quantify how regularly wood was used in spindle whorl manufacture because of the nearly complete loss of the organic materials.

### 2.1.3 Spinning Bowls

Spinning bowls are bowls of varying shapes, but all provided with hand-made internal 'loops' that are applied to the inner walls of the bowl before firing. The loops usually appear in pairs, but single loops are known, and certain examples possess up to four internal loops. The first known examples of spinning bowls were found in Jordan and date to the Ghassulian period (Shamir 2014, 146). Much later specimens come from Crete, dating to the Early Minoan II Period. Similar objects have been found in Myrtos (Warren 1972, 153, 207, 209) (EM II) and in the Middle Minoan Period contexts of Drakones, Phaistos, Palaikastro, Kômmos and Archane (Barber 1991, 74).

The first archeological and iconographical attestations of spinning bowls in Egypt date to the 11th Dynasty and this type of object remained in use until the middle of the first millennium BC (Vogelsang-Eastwood 1989, 78; Allen 1997, 33-6). The oldest archaeological evidence dates to the 12th Dynasty and was found at Abu Ghalib (a site in the northern Delta area) and at Kahun in the Fayyum. The Abu Ghalib bowls (one complete specimen and one fragmentary) are made of pottery with a ring base and an everted rim; inside are two loops connected to the centre of the bowl. The loops are roughly manufactured and show deep carvings in their lower parts. The only published spinning bowl from Kahun has a straight profile and a flat base; the inner loops attach to the walls of the bowl and to the bottom without connecting to each other. Petrie noted certain stone examples of spinning bowls from Kahun, which were of quite rough manufacture with two inner loops, or more rarely, one (Petrie 1890, 25, pl. XIII: 58).[30]

The largest preserved group of spinning bowls comes from Tell el-Amarna and date to the reign of Akhenaton (Dothan 1963, 101). While stone spinning bowls are known from the city, only bowls made of ceramic have been excavated from the worker's village connected to it. They were generally manufactured in marl clay[31] without additional surface treatments. Firing produced a white surface, but it is still possible to see a pinkish colour on the interior. Bowls made from Nile silt are rarely attested. It is also interest-

30 The bowl in the plate seems to have rings, quite separated from each other, attached to the sidewalls of the bowl.

31 Standard System Denomination of Vienna. I thank Dr. A. Salvador for providing me with these specifications.

ing that at Amarna, the clay used to make spinning bowls has been shown to have been imported from other sites (Vogelsang-Eastwood 2000, 292). Production from Nile silt would likely have been easier and cheaper, but perhaps clay was imported due to the excessive porosity of the local products. Notably, at Amarna all bowls have two rings inside, as opposed to the many variations found in other Egyptian and Palestinian sites. The morphological variation within the Amarna corpus is very slight, with diameters from 26 to 30 cm, rims folded outwards and flat, slightly rounded bases. This homogeneity has allowed the excavators to recognise a series of rims that may have been specifically related to spinning bowls, although the illustrations provided in the publication show a range of shapes with flat or looped bases and folded, everted or flat rims.[32] A unique type is represented by a bowl with the rings attached to the inner edge of the bowl rather than to its bottom (Kemp, Vogelsand 2001, 293).

The bowls recovered from the worker's village of Deir el-Medina date to the 19th-20th Dynasties and are made of pottery, although fired better than other contemporary bowls (Dothan 1963, 103). At this site various shapes are present, with flat bases, ring-shaped bases or ring bases with thick centres, to which were once added various types of rims. The main type of spinning bowl has two loops in the middle of the bottom, another variation has three loops, which (unlike those versions with two loops) have several engravings under each loop. A fragmentary limestone spinning bowl is also known: it has a ring base and three inner loops, just one of which is fully preserved (Nagel 1938, 183-4).

Two spinning bowls made of chalk come from Lisht and date to the 20th-21st Dynasties, only one of which is complete. Both bowls have two loops on the inside – in one case they join in the middle, in the other they remain separated. The engravings under the loops seem deeper than in other bowls (Dothan 1963, 103).[33]

Spinning bowls are attested in Palestine from the Late Bronze Age onward and remain in use until the middle of the first millennium. The oldest examples come from Tell el-ᶜAjjul, but there are examples known also from Beth Shean and Tell Jerishe. The majority of the examples date to the Iron I Period, particularly those from Beth Shean, where numerous examples were recovered from Layer VI (James 1966).[34] A bowl with four loops arranged in two rows is a unique example (Dothan 1963, 99). Another rich

**32** It is not clear if only the refolded edge is useful for the purpose of identification.

**33** For a more complete list of Egyptian spinning bowls, see Allen 1997, 35.

**34** Especially in the outlying rooms of Building 1500, figs. 31, 49, 50, 51, 53, 55, 56. Recently 6 other bowls were found which can be dated back to the 13th-12th centuries, all with two rings, thick walls, flat bases and no decorations. The rings have deep engravings on the inside (Martin 2009, 445).

selection of spinning bowls comes from Tell Qasile, where ten bowls were found, divided between levels XII (12th-11th centuries) and level VII (8th century). They all have ring bases and two central loops connected to each other (Dothan 1963, 99). As the appearance of spinning bowls in Palestine (with the exception of the two Ghassulian Period examples corresponds to the Egyptian conquest of these territories, it seems probable that spinning bowls were introduced (or re-introduced) to this area from Egypt. The period of their most extensive use, however, was the Iron Age, when Egyptian influence in Palestine had waned.

In the Aegean area, the discovery of spinning bowls dating to the Early Minoan Period at Myrtos is rather problematic, as the most ancient Egyptian attestations date to the 11th Dynasty (which roughly corresponds to Middle Minoan I); therefore, the Cretan materials are earlier than any examples from Egypt. It is highly likely that the two areas developed spinning bowls independently and, if an origin had to be established, it seems more probable that spinning bowls were invented in the Levant or Egypt.[35] Several scholars indicate that these tools were developed alongside the production of linen, which needs to remain damp during the spinning process for better fibre adhesion. An aqueous solution, or any solution containing substances that support better adhesion,[36] could be contained in the bowl and applied to the fibre as it was spun or doubled. Otherwise, the bowls could be used to keep the plying threads apart or to keep the yarn in tension (Vogelsang-Eastwood 1989, 85-6). It is interesting to notice the presence of stone spinning bowls in Egypt (used alongside ceramic examples) which instead are not attested in Palestine (Dothan 1963, 108).

## 2.2 Weaving

A fabric is produced through the intersection of two systems of threads; one of the two systems, the warp, is the base system that must be kept in tension during weaving and is parallel to the sides of the loom. The other system, the weft, runs perpendicularly to the weft across the loom, passing alternately over and under the threads of the warp. A fabric can be 'open', with few threads per square centimetre, or it can be 'dense', with a high number of threads per square centimetre. In a 'balanced' fabric, there is an equal number of weft and warp threads within a square centimetre of material. When the number of warp threads is higher, a warp-

35 Also for Peyronel 2004, 57. See chapter 5.5

36 Also the experimental part carried out by Vogelsang-Eastwood on the mixture of water and flour – which proved how utmost useful this mixture was to the production of a weaving thread – is interesting (Kemp, Vogelsang-Eastwood 2001, 79).

faced fabric is created; in turn, a higher number of weft threads creates a weft-faced fabric (tapestry is an example of a weft-faced fabric). Weft and warp threads may vary in quality and consistency, however the warp generally requires resistant and non-elastic threads to ensure its tension. One of the simplest types of weaves is the 'tabby weave' in which the weft passes alternately over and under the warp threads; there exist several variations of this style. Another weave is the 'twill' in which the weft passes over and under the warp threads following a regular outline, which creates a diagonal effect, with several possible patterns. Additional weft threads may also be woven in to create particular decorations.

In order to weave it is necessary to keep the warp in tension and one of the simplest loom designs is the back-strap loom, which is still used in parts of Central and South America and in South-East Asia. One end of the warp is tied to the waist of the weaver by a belt and the other end of the warp is attached to a tree or a pole. The weaver reaches the desired amount of tension by simply reclining backwards to the appropriate angle (Barber 1991, 80). The yarns are kept apart and organised by wooden sticks. In the basic weave, two sets of threads are created: those in which the weft thread run over the warp, and those where the weft runs under the warp. The temporary space which is created between these two sets of threads is called shed, and it allows to pass the weft in just one movement. In order to create this shed, a shed-bar is generally inserted between the upper and lower group of warp threads. The weft (as in the case of other looms) is inserted in the 'shed' of the warp by a shuttle or bobbin that passed from one side of the loom to the other, unrolling the spun yarn as it goes. The second step consist in switching the two sets of warp threads, raising up those that were under in the previous passage, and lowering those that were up. In this way, a counter shed is created. In order to create the counter-shed, it is not possible to simply insert another shed-bar since it would interfere with the operation of the first one. It is necessary to use a hand-held bar – which is not inserted into the warp and which can be of any shape. To this hand-held bar is tied every thread of the warp of the previous inferior series, so as to allow the counter-shed to open, once the hand-held bar is lifted (Barber 1991, 82; Peyronel 2004, 61).

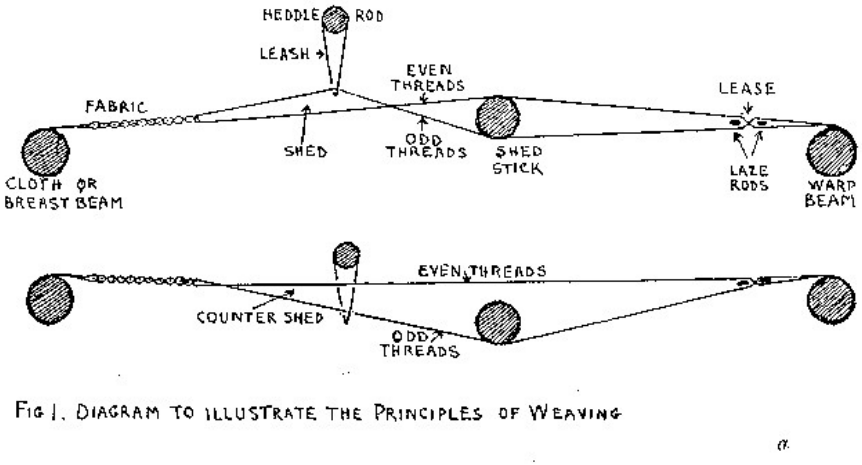



Figure 5. Scheme of creation of shed and counter-shed (Roth 1918, fig. 1)

As weft threads are woven across the warp, each additional thread is beaten by a stick or a comb to bring it closer to the weft thread in the previous row, and this is how, one row after another, a fabric is woven. This simple loom allows for the production of fabrics of small dimensions (approximately 60 to 80 centimetres wide); in order to produce larger fabrics without resorting to complicated devices it is necessary to use more stable and structured systems. In the ancient world three main types of looms were used: the horizontal ground-loom, the vertical two-beam loom and the vertical warp-weighted loom.

The horizontal ground-loom was likely the first invented of these ancient looms, and consists of two wooden beams to which the ends of the warp are attached. These beams are kept off the ground surface by small vertical supporting poles.

The first known evidence of a horizontal loom comes from Egypt, where it is represented on a bowl from the site of Badari, which dates to the Late Neolithic period, or the beginning of the fourth millennium BC (Brunton, Caton-Thompson 1928, 38). The loom is depicted as seen from above, with two structural beams with the warp stretched between them, standing on four small support poles. The heddles and a partially-woven piece of fabric seem to also be represented. The most detailed visual sources for this type of loom come from Egypt, where it is represented on tomb paintings as well as by wooden models, which will be discussed in more detail later. In the Near East, the first loom representation come from Susa and also date to the fourth millennium BC (Völling 2008, 121). This consist of a cylinder seal

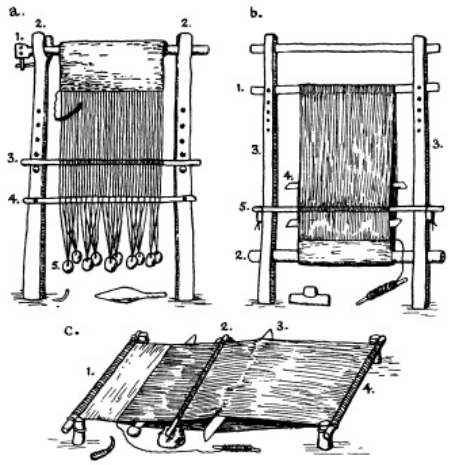



Figure 6. Looms - warp-weighted, two-beam, ground loom (Crowfoot 1937, 37, fig. 1)

from Susa on which two women crouch beside a loom with part of a fabric already woven; a third standing figure seems to be engaged in setting up a second loom (Amiet 1972, nr. 673; Peyronel 2004, 62). Other seals from the early city of Uruk may relate to looms but possess quite schematic representations, which do not allow much information to be recovered. At the end of the third millennium BC written sources of the Sumerian Ur III Dynasty regularly describe a type of horizontal loom (Peyronel 2004, 62).

The vertical two-beam loom appears for the first time in Egypt in tomb-paintings of the New Kingdom. It is worth noting that it is only through the analysis of iconographic and textual sources that there has been the chance to identify the different types of looms. The climate of Egypt is more favourable than most for the preservation of organic materials, still it is unlikely that the discovery of a complete loom will be made. The structure of a vertical two-beam loom consists of two vertical poles supporting a beam placed horizontally on top and one on the bottom to which the warp was attached. Weaving was carried out by moving from the bottom towards the top of the loom. A loom arranged in this way allowed the weaver to work seated and individually (except upon looms of great width), whereas the horizontal ground loom required the presence of two weavers. It is unclear where and when the vertical two-beam loom was invented, but it seems likely that this occurred in an area where both warp-weighted and horizontal loom techniques were known, such as the Syro-Palestinian region, but this is very difficult to prove (Barber 1991, 113; Peyronel 2004, 64).

The vertical warp-weighted loom has an advantage for modern study in comparison with other looms, as it regularly left evidence (loom weights) in the archaeological record. While the vertical two-beam loom attached its warp to a beam placed horizontally at the bottom of the loom, the vertical warp-weighted loom provides tension by weights attached to groups of threads and weaving is carried out from the top towards the bottom. Thus, the weaver must stand in order to work. Upon the structure of the warp-weighted loom, at about 1 meter off the ground, were fixed wedges with forked edges, upon which was laid another pole (the heddle rod), which allowed the warp yarns to be raised. Another pole, the shed-rod, was fixed at the bottom of the loom in order to separate alternate warp threads passing in front or behind it (Peyronel 2004, 64). A wooden beater was used to tighten the weft as well as certain tools made of bone used to fix small details (pin-beaters). On this kind of loom, it is necessary to create a separate 'starting border'. This can consist of a rope or a tabby strip and it can be made first on another loom or through card weaving (Gleba 2008, 123). The use of the warp-weighted loom is certainly very ancient, as a representation on a ceramic fragment discovered in Kars testifies, itself datable to approximately 3000 BC (Völling 2008, 122, fig. 43).

Card weaving is a very simple system that creates decorated bands that can serve as belts, fabric borders or the starting border for a warp-weighted loom. It requires two stable elements separated from each other and each fixed to a support in order to keep the warp in tension. These two elements do not require to be placed at a great distance, nor to be part of a frame. Between them a series of pierced cards are placed, which allow the two orders of warp threads to be separated, and therefore the shed to be created. Through rotation, the counter shed for the weft is created but, due to the different types of rotation that can be applied, the simple technique of card weaving can create various decorations (in more complex loom types this function is carried out by the heddles). Often, but not necessarily, a comb spacer or a pierced bar is placed behind the cards to separate the single threads.

Cards can be made of wood, bone, leather or ceramic and generally do not exceed 5 centimetres in length or width (Gleba 2008, 139). They generally take a regular geometric shape – square, rectangular, triangular or hexagonal – and they may be pieced with anywhere between two to six holes, according to the motif that is desired. The most widespread type of card appears to be the square type, one with a hole at each corner. The most ancient examples from the Near East come from Susa and date to the third millennium BC, but only some of the forty cards that have been recovered actually seem effective for weaving (Barber 1991, 119). In Egypt, card-like tools used for weaving are not attested until the Cop-

tic period.[37] That cards could be used with a warp-weighted loom system seems probable, at least on the basis of the European evidence, which in turn suggests that weaving cards bear a relation to certain types of spools (Gleba 2008, 141).

### 2.2.1 Loom Weights

The function of loom weights is to pull the warp threads taught and cause them to remain hanging in parallel. Simple stones can be used, however many cultures have developed specific objects meant for this purpose. It is not always possible to prove that stones or other objects were used specifically as weights for weaving unless they are found in groups. There are three contexts in which loom weights are mainly discovered (Barber 1991, 101). The first and the richest in information is when the weights were still fixed to the loom at the moment of abandonment, they fell to the floor as a result of the destruction of the organic parts of the loom, but still maintained their original position.[38] From the postholes and from the burnt remains of the loom beams there might be a chance to recreate the dimensions of the loom. Furthermore, from well-preserved rows of weights, the width and the complexity of the fabric being woven might be hinted at; as well, the area where they are found can be identified as a context of textile production. When not in use on the loom, loom weights were generally kept in groups inside vases, baskets and other perishable containers and these contexts too are sometimes discovered intact. Unfortunately, it seems that weaving activities were often carried out on the upper floors of buildings and, thus, loom weights are frequently recovered from collapsed layers, which is an obstacle to the reconstruction of original assemblages.

How the weights were fixed to the loom is still an open discussion, since it is possible that the warp threads were not tied directly to the weights. In fact, loom weights could have been attached through an intermediate object such as a rope, a metal ring or a wooden rod, which could also have served to keep them in position (Gleba 2008, 128; Fischer 2008, 110). The weight is the essential piece of information provided by a loom weight, as it relates to the quality of the material produced. Loom weights can range in size from about 10 grams (used for finer textiles) up to 1 kilogram

**37** Some scholars considered the possibility that weaving cards were in use also during the New Kingdom, based on an analysis of the weaving techniques present in certain preserved fabrics (Barber 1991, 119), but this theory is now generally rejected. Cf. Vogelsang-Eastwood 2000, 276.

**38** For example in Troy Level IIg (initial Early Bronze Age) in Room 206 several clay loom weights were found between two pole holes arranged in 3/4 rows as if they had just fallen off the loom (Blegen 1963, 72, fig. 3.14).

for thicker fabrics (Gleba 2008, 134). The number of weights related to a single loom is almost impossible to define in a general way, because it changes according to the weight of the loom weights, the type of fibre used, the quality of the fibre and the fabric being produced, the number of warp yarns attached to each weight, and so on. The archaeological data also shows considerable variation: loom weights are often found in groups of about ten to thirty or forty weights placed in multiple rows.

Each loom weight can be used with threads that require different amounts of tension, simply by varying the number of threads held by one particular weight. The minimum number of threads per weight is generally considered to be 10, with a maximum of 20-25 (Andersson Strand 2012, 211). Loom weights of medium weight would have been quite adaptable to a large number of different fabrics, while extremely light or heavy loom weights would have been used only for the production of specific textiles. One can expect, therefore, to find large amounts of medium weight and only rarely very light and very heavy loom weights. It is interesting, though, that numerous batches of light weights, as well as groups of heavy weights are known to researchers, often in the same context of medium weights (Andersson Strand 2012, 211). Ethnographic data collected by M. Hoffmann showed that weights of differing individual mass could be used contemporaneously on the same loom, and that more threads were related to the heavier weights and fewer to the lighter weights, in a proportional way (Hoffmann 1964, 42). In another place, M. Hoffman observed that the two lateral weights were much heavier than all the other weights, perhaps to reinforce the lateral selvedges (Hoffmann 1964, 65).

Experiments at the CTR have shown that both the weight and the thickness of individual loom weights have an effect on the fabric that is produced, confirming the ethnographic data (Cutler 2012, 152). Thickness, together with weight, influences the quantity of threads attached to a single loom weight and their proximity within a fabric. The width of the finished fabric will be determined by both width of the starting border and the total width of the weights in each row. As pertains to the distribution of loom weights, two rows of weights were needed to produce a tabby weave, and, to create more complex fabrics, more rows were necessary.

As it is the aim of this work to consider loom weights found in various excavation reports, it has been decided to use a simplified typology to describe the different kinds of loom weights attested across the Levant.

Ten main types can be distinguished:[39]

1. Bell-shaped: weight with a circular base, with a rounded top and a perforation that runs parallel to the base. The hole is usually at the top of the weight.
2. Spheroidal: rounded weights with no carination, with a vertical hole (Peyronel 2004, 224).
3. Biconical: weights whose maximum diameter is about half of their height, carinated, and with a vertical hole.
4. Cylindrical: weight with a circular base and a centred vertical hole.
5. Ring or donut-shaped: weight with a circular base and a vertical hole. Compared to cylindrical weights, these weights are flatter, they have a wide centre hole and are rather irregular in shape.
6. Conical: weight with a circular base ending in a small tip; the hole is in a horizontal position and can be placed at the centre or towards the top of the object.
7. Discoidal: weight with a circular base with a flat or slightly convex surface, quite thin with a suspension hole toward the edge (typical of the Aegean area).
8. Pyramidal: square-based weight with the hole placed at the top; frequent for the Hellenistic and Roman periods.
9. Pear-shaped: irregular weight with a circular base, perforated vertically and narrower at the top.
10. Bobbins/spools: cylindrical loom weights, sometimes with a slightly concave central part, non-perforated; they appear at the beginning of the Iron Age.

**39** The typology proposed by Gleba (2008, 129) is here adopted but slightly modified to fit the different geographic context.

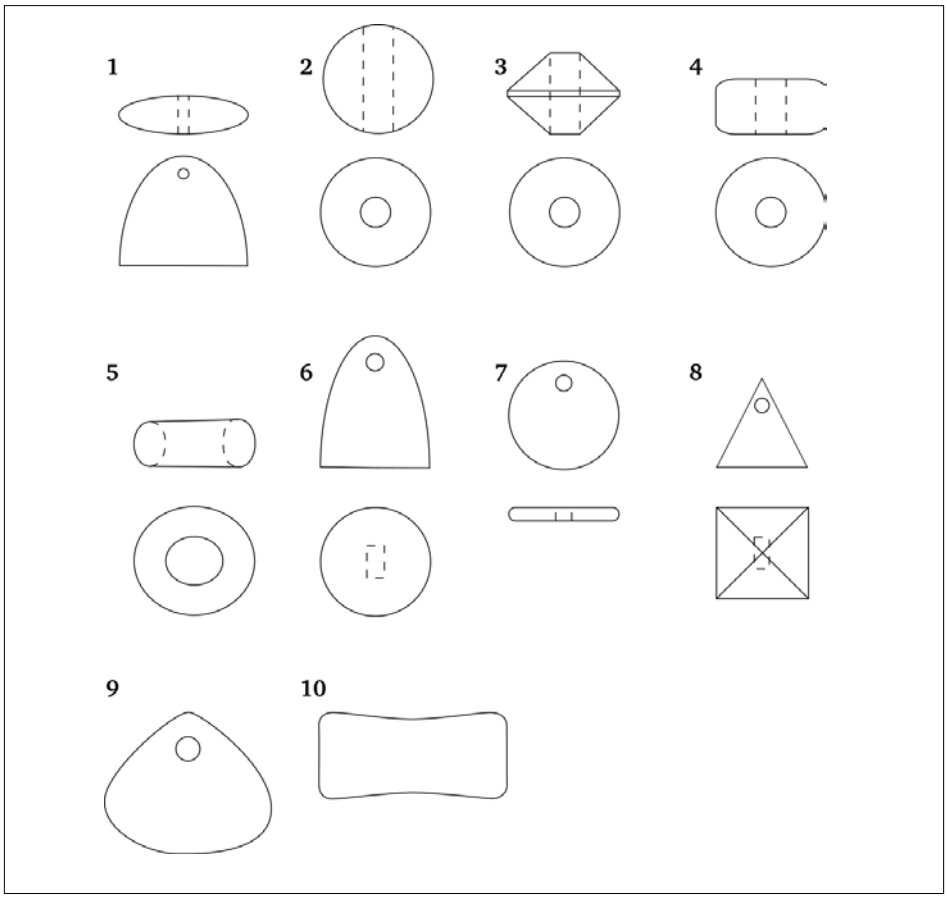



Figure 7. Loom weights typology

The earliest loom weights[40] known from the Near East come from the Anatolia, especially from Çatal Höyük, where some clay weights appear to date to the Neolithic levels. From the Chalcolithic period onward the evidence becomes more numerous and certain (Mellaart 1962, 56).

**40** In the Aegean the most ancient attestation of a loom weight dates to the Neolithic; it comes from Corinth; and it is a truncated pyramid, horizontally pierced just under the top (Barber 1991, 99; Carington Smith 1975, 123). In the Late Neolithic phase, loom weights spread throughout Greece, but most finds are from Northern sites. In Crete, loom weights are well-attested from the Middle Neolithic period onward, as demonstrated by two groups of weights in low-fired clay of a rectangular shape and with double holes (Evans et al. 1964, 180, 234-5, pl. 56; McDonald, Wilkie 1992, 675).

At Ugarit the so-called *galets à encoches* (De Contenson 1992, fig. 128, pl. CXII) may be classified as potential loom weights. Similar pebbles (of various shapes) with wide lateral grooves characterise levels VB and VA (Neolithic levels of approximately 7000-6000 BC). The production material is limestone or stoneware and they are quite numerous, although only one of these objects has been pierced. While the theory that these *galets* were loom weights is attractive, they were not found in relation to other tools related to textile production, so their interpretation remains somewhat uncertain. It is interesting that in Chalcolithic phase IV C at Ugarit a small bobbin or spool has been found (De Contenson 1992, 138, fig. 157), which is similar to those typical of the Iron Age and the function of which is still under discussion.

#### 2.2.1.1 Early Bronze

If the so-called "pierced discs" which will be discussed further on are excluded, the first good evidence for loom weights in the Levant appears in levels dating to the Early Bronze Age. Loom weights are attested in the urban levels of the city of Hama (Fugmann 1958, 40, 56, 62, 71, 74, 127, 251), although the publication does not provide many details about them, neither their individual descriptions nor quantity (Fugmann 1958, 40). From the Early Bronze IV phase onward, limestone and basalt loom weights are attested; their main shapes are conical, globular and donut (Fugmann 1958, 56, 61, 64, 71).

Braun (2013, 101) reports that in Megiddo various stone loom weights and basalt rings are known from EB I levels, however it is not clear if these objects were actually used as loom weights or should rather be inserted in the uncertain category of 'pierced discs'. The discovery of a group of these objects in a *cache* in Section B/V/1 of the East Slope is interesting, however, as it suggests that these objects might have been weights tied to a loom (Braun 2013, pls. 32-33). The limestone loom weight described by Sass (Sass 2000, 370) is more securely recognizable: it has a conical shape, but flat, and is perforated on the upper side.

#### 2.2.1.2 Middle Bronze-Late Bronze

##### Syria

Loom weights appear to have existed in levels from Middle Bronze Age Hama and ceramic examples are noted in the site report but little specific information is provided. A flattened conical-shaped loom weight with an upper hole made of basalt is, however, known from the site (Fugmann

1958, 189, fig. 132). The same type is also observed in the levels of the Late Bronze Age along with a similar object slightly more square in shape (Fugmann 1958, fig. 153).

No loom weights have been recovered from the Early Bronze Age phases at Ebla, while for the levels of Middle Bronze Age date only two examples were found and they are made of low-fired clay in a conical/bell-shape. Certain pierced discs must be mentioned, which Peyronel excludes from use with a warp-weighted loom because of their remarkably heavy weight, which makes them unsuitable weaving tools. It seems therefore that there is little evidence to suggest the use of the warp-weighted loom at Ebla during the EBA and MBA periods, and the few objects similar to loom weights that have been recovered should be considered counterweights for other purposes, not linked to the textile production (Peyronel 2004, 199).

No loom weights were recovered from the Early and Middle Bronze Age periods at Ugarit, however some objects identified as weights did come from the Late Bronze Age levels. These objects are made of baked clay with a discoidal shape and a perforation close to the edge (Yon 1987, figs. 5, 66, 76). This type, typical of the Aegean world during the Early and Middle Minoan Periods (Warren 1972, 212, 220-2; Gleba, Cutler 2012, 115; Cutler 2012, 147), was widespread in the Eastern Mediterranean area and especially prevalent on the Anatolian coast between the Middle and Late Bronze Ages (Gleba, Cutler 2012, 115). At Ugarit, stone weights similar to the baked clay discoids mentioned above were manufactured, but the material does not find any match in the Aegean world (Elliott 1991, fig. 12:7-9).

Some loom weights made of unbaked clay were found at Tell Afis (Cecchini 2000, 213 note 14, fig. 5:60) and are dated to the final levels of the Late Bronze II; they have a conical shape and are perforated. Their numbers are rather low however, especially when compared to the number of weights discovered in the Iron Age levels.

### Palestine

The amount of preserved loom weights from the Middle Bronze Age (XI-IIb-IX) levels at Megiddo is rather considerable and the most numerous type among them is the conical shape with a horizontal hole (Loud 1948, 169-70; Peyronel 2004, 202). They are all made of baked clay except for two made of stone; 8 examples show the impression of a seal (Loud 1948, 164). There exist additional fragmentary conical examples in unbaked clay (Sass 2000, 372). There are 26 weights, which come from a single context and are conical or bell-shaped, of varying dimensions (Stratum X area BB, L. 3036, Loud 1948, pl. 170). Some loom weights come from funerary contexts at Megiddo, but no association with other weaving tools is witnessed and they are always deposited individually, never in groups (Peyronel 2004, 203).

The clay loom weights of Jericho only began to appear in the Middle Bronze Age layers of the site, from which 58 conical or globular weights are attested, often with flat bases and horizontal perforations near the top (Wheeler 1982, 623) and a length of about 10 cm. Some examples have been found in groups, such as the context "Reg. 697" which includes ten weights, some of which bear traces of bugging, due to yarn friction. Another context, "Reg. 354" includes 14 weights (Wheeler 1982, 624). Unfortunately, the mass of individual weights is not given and no further information can be obtained. All weights known from Jericho come from area H, where several domestic installations have been found.

The first loom weights in evidence at Hazor are made of basalt and have a donut shape (Yadin 1960, pl. CXXVI: 9; pl. CXXVI: 10). Ceramic loom weights, roughly made, are attested only from the Late Bronze I period (Yadin 1958, pl. CXXIV: 15).

At Beth Shean, from the Intermediate Bronze Age layers there is only one basalt donut weight that cannot be attributed with certainty to textile activities. From the layers of the Middle Bronze Age three weights in unbaked clay and four in baked clay are attested, all of which have conical shapes and a horizontal hole placed towards the top of the weight. One of these weights shows a sort of narrowing at the height of its hole (Yahalom-Mack 2007, 664). No loom weights were found in the Late Bronze Age layers of Beth Shean.

#### 2.2.1.3 Iron Age

Beginning in the Iron Age, there was a considerable increase in the production of loom weights, as well as the introduction of a new type, the so-called bobbins/spools. These cylindrical objects are not perforated, are sometimes slightly concave on the long side, and are produced in unbaked or partially baked clay, which has certainly compromised their preservation and evidence in many archaeological contexts.

##### Syria

At Hama, a more numerous and more varied loom weight industry (than in previous periods) is attested; weights are generally made of baked clay and the most common shapes are the conical ones with horizontal perforation and donut ones with vertical perforation (Riis, Buhl 1990, pl. 96: 729). Alongside these types, there is also a good number of cylindrical spool/bobbin weights made of clay, 34 of which come from Batiment V, 32 of which were recovered from one room, 'Room G' (Fugmann 1958, 252).

There are 981 loom weights recovered from first millennium contexts at Ebla, and almost all of these belong to the Persian period, while actual

evidence from the Iron Age II-III levels proper are more sporadic. The most ancient examples come from pit fillings in "Area G," they are spherical and/or donut-shaped, each with a weight less than 200 g (Peyronel 2004, 234).

At Tell Afis, the first cylindrical spool/bobbin weights appear in levels dating to the Iron Age I and come from different areas of the site (Areas G, N, E, D). They are generally made of unbaked clay and measure approximately 9-11 cm in length with an average weight of 250 g (minimum 100 g and not more than 500 g) (Cecchini 2011, 196). The production of these objects continued through the IA II period, though in seemingly decreased numbers and with a change: along with the unbaked clay loom weights examples, spools that were baked at low temperatures in cylindrical shapes and with a slightly concave central part began to appear; one of these weights still bears signs of impressions made by threads (Cecchini 2000, 219). It is worth noting the presence of a possible area of textile production outside the northern city walls (area B3), consisting of a platform, a posthole and a rectangular pit containing numerous spool-type weights, some made of unbaked clay and some lightly fired (Scigliuzzo 2005, 43-5). Aside from these were found a series of ceramic dolium rims re-shaped into cylindrical forms, which may have been used as loom weights, although they could have served other purposes (Cecchini 2000, 219; *contra* Peyronel 2004, 308).[41] Many of these weights have been found in rather conspicuous batches, for example in Room A1 in Area E4, where were found 26 weights of the III phase (along with 4 spindle-whorls) and 23 in the phase IIIc (Venturi 2007, 150, 156, fig. 36). In the Iron Age II period Afis also witnessed the introduction of loom weights of the donut-shaped type, vertically pierced, which replaced the use of cylindrical weights in the IA III, along with other new shapes: biconical, spherical, pyramidal or bell-shaped weights with horizontal holes (Cecchini 2000, 222). Their weight ranges between 50-60 g and 460-470 g. Conical examples with horizontal holes are always very rare (Cecchini 2000, 223, fig. 5).

At Qatna, 232 loom weights were found in the excavations conducted between 1999 and 2005 (Besana 2005, 81). Most of these (136 total) are of the cylindrical spool type, narrowing in the middle, almost all of which were baked at low temperatures. Their relevance to the textile-production sphere is proven by some traces of wear due to friction caused by yarn on at least two examples (nos. 38, 51). A peculiar element of the loom weights from this site is decoration with tiny dots on the edges of 45 spools, the function of which is unclear. Although they vary in number, the dots have a diameter of about 1 mm, they are not deep and are arranged in four regular rows (Besana 2005, 85). The other type well-attested at Qatna is

**41** A similar practice was also identified at Tell Mastuma, not far from Afis, where 25 spool weights were identified, as well as several re-shaped dolium rims (Cecchini 2000, 219).

the donut-shaped loom weight with a vertical hole through it. 51 examples are known (plus one cylindrical example) made of unbaked clay. There are also 43 weights with horizontal perforations, these are divided into various types such as conical, truncated conical, bell-shaped and pear-shaped.

From an open courtyard in area H (IA II) at Qatna come 128 weights, which have a spool or truncated conical shape with through-hole. The spools measure on average 5.5 cm in diameter and 8-9 cm in length, they are cylindrical and have a slight concavity towards the middle; they were baked, some at quite low temperatures. The truncated cone weights have a base diameter of 5.5 cm and a height of 8.5 cm on average (Besana 2002, 45-6). Not far from this courtyard were found six fragments of bone implements, these may have perhaps once been spindles. It is therefore possible that Area H was a locus of intense textile activity, perhaps on an industrial scale. In Area J, donut-shaped loom weights were the type most frequently found. They were scattered through various fill layers of the excavated area and not concentrated in a single context, suggesting that the range of textile production was domestic rather than industrial (Besana 2005, 91).

### Palestine

Loom weights are known from the levels of Iron IIC period onward at Tell Keisan (Nodet 1980, 319). 85 weights of unbaked clay were found in several batches, some of them related to traces of charred wood, possibly identifiable with the remains of a loom. The shapes seen at this site are quite similar to those at other sites, globular and donut weights for the most part, with a few spool weights. Three groups of loom weights stand out from the rest: 39 weights were found in Locus 310, of which 36 have an average weight of 700 g and 3 weight at least 450 g. The second group (of 20 weights) was found in Locus 414; all but one of these have an average weight of 390 g, the outlier weighs 200 g. The third group consists of 17 weights of approximately 480 g each, and 8 weights of 250 g. The differences in mass between loom weights within each of these three groups is remarkable, suggesting the production of different fabrics. The publication, however, gives only averaged values, so it is not impossible that the disparity in mass between individual loom weights was actually less pronounced. Considering the materials in their entirety, in fact, three types of weights can be distinguished according to their weight (and not two, as the author suggests). A first group has a weight of between 200 and 250 g and it is composed of 9 examples; a second group has a weight between 390 and 480 g and is made of 40 examples; a third group weighs approximately 700 g and is composed of 36 examples. Although this data

is not exact,[42] we can surmise that textile production at ancient Tell Keisan was orientated towards medium-low quality fabrics, as there were recovered only a small number of weights suitable for finer production. The fact that most loom weights were of an intermediate weight is in line with the observations previously made regarding the multi-functionality of loom weights with an intermediate weight.

As for the site of Megiddo, most of the loom weights found there relate to Iron Age contexts. It should, however, be stated that a basic continuity can be seen for certain types of loom weights starting in the MBA, through all stages of Late Bronze Age and continuing into the Early Iron Age (Peyronel 2004, 251). It is, however, only in the Iron Age II Period at Megiddo that the finds of loom weights become very numerous. More than 81 pottery loom weights were listed by Paice and dated to level VI (IA I), almost all coming from the area CC. In particular, a group of perforated cylindrical weights was found in Room 2069 in Area AA and another large group came from an open area, Locus 1750 (Paice 2004, 59-60, fig. 33). Loud recorded a spool-type weight, slightly concave in the middle, in the layer VIA (IA I) (Loud 1948, pl. 170: 26), which belonged to a domestic structure. The 17 weights catalogued by Sass (2000, 372-4) are of a different type: most of them are donut-shaped with a central hole and are made of unbaked clay dating back to IA II; there is also one with an incomplete perforation.

The Iron Age Levels of Jericho have produced 7 donut loom weights with conical shapes, from a disturbed context. This causes their designation as 'Iron Age' to be rather suspect, since they could actually be related to the Middle Bronze age. A further 20 weights – 19 donut shaped and 1 conical – were found on the surface (Wheeler 1982, 623).

At Hazor, donut-shaped weights appear to only a slight degree in the excavation reports, although there seem to have been numerous spheroidal loom weights, often found in groups (Yadin 1958, 18, 44-5). A large batch of spheroidal weights has been found in a collapsed context, over the ruins of what was supposed to be the ceiling of the Pillared storeroom (Building 1, stratum V Area A) (Yadin 1958, 18, pl. VII: 3-4; Peyronel 2004, 265). A second group of loom weights was found together (9 in locum V, stratum 3066 area B dated to the 8th century) (Yadin 1958, pl. LXXII: 14-18), consisting mainly of unbaked, or sometimes lightly baked, clay spool weights; a spinning bowl was also been found in the same context (Yadin 1958, 45, pls. LXXI: 6, CXIII: 10).

At the site of Beth Shean 115 loom weights were recovered in Areas P and S, in IA II layers. There were 109 of these recovered from Layer P-7 of building 28636 (Yahalom-Mack et al. 2006, 476, 478). These were

42 Because the given data (the exact weight of each loom weight) has been 'filtered' by the author of the site report, and the 'raw' data left unreported.

found grouped together in two clusters near a charred pole, which may have been part of a loom. These loom weights take a donut shape for the most part, they are pierced vertically and can vary considerably in size and weight (from 43.28 to 630.11 g). One conical weight was found in another context. 10 bell-shaped weights made of gypsum have been also found, they are pierced horizontally at the thinner edge. Similar loom weights have been found at Tell 'Amal and Tell el-Hammah and are typical of this region in the IA II period (Yahalom-Mack et al. 2006, 477-83). A further two hundred cylinder-shaped weights made of clay and one hundred conical weights made of limestone and basalt were found in the IA II levels at Beth Shean (James 1966, figs. 118:14, 17). On the basis of the chronological revision only a few clay examples can be traced back to the previous phase (Peyronel 2004, 260). Another hundred conical stone weights with horizontal holes were also found in levels dating to the IA II, all grouped within a couple loci (48 and 83) and made of gypsum, basalt or limestone. The discovery of clusters of loom weights inside some buildings, often in significant quantities, suggests that large-scale textile production activity was concentrated in these areas of the site (Peyronel 2004, 260).

The evidence related to the presence of the warp-weighted loom during the Iron Age at Tell Abu al-Kharaz is plentiful, especially in Levels XIII and XIV, which date to the IA II. Weights are not described as per their shape in the site report, however, some deductions are possible on the basis of the few weights that were drawn. First, the initial phases of the Iron Age exhibit few loom weights, but a type of spool defined as 'Aegean' can be recognised. A basalt spool is unusual (Fischer 2013, 147, 284, fig. 846). There is evidence for cylindrical weights but not for donut shaped weights, which appear only in the IA II (Fischer 2013, 343, fig. 369). Phase XII, which is the transition between IA I and II at Tell Abu al-Kharaz, testifies to the persistence of unbaked clay spool weights, but also to the appearance of donut-shaped weights and biconical weights (Fischer 2013, 75, 136, 368, figs. 64, 115 and 125). With phase XIII, the presence of loom weights, mostly donut shaped, becomes overwhelmingly clear, with different clusters of materials from single contexts. Particularly noteworthy is Court L 194-1 in Area 7, where 110 globular and donut-shaped loom weights were found; they were associated with other textile production materials, such as bone shuttles and spindle whorls. In the eastern part of the court other loom weights were identified, making it very likely that weaving took place on a large-scale in this environment (Fischer 2013, 162, fig. 181).

Domestic structures dating to phase XIV (IA IIB) have been found in Area 7, some of which have provided several groups of loom weights, notably Houses 1, 2, and 3, while Houses 4 and 5 provide only sporadic evidence. An interesting discovery concerns 40 unbaked clay donut weights stored inside a jar in House 1 (Fischer 2013, 203, 207, figs. 186 and 187A). Spool weights, after a phase of coexistence with donut- shaped weights in

the transition between Iron I and Iron II, seem no longer to be attested in Iron II levels. 64 weights with conical, globular or donut shape, all made of unbaked clay, were in use during Iron II C. They have notable weight variations with the lightest group ranging from 189-272 g to the heaviest group weighing between 413-640 g (Rinner 2009, 148).

## Conclusions

In conclusion, the warp-weighted loom seems to have appeared in the Levant at the beginning of the Early Bronze Age, when it occurs at certain sites such as Hama. At the same time, it seems to be absent at other Syrian sites such as Ebla or Tell Afis.[43] In the Southern Levant, evidence for this type of loom is more substantial at sites such as Megiddo, Tell Abu al-Kharaz and Jericho (Nigro, Sala 2010, 4; Fischer 2008). It is possible that part of the evidence for the warp weighted loom should be sought in the category of the so-called 'perforated discs', which will be discussed later on. However, except for a few cases, it seems that in Syria the warp-weighted loom, even if well-known, was not the main type in use during the entire Bronze Age. The evidence for its use seldom appeared during the Middle Bronze and the Late Bronze Ages, with loom weights rarely attested at Ebla, Afis, Ugarit and Hama, which certainly reflect a different situation when compared to the evidence that comes from the Palestinian region.

Various discoveries have been made at the big sites of Megiddo, Jericho, Beth Shean and Gezer, but other groups of loom weights are known from sites such as Tell Ta'anach, Tell Ifshar, Tell Beit Mirsim, Tell el-Far'ah N, Tell el-Ajjul, and others (Peyronel 2004, 205). During the Late Bronze Age, the evidence for loom weights becomes extremely rare in both Palestine and Syria, with some weights still present, but definitely in lower numbers than in the previous and subsequent levels. No loom weight comes from the Late Bronze Age layers of Beth Shean, for example, except for a few examples of the stone discs whose purpose is still discussed. The same situation is confirmed at Hazor, Megiddo (which has 4 conical weights which probably drifted from MB layers), and Lachish. In the MBA layers of Tell Ta'anach 76 conical weights were found, compared to 3 weights recovered from the Late Bronze I and II layers (Yahalom-Mack 2007, 668). It seems therefore possible that the warp-weighted loom was used to a much lesser extent during the Late Bronze Age in Syria and Palestine, perhaps due to the introduction of the vertical two-beam loom. From a morphological point of view, loom weights do seem to have been quite standardised during the Bronze Age, with a predominance of conical and

**43** It should always be kept in mind that the published excavation documentation is much more numerous for Palestinian contexts and this could undermine our understanding of the spread and use of the warp-weighted loom.

bell-shaped types with horizontal holes, and the sporadic attestation of donut weights.

At the beginning of the Iron Age, there is a change in weaving techniques, with a renewal of the warp-weighted loom. At many sites, the Iron I Period marks the introduction or return of loom weights, in particular a new and long-debated shape; the bobbin or spool-type, which appeared in Syria and southern coastal sites at the beginning of the Iron Age, as evidenced at Tell Afis (Cecchini 2011, 196). These were also already present during the Bronze Age in the Aegean and in Anatolia, where the bobbin/spool-type loom weights remained in regular use throughout the entire Bronze Age. This fact leads us to consider the re-adoption of the warp-weighted loom in the Levant as a result of the arrival of exogenous populations, Anatolian, Aegean, or more likely, Cypriot (Cecchini 2000, 216-17; Fischer 2014, 478-9). This type is first joined by, but then replaced by, the donut-shaped type, which becomes the prevalent shape throughout the Syro-Palestinian area beginning in the Iron II Period. In addition, conical types with horizontal perforations were also present, in some cases in regional varieties such as those from Beth Shean and Tell ʻAmal, where stone weights were produced in these shapes (Yahalom-Mack, et al. 2006, 482).

### 2.2.2 Perforated Stone Discs

This category of objects is rather unclear and has not been well-defined in the secondary literature. Under this heading fall a large number of stone objects that have a hole through their middles, or slightly off-centre and which could have served several functions. The shapes of these objects are extremely varied, as almost every perforated pebble can be included in this category, from those 3-4 cm in size to examples that are 20 cm in diameter; their surfaces are sometimes smoothed, but often left rough and unworked. In the various excavation reports these objects are known generically as ‘perforated stone discs or weights’ and have been interpreted as ‘digging sticks’, ‘pivot(s) for drilling’, ‘weights’ (weights or counterweights across the various sources), and also as potential loom weights.

The chronological span of these objects of different shapes and sizes is wide; they are in evidence from the levels of the PPNB in Jericho and appear in Iron Age layers. The materials used for their production are few, with basalt being generally used and only secondarily limestone. It is possible that this group of objects, due to their heterogeneity, have indeed served all the functions suggested above, as their simple design allows them to have been of multi-purpose use. It is also possible that actual spindle-whorls and loom weights might be recognised from amongst this group of objects, distinguishable at least in some cases on the basis of their morphology, weight and context. Unfortunately, many excavation reports do not provide

detailed descriptions of all such simple objects of daily life, and usually only rarely provide extensive information regarding their sizes or weights, and this fact hinders the identification of particular functional categories. The same objects are also considered differently depending on the particular historical period to which they belong. For example, the Iron Age exhibits intensive production of so-called 'donut' loom weights in clay, as well as similarly shaped objects made of stone. When these stone 'donuts' are recovered from older contexts however, their designation as loom weights is considered uncertain, since (although it is possible) it is not known whether stone 'donuts' functioned exclusively as loom weights in all periods.

Some examples from the major Levantine sites are here provided, around which our discussion of "perforated stone discs" used in spinning and weaving, can be structured. The first pierced stone objects from Jericho were found in levels dating to the PPNB, with various interpretations provided by the excavators (digging sticks, mace heads and fly-wheel weights from semi-rotatory drills), although no suggestions related to textile activity (Dorrell 1983, 534). A total of 15 discs have been found in these early levels, 10 of which are in limestone, one in basalt, with the others not specified. 9 of these objects are well-rounded and symmetrical, while the other 6 are more irregular and have an off-center hole. In the levels of the following Pottery Neolithic (PN) only 6 stone weights were found, 4 of which are of limestone.

Only 2 perforated stone discs were found in the Proto-urban levels of Jericho, while 8 were recovered from the Early Bronze Age layers (Dorrell 1983, 558). In the transitional levels between the Early Bronze Age and the Middle Bronze Age, 4 such objects were found (Dorrell 1983, 562), some of which with incomplete perforation. 13 examples were recovered from Middle Bronze Age layers, almost all made of limestone. One of these shows traces around its hole left by a semi-rotary drill bit. One of the most attractive theories is that some of these perforated stone discs related to the drill technology itself, and were used with the tool, as pivots. In fact, there are certain objects, which have been found that bear numerous holes on their surface, not all of them completed through the object. However, for those with a single hole, it is not possible to narrow down their use more; they can still be linked to handicraft or textile contexts, or both if one subscribes to the 'multifunctional-use' theory.

As seen mentioned above, in the Iron Age levels from Hazor several discs were found grouped together, the 9 from locus 3066 stratum V Area B which dates to the 8th century BC, but before the Assyrian Conquest of 732 BC (Yadin 1958, pl. LXXII: 14-18) and were found together with a spinning bowl.[44] These weights are made of stone, mostly from basalt

44 It is described as "A flat bowl, with a hole in the base made before firing". Apparently not a spinning bowl (Yadin 1958, 45, pls. LXXI: 6, CXIII: 10).

and measuring between 5 and 10 cm in diameter. Of special interest is artefact C 10315 (Yadin 1958, pl. LXXXVII: 26, CLX: 7) made of polished basalt and dated to the LB II, as it shows a central groove that suggests threads were affixed to it.

There are not many perforated stone discs reported in the publications of Megiddo. Braun (2013, 101) reported that various weights including stone-frame weights and basalt rings are known from EB I levels, but provides no further information. Sass (2000, 376) reported three examples from IA II levels, two in basalt and one in limestone. There are some rare examples from tombs, such as a disc made of basalt from Grave 1102 of the Early Bronze Age and two similar discs, also of basalt, from Late Bronze Age tombs (877 C1, 63B). Finally, two perforated rings come from (undated) Tomb 80 (Guy, Engberg 1938, pl. 173-4).

At Beth Shean, under the section describing stone ring-weights are listed a number of circular stone weights, of which 27 are known from Early Bronze Age level IB, but which are completely lacking in levels dating to the Early Bronze III (Mazar, Rotem 2012, 362). The small scale weights made of limestone, with an average diameter between 3.3 and 4 cm and a hole diameter between 0.5 and 0.9 cm are interpreted as spindle whorls. In the MB II layers, 9 perforated discs have been found, all in basalt except one which is in limestone. They measure from 8 to 17 cm in diameter, apparently too large to be related to textile production (Yahalom-Mack 2007, 639). Several stone rings, all made of basalt except one made of limestone, were found in the transition layers between the Late Bronze and Early Iron ages. They had similar diameters of those of Middle Bronze date (Yahalom-Mack, Panitz-Cohen 2009, 725).

In Hama, the oldest perforated disc dates to Level 1 of the site (fourth millennium) is of basalt and 22 cm in diameter (Fugmann 1958, 17). Its weight is unrecorded, but even if it was known, this object could hardly have been associated with the use of a loom given to its dimension. Weights found in the later period layers at Hama are of different dimensions, though generally around 10 cm of diameter, similar to those coming from the other Palestinian contexts under examination here. Perforated stone discs seem very numerous and present in almost all levels of the Bronze Age, which is sign of great continuity in their use, whatever exactly it may have been. The material from which most were made is basalt, with limestone used to a lesser degree. In level J7 (2400-2300 BC) several of these discs were found in domestic contexts, but not in close association with spindle-whorls or the loom weights made of limestone, which were present in large numbers (Fugmann 1958, 56). On the other hand, in level J5 (c. 2200 BC) in *pièce* 1 and 4 both perforated stone discs and loom weights were found (Fugmann 1958, 62, 66), in this instance linking their use with textile production. Unlike loom weights, perforated stone discs continued to be used during the Late Bronze Age at Hama, although for the most part their total amounts within layers are lacking,

making statistical comparison difficult. The production of perforated stone discs continued uninterrupted until Iron Age levels (Fugmann 1958, 138, 143) without modification, continuing the dichotomy between elaborately-worked weights and rather rough pebbles.

The most interesting case, and which can be used as a model for a functional study of rings or perforated discs, is undoubtedly the series of artefacts from the Early Bronze Age phases of Tell ʻAbū al-Kharāz. At this site, the remains of at least two warp-weighted looms as well as spindle whorls still attached to spindles have been found (Fischer 2008, 109-10). This implies that the adoption of the warp-weighted loom had taken place in the Jordanian-Palestinian by the Early Bronze Age II, or c. 3000 BC (Fischer 2008, 116). As for the archaeological evidence, the two looms (L316 and 328) were placed in one room and had approximately the same dimensions. One of the two looms was in use at the time of the destruction of the house, as 8 weights (7 of basalt and 1 limestone) were found in a row, they may have been hooked to each other by a wooden stick. The loom measured about one meter in width (between the two side poles) and probably stood 1 meter tall. In association with the loom 2 other basalt weights or spindle whorls were found, several bone spatula or shuttles, as well as an awl and a copper knife.

The Tell ʻAbu al-Kharāz weights or spindle-whorls have ring or cylindrical shapes and can be divided into two types (Fischer 2008, 112). Examples from Group 1 take a circular shape, have a central hole, polished surface and weigh between 20 and 60 g (an amount which includes the spindle whorls which are still attached to their spindle). It is highly likely that this group of objects was mainly created for spinning, but their use with looms used for weaving very thin threads is still possible. The second group of apparent weights (Group 2) is a little less homogeneous than the first, in both surface finish and shape; they have an average weight of 90 g. Experimental tests have lead to the conclusion that these were not used as spindle whorls, because they oscillate excessively; if they do relate to textile activities, they are better suited to use as loom weights.[45] Similar objects to these are also attested in the later stages of this site, but show a significant decrease from the Middle Bronze Age onward. During the Iron Age a clear predominance of clay loom weights is seen.

In conclusion, the available data does not allow a precise identification of the stone materials connected to textile production, but it is possible to outline certain facts that may allow some steps forward. Firstly, the production of stone weights that are characterised by a regular circular shape, a central perforation, a treated surface, a diameter (up to 6 cm) and that are fairly lightweight has been verified in at least two sites (Tell

**45** Materials similar to those of both groups were recorded also at Qiryat Ata (types 3 and 4) (Shamir 2003, 210).

'Abu al-Kharāz and Beth Shean) during the Bronze Age. These objects, as evidenced by the recovery of one with the fragment of a wooden stick still inserted through it, probably were used as spindle whorls, alongside the more classic shapes discussed in section 2.1.2. The second group identified at Tell Abū al-Kharāz could have served as loom weights, which is suggested by the weights found *in situ* in a row (the exact dimensions and weights of which are unknown). However, these objects are more difficult to establish with certainty as loom weights, as they could simply be counterweights. The discovery of looms already in the early stages of the Early Bronze Age makes it more likely, however, that many of these objects should be linked to weaving. Definite proof for the identification of these objects as loom weights is provided only by the context of discovery; through association with other tools for textile production, or when these 'discs' are found in groups or rows that allow the presence of a loom to be recognised.

### 2.2.3 Other Tools Linked to Textile Production: Spatulae

The earliest examples of bone 'spatulae' come from level III (c. 8000-7600 BC) of the site of Mureybet on the Middle Euphrates (Doyen 1986, 47-51). The objects designated as spatulae are oblong, flat, very thin and measure between 10 and 12 cm long, 1.5 and 2 cm wide, 0.1 and 0.02 cm thick; they exhibit one rounded and one sharp end and were obtained from the ribs of animals. A long debate has characterised the identification of their function, earlier they were supposed to be tools related to writing and the preparation of wax tablets, or leather-working tools, it has also been suggested that they were used in the manufacture and repair of nets, or as part of cosmetic/toilet kit. The proposal to recognise these objects as instruments related to the manufacture of textiles began to be voiced from the '50s onward (Tufnell 1953, 397; Crowfoot 1957, 461-2), but their exact function has not yet been determined, as they lack contexts that allow us to prove their use in one way over other. Across the Levant, several flattened objects made of bone of lanceolate shape with one pointed and one rounded tip have been found: they can be defined as spatulae and in many cases these exhibit thin parallel marks near the tip and on one side of the object.[46]

Only two spatulae have been recovered from Qatna, one almost complete and one with only one tip preserved; these were found in association with some bovine ribs lightly shaped as well as some unprocessed ones (Besana 2005, 133), suggesting the presence of a tool-making workshop.

**46** Generally they are made from flat bones, such as the ribs and shoulder blades of sheep, goats or cows as they are better suited to produce these kind of objects; bone awls and tips are also obtained from the diaphysis of long and metapodial bones, while the humerus and femural condyles were used to produce rounded objects such as spindle-whorls (Peyronel 2016, 2).

A similar context was also found at Tell Afis, where four spatulae were found in room L. 534 of Area D along with other bone finds (Cecchini 1992, 14). Furthermore, several similar bone instruments were found. These were usually flat, between 10-12 cm long, 1.5-2 cm wide and 0.1-0.2 cm thick, with a sharp tip and the other end rounded. Spatulae were usually obtained from animal ribs and have a polished surface, while the tip has traces of usage (Cecchini 2000, 223). All of them come from Iron Age levels prior to the Assyrian conquest, and therefore the idea that they were used in conjunction with newly-introduced fibres such as cotton and silk can be excluded (cf. Doyen 1986, 49-51). In some cases, spatulae from Afis are decorated with circles and dots, as are the Levantine examples. Spatulae are interpreted by Cecchini (2000, 229) as tools related to very fine and tight textile weaving, and likely they were tools used to tighten the weft and untie knots. Furthermore, Cecchini underlines the inconsistent appearance of loom weights and spatulae together in the same contexts, and writes that this suggests that their function was not linked to the warp-weighted loom.

The 12 bone spatulae of Tell Mardikh date to IA II-III (Peyronel 2004, 360). In many cases, they have been found in primary contexts associated with clay loom weights. Their original lengths were probably between 9 and 15 cm, although many of the discovered tools were fragmentary and could have had different dimensions from those included in this range. They are usually around 2 cm wide with a thickness from 0.2-0.3 cm. In the lengthwise direction, the profile is generally flat or slightly curved, while the cross-section tends to be ellipsoidal and flattened, with rounded edges (Peyronel 2004, 357). The process of manufacture from the ribs of cattle and goats involved cutting the rib in a transversal direction, so as to obtain a flat instrument with a smooth side and one with the trabeculae still evident. This cut was followed by the smoothing and polishing of the surface. One end was shaped as a lanceolate or sharp edge and the other end was left flat or carved into a slightly rounded shape. According to Peyronel (2004, 357) the spatulae were generally smoothed during production, so the smooth surface that characterises them is the result of their preparation and not the use of the tool. Peyronel suggests that spatulae were used in relation to weaving and indicates a Cypriot origin, as they are well known in Late Bronze Age contexts there (Peyronel 2004, 371).

In Hama bone spatulae are known from the grave goods of the cremation necropolis. One such tool was found in an urn containing fragments of a spindle, three bone spindle-whorls and a comb made of bone, all of which are tools that relate to weaving or body care (Riis 1948, 178, 239, fig. 224).

Several spatulae (38) come from Megiddo, with shapes ranging from quite wide to rather short examples with pen-nib points and concave or straight sides, while the other end is generally rounded (Lamon, Shipton 1939, pls. 95-6; Loud 1948, pl. 199). Most of these come from level III, i.e. after the Assyrian destruction of 732 BC, but the first examples began to

appear in the VII-V levels, which date from the LB II until the beginning of IA II, but they nevertheless remain rare. The production of this type of artefact continues into the Persian period.

Lachish has brought forth 16 bone spatulae from its Iron Age levels with (if preserved) sharp tips and rounded ends. Most of them come from the Iron II A and B levels but production continued into the Iron II C and the following periods (Sass 2004, 2011-13).

Beth Shean provides evidence of 9 bone spatulae, 7 from Early Bronze I and II Early Bronze III, all with smooth surfaces and slightly concave interiors. Some have small traces of wear near the tip and measure from 2.5 cm (for broken examples) to 11 cm in length, but most of them are about 9 cm long. The width varies from 1.4 cm to 2.5 cm, while the thickness ranges from 0.2 to 0.4 cm. There were also spatulae found in the LB II strata and in the transition from the Late Bronze Age to Iron Age I A (Yahalom-Mack et al. 2006, 497; Panitz-Cohen, Yahalom-Mack 2009, 740).

In conclusion, the production of bone spatulae with lanceloate shape is generally attributed to the Iron Age period. There is a tendency, however, not to assume that the tools from earlier periods served the same functions as similar tools from the Iron Age. According to Peyronel, spatulae dating to the Early Bronze Age are linked to an older tradition of production in bone, that of tools (drills, bits, blades) and personal ornaments. It is only with the Middle Bronze Age that a production geared more to the textile sphere (spindles, spindle-whorls and spatulae) as well as pins and toilette items began (Peyronel 2004, 79). However, the Bronze Age spatulae from Beth Shean do appear to be of the same type and function (based on signs of wear) as those from the Iron Age and following periods, which indicates continuity in the use of this tool for the weaving process. A clear intensification of the production of bone spatulae occurs towards the final phase of the Late Bronze Age and the beginning of Iron I, through all the Levant. The Iron II and III periods see the greater spread of this tool, which persisted into the Persian and Hellenistic-Roman periods.

Although the relation between bone spatulae and textile production is generally accepted by most researchers, certain scholars have occasionally considered the appearance of the bone tools alongside the introduction of the warp-weighted loom. This theory actually clashes with the evidence described above as well as with the Egyptian evidence, which shows that bone spatulae of the same shape as described above are very well attested throughout the Pharaonic period, whereas the warp-weighted loom is not. It seems possible, as suggested by Cecchini (2000, 229), that bone spatulae relate to fine textile work in general, and not to specific weaving techniques and looms. Thus, the identification of the precise function of these tools remains a topic for debate, reliant on further detailed studies and their discovery at more sites, in order to provide a reliable chronological and geographical pattern of their spread.

# 3 Archaeological Evidence from Ancient Egypt

**Summary** 3.1 Egyptian Textiles. – 3.1.1 Prehistoric Period. – 3.1.2 Predynastic Period. – 3.1.3 Protodynastic and Old Kingdom. – 3.1.4 Middle Kingdom. – 3.1.5 New Kingdom. – 3.1.6 Third Intermediate Period and Late Period. – 3.2 Objects Connected with Textile Production. – 3.2.1 Hanks of Flax and Balls of Yarns. – 3.2.2 Spindles and Spindle Whorls. – 3.2.3 Parts of Looms. – 3.2.4 Needles. – 3.2.5 Bone Spatulae and Other Tools. – 3.2.6 Net Weights and Loom Weights. – 3.3 Iconographic Evidence. – 3.3.1 Middle Kingdom Tomb Paintings. – 3.3.2 Middle Kingdom Funerary Models. – 3.3.3 New Kingdom Tomb Paintings.

## 3.1 Egyptian Textiles

Textiles played a very important role in Ancient Egypt, as well as in the Near East. First of all, textiles served to dress the body, as tunics, robes, cloaks and other assorted garments; they were also necessary as bed linens, curtains, and to cover home furnishings. Secondly, textiles had a funerary use that gradually intensified during the Pharaonic age, as wrappings or shrouds for the deceased, but they were also left as grave goods within the tombs. Additionally, fabrics were offered to the gods within temples and used as an exchange currency, often paid as part of a worker's wage. Therefore textiles, although mostly lost now, were once present in all contexts: palatial, domestic, temple and funeral, which required that they were produced in huge quantities. Remarkably, the climate of Egypt has allowed a large number of ancient textiles to survive the ages, some of which in an excellent state of preservation, allowing modern researchers to study these usually-lost artefacts. The number of preserved Egyptian textiles is comparatively great, however, to those available from other regions, but it must be remembered that they represent a very small fraction of the output of ancient production. As well, the discovery contexts of ancient textiles are usually limited to the specific air-locked conditions of ancient tombs, which do not provide a comprehensive picture of their actual use in ancient Egypt.

### 3.1.1 Prehistoric Period

The oldest piece of fabric yet recovered in Egypt is a linen fragment discovered in a pit inside Silo 16 at 'Upper K', a Neolithic site in the Fayum (Caton-Thompson, Gardner 1934, 46, pl. XXVIII); recent microscopic analysis confirmed its identification as *L. usitatissimum* (Jones 2008, 105, figs. 1-2). The fibres within this fragment were prepared with great care, but its threads are coarse (with a diameter of 0.7 mm) and it was rather loosely spun; it is quite difficult to recognize the points at which it was twisted together, however it is recognizable as "S, 2z," that is, of a single z-twist yarn and S-plied. In total, this piece of fabric is rather rough and irregular, with 18x16 threads per square cm (Jones 2008, 107). Despite the appearance of flax at the beginning of ancient Egyptian textile history, other fibres were in use alongside it (Tata 1986, 25), and flax cultivation was limited until its implementation by the early Egyptian state.

The only other remains of Neolithic era textiles belong to the Badarian culture of Upper Egypt, after a considerable chronological hiatus from the remains at the Fayum site. The fabrics of the Badarian culture show a selvedge preserved in several cases, which indicates that at this stage fabric was produced on a loom via the continuous passage of the weft through the shed from side to side, and then backwards. The weft typically remained 'open' and was not beaten tightly against the previous row. Many of the Badarian threads were twisted with a very tight s-twist and only occasionally did a single thread show a z-twist (Midgley 1928, 64-7). All fabrics were woven in some variation of a 'tabby weave': some are 'open-weave', some are densely woven and some show a combination of the two practices. Many fabrics of the Badarian period and some of the Predynastic period show a peculiarity already noticed at the time of discovery: the weft and the warp are not arranged perpendicularly, but often show significant discrepancies. For example, fabrics from Gerzeh (Wainwright 1912, 6) show angles in the weft that reach up to 20-40 degrees in relation to the warp (Brunton 1948, 23). According to Midgley (1927, 70) this is a precaution taken to prevent the edges from fraying. Whether it was purposely done or not, Predynastic fabrics from the Naqada III period onward show a perpendicular slant and a change in the ratio of weft and warp threads (from 1:1 to a ratio of 1:2 or even higher). It seems possible that between these two periods certain technical alterations might have occurred thus leading to these changes (Jones 2008, 113).

### 3.1.2 Predynastic Period

The practice of spinning of single threads in both s- and z-twist continued into the early stages of the Predynastic Period. Fabric remnants from the

tombs of Abydos show that z-twist spinning was also practiced throughout the Naqada I A-C periods. However, some textiles showing z-spun yarns may have been older or somewhat worn-out fabrics re-purposed for funerary use. The Naqada II period fabrics from Hierakonpolis show a combination of s- and z-threads within the same fabric (Jones 2001, 14). On the basis of other cloth finds from the tombs at this site, it appears that a transitional phase existed, which saw the practice of z-spinning give way entirely to the s-spinning, which remained typical of the rest of Egyptian history. This transitional phase should be located between the end of Naqada I and the beginning of Naqada II.

The fragment known as the 'Gebelein Fabric' painted with boats and 'dancers' and housed in the Museo Egizio (S. 17138) is difficult to date because its provenance is uncertain (Donadoni Roveri 1987, 198; Borla, Oliva 2015, 237). Based on its decoration, it is possible to attribute it to the Naqada IC-IIA period, as it exhibits s-spun threads and a fringe. At Adaïma, fabrics from the necropolis of the Predynastic period (starting from Naqada IC) are all of s-twist manufacture (Jones 2008, 110). It therefore seems possible that by the beginning of the Naqada II phase the s-twist had become the dominant spinning technique, suggesting that the Egyptians already understood the advantages of following the natural direction of the flax fibre at this time (Jones 2008, 111). During the Predynastic period an increase in textile production seems to have occurred; likewise, a slight improvement in quality can be noticed. All the fabrics that remain from this period come from tombs and therefore give evidence for their marked use in funereal contexts; textiles were not only being used to wrap the corpse but also were clearly deposited as grave goods. Several of the known examples seem to have been specially produced for funerary use, with a decrease in the deposition of re-used textiles in burials (Tata 1986, 31).

The Predynastic textiles recovered from the sites of Qau and Badari are very similar to the older fabric remnants from the same sites (Midgley 1928, 64-7). The weft is open, not beaten, and often the threads do not lie exactly perpendicular to the warp. Most of the textiles from the site of Mostagedda are of tabby weave, and the appearance of these vary depending on the use of single or plied threads. In some cases, despite the same 'open' structure weave seen at other sites, some textiles from Mostagedda include quite thin threads (Brunton 1937, 92-3). In contrast, fabrics from Gerzeh and Mazguneh have a 'plain' weave structure but a warp/weft yarn ratio that is almost double these (Wainwright 1912, 6). At Armant, the textiles have an open structure and an unbeaten weft (Tata 1986, 33). It is only at this time that the first dual-coloured textiles appear, as evidenced by a fragment of white and brown wool fabric recovered from Deir el-Ballas (Petrie, Quibell 1896, 24, T26).

The important site of Tarkhan/Kafr Ammar, which dates to the Naqada III phase, or the end of the Predynastic period, has returned a large quan-

tity of fabrics, many of which are of the finest linen. The first true 'dress' (a complete, long garment) comes from this site, has sleeves, is made of linen, and still bears clear signs of pleated detail. The fabric from which it is made contains 22-23 threads per centimetre in the warp and 13-14 per centimetre in the weft (Tata 1986, 45). Mastaba 2050, although it had been plundered, still contained seventeen linen textile samples of various quality, the finest of these were composed of 80×20 threads per centimetre (Midgley 1915, 48-51). Midgley's analysis of 22 fabrics recovered from three mastabas in this necropolis demonstrated that 17 of these samples contained warp threads that had been plied, while in 12 examples the weft threads had also been plied. In three of the textile samples the weaver had used two threads coupled in the same shed (known as a 'basket weave') instead of using cabled threads. The direction of the twist for all the threads evidenced within the textile corpus from these three tombs was S twist.

The Predynastic period was therefore very important for the development of the spinning and weaving technologies of ancient Egypt, as it can be seen that during this period differing directions of yarn-twist were tried, in order to obtain at the most efficient result. Due to the results of these experiments, the quality of early Egyptian yarns and fabrics improved dramatically and, by the last phases of the Predynastic, fabrics as fine as those of Pharaonic-period production were being woven. Although the Naqada I-III periods are usually considered as 'precursors' to the later centralised regime, the technologies and textile-working ability that are known in the following periods can be seen to have been available during the formative phases of the ancient Egyptian state.

### 3.1.3 Protodynastic and Old Kingdom

Fabrics from the Protodynastic period are in evidence from the sites of Qau and Badari; they are made of simple tabby weave linen and are very similar to earlier Predynastic fabrics known from the same sites (Midgley 1927, 70-1). The peculiar technique of angular weft insertion (in relation to the warp) continues (Tata 1986, 46). From the Protodynastic period comes a unique woolen find: a piece of tabby weave fabric that had been wrapped around a male individual interred in a grave of the first dynasty of Helwan (Tata 1986, 49). The fabrics from Tarkhan (Midgley 1915, 48-51) and Saqqara are all of flax, while sites at the border of the Nile Valley continue to produce fabrics with vegetable fibres other than linen (Tata 1986, 49). The so-called 'Tomba di Ignoti' at Gebelein dates to the 5th Dynasty and has provided many fabrics used both to wrap mummies and for funeral offerings, as well as, remarkably, an inventory text written in hieratic, where textiles are also listed (Donadoni-Roveri 1987, 199; Borla, Oliva 2015, 237, fig. 302). The Gebelein textile corpus also included pleated and fringed

tunics with long sleeves formed from several specifically-cut pieces that demonstrate the high standards achieved in tailoring techniques by this time. In some cases, the tunics show traces of wear, while others seem to have been created specifically for funerary use.

### 3.1.4 Middle Kingdom

Fabrics dating to the 11th and 12th Dynasties seem to indicate a great homogeneity in the textile production of the Middle Kingdom (Tata 1986, 153). Individual fabrics do not show great differences, except for the distinction between the finest ones produced for the elite (with a very high sett of weft and warp threads) and those produced for the rest of the population. The type of weave created, however, remained substantially the same at all social levels, and there are no complicated techniques (such as additional weft threads) that would distinguish more expensive fabrics; the only factors that can be considered are the fibre quality and the set. Many fabrics have fringed edges, both those for the elite and for middle class people.

Many mummy cloths found in Thebes which date to the 11th Dynasty have been analysed and have confirmed this homogeneity (Braulik 1900, 40): they show a tabby weave with threads that vary from very regular to quite irregular. Only one of these cloths is weft-faced, with a larger number of weft threads as compared to the warp (21 warp × 46 weft per centimetre). The textiles of the Middle Kingdom are almost all without decorative motifs, except for an example that comes from a tomb of the 12th Dynasty at Deir el-Bahari. It has thin stripes and zig-zag motifs made by additional loops inserted into the weave. The decorative pattern is overall quite simple, but loop-weaving requires considerable skill, and it is interesting to notice that the first known example is so well-crafted (Tata 1986, 154). A second fabric with loop decoration comes from the same context and was entirely made by the technique of loop-weaving (Winlock 1932, 34-5). There are a few other examples of this technique preserved from the Middle Kingdom, such as a fabric found in the Warriors' Tomb of the reign of Mentuhotep and some fragments from Kerma, Sudan (Tata 1986, 155; Vogelsang-Eastwood 2000, 276).

### 3.1.5 New Kingdom

In the New Kingdom period, more elaborate fabrics began to appear, perhaps in direct relation to the introduction of the vertical loom in Egypt. Fabrics preserved from this period are decorated with different motifs and their yarn was dyed with a wide range of colours.

At the Workers Village at Amarna, however, only wool[1] and linen textiles with a tabby weave are present, although there are some that show slight variation from these, such as a few examples of 'basket weave'[2] technique (Vogelsang-Eastwood 2001, 94). Generally, woolen fabrics are made of thick threads and open weft, although there are also certain examples of finer work; woolen threads are always plied and are characterised by a single s-spun and a z-plyed (Vogelsang-Eastwood 2000, 145). Fringes are not present on any of the preserved woolen fabrics from the Workers Village, but certain fragments of linen cloth from this area do exhibit 'loop weaving', a method that seems to continue until the Late Period. As for thread sett, most of the Amarna fabrics have a higher ratio of warp than weft, and in many cases the ratio is 40 to 20. Sett can vary a lot between different fabrics some with up to 60 threads per centimetre and others with only 5 threads/cm.

An innovation of the New Kingdom is the 'tapestry weave', which uses the same setup as that of a normal fabric, the difference being that in normal weaving practice the weft thread runs from side to side (from one selvedge to the other), adding one row at a time, whereas in tapestry weaving the weft is passed only in a narrow part that produces only a small portion of fabric. The weft yarn is beaten until it completely covers the warp, which is no longer visible in the finished work. This type of weaving appears in ancient Egypt from the XVIII Dynasty onward, although preserved examples are rather rare. Most of them come from tombs, as do almost all fabric samples, in particular from royal tombs, such as that of Thutmose IV wherein was found a cloth with the cartouche of Amenhotep II woven into it (Vogelsang-Eastwood 2000, 275; Carter, Newberry 1904, 143-4).[3] This remarkable piece is made with a z-plied thread for the warp, while the weft is s-plied. The thread sett is very high with 29 threads for the warp and 88 for the weft per square cm. Two other examples of tapestry weaving are stored at the Museo Egizio and come from the tomb of Kha at Deir el-Medina. These consist of two seat covers with floral decoration in brown, red, green and unbleached linen fibres; both have fringed edges.[4] In addition to the tapestry technique, these two fabrics exhibit loop weaving on the reverse.

The richest collection of New Kingdom tapestry fabrics comes from the tomb of Tutankhamun, which contained several tunics that show this

1 Three textile samples from Amarna show a mixture of sheep and goat fibres (Kemp, Vogelsang-Eastwood 2001, 35-8).

2 Two threads of weft per two threads of warp.

3 The fabric may therefore be older and the technique used at least from the reign of Amenhotep II.

4 S. 08528, S. 08529. Schiaparelli 2007, fig. 114; Donadoni Roveri 1987, 204, 213.

technique, of which one was entirely created by tapestry weaving. Two other fragments of tapestry fabrics have been found in the King's Valley (Daressy 1902, 302-3); their precise provenance is unfortunately unknown. For this reason, their designation as New Kingdom period materials is in doubt, although their decorative motifs are quite similar to the other examples of this era.

An unique example of a 'double weave' is the famous Ramses III garland,[5] the warp-faced ornamental motifs of which seem to be similar to the warp-faced ribbons with geometric patterns found in Tutankhamun's tomb (Tata 1986, 215).[6]

The techniques of embroidered decoration seem to begin with the New Kingdom. The first preserved example of this method is one of four textile fragments found in the tomb of Thutmose IV; it consists of a tabby weave fabric decorated with simple embroidery. The most well-known example comes again from Tutankhamun's tomb, where embroidered decoration is seen on the side-panels and cross-bands of a tunic. Barber (1982, 442-4)[7] disagrees with the identification of these decorations as embroidery proper, and sees them rather as the result of a different method of weaving. Other small examples of embroidered elements[8] appear on fabrics of the already mentioned tomb of Kha.

As well, the technique of dyeing fabric was known and had been employed sporadically since the Predynastic period, but in textile remains from the New Kingdom it appears more regularly and with a high degree of proficiency (Tata 1986, 221). Fabrics, which would otherwise remain pure white, were further elaborated in this period with beads, sequins, ribbons, fringes or even painted decoration.

### 3.1.6 Third Intermediate Period and Late Period

With the end of the New Kingdom, some of the innovations that characterised the weaving technology of this period seem to disappear, such as the decorated fabrics. The fabrics recovered from contexts of the Third Intermediate Period show a return to bleached linen, even if their quality

5 About which much has been written, including Johl (1924), Crowfoot, Roth (1923, 7-20), Barber (1991, 120-1) and Vogelsang-Eastwood (2001, 276) among others.

6 Many discussions have been held regarding the techniques used in their creation, but it seems clear that no tablet weaving technique had been used. See also Vogelsang-Eastwood 2000, 391.

7 Tata (1986, 219), in contrast, supports their identification as embroideries.

8 It is not a decoration, rather a property mark, which is embroidered in some of Kha textiles.

remained rather elevated. The few decorated fabrics, among which a linen scarf with blue motif may be seen, are all datable to the 22nd Dynasty (Tata 1986, 236).

To the period between the New Kingdom and the Third Intermediate Period belong the textiles from the Deir el-Bahari cache, which are today stored in the Museo Egizio (Borla, Oliva 2014, 85). These textiles are not associated with any inscriptions that would suggest a more precise date, although we can recognise two groups within them: the original cloths that were deposited with the mummified bodies in their first internments, and textiles used by priests of the 21st Dynasty to re-wrap the bodies when they moved them into the *cachette* at Deir el-Bahari. All of these fabrics are made of linen in tabby weave and many of them exhibit fringed edges. The thread used within them has an s-twist and appears in many cases with two or three plies, contrary to those stored at Leiden and coming from the same *cachette,* which have cabled threads only to strengthen the selvedges (Van Rooji, Vogelsang-Eastwood 1994, 14). In many cases, these textiles show clear signs of having been cut from shrouds, as they are too large to be considered purpose-made bandages. Some fabrics show tailoring elements such as overlock stitching, embroideries, evidence of darnings and other marks that testify to their not having been produced for funerary use. Certain fragments are made of extremely fine linen dyed red; these are generally only seen in tombs of high-ranking persons. A fabric of double-weave, which has been dated between the 20th and 21st Dynasty, bears painted decoration consisting of a vertical strip of red-brown colour (Borla, Oliva 2014, 88:4).[9]

An embroidered textile was recovered from within the fourteen tunics wrapped around the body of a priestess of the 23rd Dynasty. The embroidery itself is seen around the neck and on the sleeves of one tunic; it was worked in blocks of red, purple (or blue) on natural linen (Vogelsang-Eastwood 2000, 280).

In the Late Period, the evidence for and studies of Egyptian fabric are more sporadic, but it seems that textile production continued as in the previous periods, although lacking the wealth and variety that had characterised the New Kingdom. With the end of the Late Period and the conquests of Alexander the Great, the advent of Greek and then Roman domination, new weaving production techniques and new materials arrived in Egypt, altering the system of textile production at a deep level. A major example of this change was the strong support given by the Ptolemaic (and later Roman) state for wool production, to the disadvantage of the native linen weaving industry (Mayer Thurman, Williams 1979, 36).

9 S. 1678.

## 3.2 Objects Connected with Textile Production

### 3.2.1 Hanks of Flax and Balls of Yarns

At many Egyptian sites, yarn gathered in hanks or wound into balls has been recovered. These are part of the extraordinary finds preserved in Egypt, where we are uniquely able to connect archaeological materials with all the phases of textile production. These unutilized pieces of yarn indicate that at least part of the yarn spun was not immediately used for weaving, but deposited and used later as needed. This yarn, which was put-by for use at another time, could have been used for sewing or darning, not just for weaving, or perhaps something else entirely, such as the knotting of fishing nets.

Small quantities of yarn were also found at Kahun/Lahun, dating to the end of the Middle Kingdom, c. 1850-1750 BC (Quirke 2003). In total, four hanks of flax and thirteen balls of linen yarn come from the site; the balls of yarn are slightly s-twisted and each wrapped around a core of waste fibres (Allgrove McDowell 1986, 221). Most of the yarn is of medium-fine quality, but there are also coarse threads in evidence, which, according to Petrie (1890, 28) would be thread for making nets. In at least one case this might be true (UC 7511): yarn wrapped around a pottery sherd is s-spun and z-plied, like the threads of the nets of the same site (Cartwright 1999, 101); however, sewing thread generally has the same structure. Fine linen has also been found at Kahun, as well as a net fragment made with very fine yarn. Threads were used both singly and two- or three-plied; occasionally one yarn can consist of up to 6 strands (Petrie 1890, 28). In two linen balls of yarn the splicing points have been recognised (Quirke 2003): they are about 5 cm long and approximately 35 cm apart from each other. Additionally, four other balls of yarns (UC 7510) show traces of splicing, as does another yarn wrapped around a sherd (UC 7421). UC 7510 is an example that shows a peculiar direction of splicing and plying, since in UC7510a threads are s-spliced and z-plied, while these directions are inverted in the other balls of yarn (Quirke 2003). All the wool samples found in Kahun have been confirmed as medieval and intrusive and therefore will not be discussed here (Cartwright 1999, 101).

From Gurob come seven balls of yarn that can be dated to the New Kingdom, with differing thicknesses of threads (0.1 mm to 0.5-1 mm). They were recovered from one or more houses of the town (UC 27882 i-iv) and are probably wrapped around tow (Thomas 1981, 39 nos. 85-8). In one case the thread is wound around a broken cane (UC 27883 iv) and another around a triangular pottery sherd (Kemp, Vogelsang-Eastwood 2001, 83). Two more hanks of fibres, probably also from houses, were found (UC 27883 i-ii) (Thomas 1981, 39 nos. 89-90).

From the Workers Village at Amarna no balls of yarn have yet been found, but 24 hanks of yarn have been identified (Kemp, Vogelsang-Eastwood 2001, 84-6). Not all of them are in good condition and only in some cases was it possible to determine the presence of plying, while in other cases the threads remain single.

From Lisht there are two balls of yarn that date to between the end of the New Kingdom and the onset of the Third Intermediate Period. The thread sizes vary remarkably within each ball of yarn, however both are s-twisted, thin and suitable for weaving (Kemp, Vogelsang-Eastwood 2001, 84-6).

### 3.2.2 Spindles and Spindle Whorls

With the discovery of two (a discoidal and a conical-with-convex-sides) limestone spindle whorls at the site of Kôm W in the Fayum (Caton-Thompson, Gardner 1934, 33, pl. XII), the production of spindle whorls is attested in the Egyptian Neolithic. Several further examples come from Badarian contexts (Brunton, Caton-Thompson 1928, 34). At the site of Naqada, globular, conical and spherical spindle whorls have been found (Petrie, Quibell 1896, 2, 26, 35), as well as certain objects similar to spindle whorls set along a rod with a dotted surface that may have been used as toys tomb-models (Petrie, Quibell 1896, 35). Other limestone spindle whorls and bone spatulae are attested from the town site at Naqada (Petrie, Quibell 1896, 54). A dozen clay spindle whorls have been found in a house of Naqada Phase IIA date at Hierakonpolis (HK11), meanwhile in Maadi were found 17 limestone spindle whorls dating to Naqada Phase II B (Jones 2008, 112).

From the worker's village of Fourth Dynasty Giza (Heit el-Ghurab) comes no great evidence of spinning and weaving activity, which is unsurprising since organic materials have rarely been preserved at this site. A dome-shaped spindle whorl of ceramic was recovered from there however, which suggests that spinning-related activities did take places at the site (Tavares 2004, 10).

Spindles of the Middle Kingdom and New Kingdom from the sites of Kahun and Gurob exhibit typological differences from each other, as Petrie noticed (Quirke 2003). The older form of spindle takes a large cylindrical spindle whorl (UC 7306ii), while the later examples from Gurob (UC 7809) consist of longer rods with smaller spindle whorls, the tip of which point to the top of the spindle. Both have grooves for fastening fibres towards the top of the spindle; while the groove attested on the Middle Kingdom example has a spiral shape, later versions bear simple incisions.

At Kahun, spindles are quite commonly recovered with dimensions ranging from 17.8 to 38.1 cm. They are characterised by very thick, nearly cylindrical wooden spindle whorls and a long spiral engraving for fasten-

ing the thread (Petrie 1890; Petrie 1917, 53 no. 140). From Kahun come also other types of spindle whorls, such as dome-shaped or conical spindle whorls made of limestone, bone or pottery (Petrie 1917, 53; Allgrove McDowell 1986, 214). Many spindle whorls show traces of mud or plaster, on which there may have been painted decoration (Allgrove McDowell 1986, 215).

Three spindles with spindle whorls still attached, 4 rods and 37 spindle whorls are known from the site of Gurob and are dated to the New Kingdom. The spindles are all made of wood and measure respectively: 24.8 cm in length and 0.3-0.4 cm in diameter (UC 7809), 24.5 cm in length and 1.0 cm in diameter (UC 7810), and 13.5 cm in length (UC 7814 i). At least two spindles still exhibit the groove that hooked the fibre, while it is not clear from the report if the third spindle is broken or complete. The spindle whorls inserted on the spindles are located near one end; the other end was formed to a point. In two cases the spindle whorls are dome shaped,[10] one example is discoidal and all are made of wood. Four other wooden spindle rods from Gurob measure between 9 and 16.8 cm in length (not all are intact); one of them (UC 7812) is decorated with a herringbone pattern that might rather place it in the category of 'pins' (Thomas 1981, 38 no. 82). The first reported group of spindle whorls are 21 in number, they are dome-shaped and some of them show traces of painting. From a second group come 16 other spindle whorls (UC 7814), among these are 13 wooden spindle whorls of different sizes, 3 with part of the spindle still inserted through them and one spindle whorl consisting of two overlapping circular pieces where the spindle itself is still preserved for 4 cm in length. On the second piece basis there are some threads signs (Thomas 1981, 39 no. 84).

The Amarna New Kingdom spindles are made of wood, with one sharp end, and the other end engraved with a spiral, which follows the direction of the s-twist (Kemp, Vogelsang-Eastwood 2001, 266-7). There are no fully preserved examples. Until the New Kingdom, Egyptian spindle whorls mainly took cylindrical shapes and were placed at the top of the spindle. Some examples with domed or conical shape were found in Kahun, but it is only with the onset of the New Kingdom that dome-shaped or truncated-conical spindle whorls became frequent. At Amarna, the discoidal spindle whorls were generally made of wood, while other shapes were made of materials such as stone and terracotta.[11] The preservation conditions of the Workers Village are more favourable than those of the Main town (wood is

**10** One of these spindle whorls is rather small, measuring only 2 cm in diameter and 1.5 cm in height (Thomas 1981, 38 nos. 80, 81, 83).

**11** Among the terracotta spindle whorls, those made from perforated pottery sherds should be included in the counts of objects, as seen in the previous chapter, but unfortunately, no further elements are provided in the publication.

often preserved in the Workers Village but rarely in the Main Town), which skews the data regarding wooden and stone spindle whorl distribution.

In the Workers' Village, where organic materials are better preserved, wooden spindle whorls are in a ratio of 30:1 as compared to those of other materials, and 100:1 if the spindle whorls made from ceramic fragments are excluded. The main shapes of wooden spindle whorls are cylindrical, more rarely dome shaped, and have an average hole diameter of 0.7-0.9 cm. Some have engraved marks on the surface. Data analysis concludes that spindles and spindle whorls were very common in the village of Amarna both inside and in proximity to the houses, although there is no regular distribution per house (Kemp, Vogelsang-Eastwood 2001, 278).

In the main city the situation appears to have been different, as most of the organic materials were lost. The diameter of individual spindle whorls varies from 18 mm to 81 mm, which is not surprising given the wide range of textiles that must have been produced, from ultra-fine linen yarns to wool and cordage (Kemp, Vogelsang-Eastwood 2001, 280). Some of the stone spindle whorls are made of alabaster and were originally recognised as loom weights. The study sample from the town, as considered by Kemp and Vogelsang-Eastwood, consists of 218 spindle whorls, excluding most of the perforated pottery sherds. It shows that the stone and wooden spindle whorls are almost equal in number, while far fewer examples are made of clay and pottery. A spindle whorl made of ivory was also present in the assemblage from the town. Most spindle whorls have a diameter between 4.5 cm and 5.5 cm, although wooden spindle whorls are, on the whole, larger than the stone examples. Interestingly, spindle whorls from the Workers Village are substantially smaller and lighter than those found in the city (Kemp, Vogelsang-Eastwood 2001, 289). Some spindle whorls bear elaborate surface decoration while others have only simple engravings of crossed lines on the upper side; however, none of them show the marks attested on examples from the Workers' Village.

At the site of Matmar, certain spinning-related objects have been recovered from houses in the area of the temple. This area dates to the Second Intermediate Period but saw its peak of occupation in the 19th dynasty. Amongst the objects recovered are spindle whorls made of stone (particularly limestone), some of which have the spindle rod still inserted through the hole. These spindle whorls are of cylindrical shape with a rather thick profile (Brunton 1948, 71 pl. LII). A conical spindle whorl with engraved floral motif and a lenticular whorl, both made of limestone, are also attested. Some fragments of wooden sticks found in this area may be have been part of spindles, especially one example of a long rod with a rounded end (Brunton 1948, pl. LII: 68). From Kôm Rabi'a come 23 perforated

pottery sherds, most with a rounded shape and a central hole.[12] To these must be added a clay weight of discoidal shape (Giddy 1999, 200, pl. 42). These objects were recovered from various occupation levels of this site.

### 3.2.3 Parts of Looms

It was Petrie who first suggested the use of 'heddle jacks', items that served as the supports for the heddle-rod. They were placed near the warp in order to support the shed bar and open up the shed and could have been removed easily to close it (Winlock 1922, 71).[13] Seven of these wooden objects have been found at Kahun: they are shaped to fit the heddle; four are relatively light while one example is made of heavy and hard wood. Although no $^{14}C$ analysis has been performed on them, it is most likely that they date to the Middle Kingdom, the period of maximum growth for the settlement of Kahun (Cartwright 1999, 92). There are no known heddle jacks from New Kingdom settlements, such as Amarna, Deir el-Medina and Gurob, but four examples have been found at the site of Lisht (Hayes 1959, 218).[14]

Heddle supports are other loom-related objects, which take a flat shovel-shape and are pierced in the middle with a short pole which protrudes. They can be more rounded and nearly oval-shaped, and also their inner hole can vary between squared or rounded. Four of these objects have been discovered in Amarna, with quite standard dimensions: from 34 to 37 cm in length with a width from 13 to 16.5 cm. At the moment of discovery, some examples exhibited skin wrapped around their upper parts, and some had ropes carefully knotted around the ring and around the small pole (Kemp, Vogelsang-Eastwood 2001, 348-51). A wooden object similar to these has been recovered from Gurob and dates to New Kingdom (object UC 7926). It consists of a circular ring from which a wooden portion protrudes. According to Thomas it was likely fixed to the wall in order to support part of a loom (Thomas 1981, 39 no. 95).

Another type of object occasionally recovered from Egyptian sites are wooden bars. Three of these was recovered from Middle Kingdom-period Kahun, one of which might have served as one of the beams for a loom. It measures 157 cm in length and is 5.7 cm wide, with rounded ends near which there are deep grooves, probably for fastening the beam to the rest

**12** Three examples from this group actually have two holes and should not be recognised as spindle-whorls.

**13** The use of heddle jacks has been deducted from the wooden models, like those of Meket-Ra, where they are represented on the ground next to the heddles.

**14** Their presence in New Kingdom levels might be a good clue that the horizontal ground loom continued to be used in this period and, thus, contemporaneously with the vertical two-beam loom.

of the loom (Griffith 1910, 11).[15] Another long wooden bar that is variously thought to have been used as beam for a loom, or as a spacer for the production of mats, was found at Kahun and dates to the Middle Kingdom (Allgrove McDowell 1986, 228). It is 97.8 cm long and 8.2 cm wide (Petrie 1890, 28; Griffith 1910, 11; Johl 1924, 33). It exhibits 28 holes drilled through it, which are separated from each other by approximately 4 cm. The holes were originally of a round shape, but were altered over time through use. From the same context is also attested a long, flat wooden bar probably used to keep the reeds or fibres being woven in position, and which is 91.7 cm long and 6.5 cm wide.

Another long bar (1.063 m) recovered in five pieces from Gurob is triangular in cross-section and bears traces of wear from the friction of thread passing over it. It has been interpreted as a weaver's 'slay' or beater-in (tool used to beat the weft threads) and dates to the New Kingdom. A second object from Gurob (UC 7824) with grooves similar to the one just described, but only partially preserved, may have performed the same function (Quirke 2003). Another use for wooden bars could have been as 'shed sticks,' which were rather wide wooden bars used to open the shed on horizontal ground looms. An example with a triangular section is stored in the Cairo Museum and measures 66 cm in length. It shows clear signs of wear on its edges. It has one sharp end and the other shaped as a handle (Kemp, Vogelsang-Eastwood 2001, 351).

Weaving swords were used to pack the weft tightly together after a weft thread passed through the shed. However, the function of these objects is not entirely certain, as all the surviving examples are very short and seem different from those represented in the tomb models and paintings (Griffith 1910, 11)[16]. A possible example, which is complete except for its handle, comes from New Kingdom period Kahun (Quirke 2003, Petrie 1890, 28).[17] Twelve other examples of possible weaving swords come from the Workers Village of Amarna and have (preserved) lengths from 18.5 cm to 32 cm. The distribution analysis that can be carried out at Amarna is interesting; however, as it shows how none of these supposed weaving swords come from a room where a loom was posited to have been located; this situation is opposite to that of spindle whorls, which are usually recovered from the same contexts as other textile tools (Kemp, Vogelsang-Eastwood 2001, 354).

A 'warp spacer' is another tool used in weaving, which has several grooves where a group of threads (not single threads) were inserted and carefully arranged. Warp spacers serve to keep warp threads at equal distances from each other; this is especially important when the whole

15 Manchester Museum 34.

16 Manchester Museum 36.

17 UC63630.

warp set is transferred onto the loom. After the transfer, the warp spacer can then be removed or left attached to the warp beam during weaving (Kemp, Vogelsang-Eastwood 2001, 346-7). A wooden warp spacer (UC 7807) dating to the new Kingdom was found at Gurob (Thomas 1981, 39-40). It has a flat base, curved sides and a rounded top. The rounded top part has been incised at an approximate depth of 1.5 millimetres at regular intervals of 6-8 millimetres. Unfortunately, it is not intact and the handle is broken away.[18] Two other smaller spacers from Gurob were mentioned as photographed by Petrie (1917, 53, pl. XLVI), along with 3 additional fragmentary examples from the same site.[19]

Furthermore, few more examples of warp spacers are reported. A spacer is housed in the Cairo Museum, it still has its pointed end preserved and shows a triangular section. It is 21.4 cm long, 2.3 cm high and exhibits 44 incisions. A single spacer comes from Amarna, from the Workers Village. It preserves a flattened edge and a triangular section and it is 20.9 cm long, 2.4 cm high and 2.4 cm thick. It bears 33 incisions but there are no signs of wear from the friction of the thread (Kemp, Vogelsang-Eastwood 2001, 341). A spacer of rounded shape with a preserved edge was found at Lisht,[20] and an additional example was found within the remains of a Third Intermediate Period settlement built on the ruins of the pyramid of Neuserra at Abusir (Johl 1924, 40). Two spacers are housed at the Neues Museum of Berlin, one of which preserves a tapering end (Johl 1924, 40, pl. III). All known warp spacers come from New Kingdom contexts and there is no evidence of their use during the Middle Kingdom, even if they can be employed in both vertical and horizontal looms.

In the category of loom supports, comes evidence from several houses in the Workmen's Village of Amarna. This evidence consists of many stone blocks, generally found in pairs, which were probably meant to support vertical looms.[21] The blocks are made of limestone, and are squared and carved to hold horizontal poles. The carvings appear either about half-way along one side of the block, or as 'channels' that run from one side of the block to the other (Kemp, Vogelsang-Eastwood 2001, 374). Most of these loom supports were recovered from the front rooms of houses, but

**18** The total length of this spacer is 57.8 cm, the width 2.4-2.7 cm, the depth 3-3.1 cm.

**19** The other pieces are: 1) 17.5 cm long, 1.3 of high, with 26 incisions; 2) 37.7 cm long, 1.9 cm high, 1.4 cm thick with 92 incisions; 3) 33.9 cm long, 1.8 cm of high, 1.3 cm thick with 37 incisions; 4) a preserved edge with flat shape, 22.7 cm long, 2.9 cm of high, 2.8 cm wide with 24 incisions (Kemp, Vogelsang-Eastwood 2001, 341.6). These all remain uncatalogued at UCL (under the reference numbers 339.2, 339.3)

**20** It measures 47.9 cm in length, 3.2 cm high, with a thickness of 2.5 cm; it preserves 40 incisions (Kemp, Vogelsang-Eastwood 2001, 344.8).

**21** This is the theory followed by Kemp and Vogelsang-Eastwood, but rejected by Barber (1991, 88-9).

others come from other areas, such as rooms thought to be bedrooms or other lateral rooms. It seems that the front rooms of houses often hosted a variety of home-based activities, particularly textile creation, as many spinning and weaving tools come from these spaces. The identification of these stone blocks as loom supports is still doubted by some scholars, despite the fortunate *in situ* recovery of many such sets, alongside the wealth of information that Amarna provides.

Currently, it is not possible to reconstruct any evidence of weaving cards from ancient Egypt during the historical phases here examined. The only potential 'weaving card' of the Pharaonic age comes from Tell el-Amarna and it is really too large and thick to be considered as one of these tools (Kemp, Vogelsang-Eastwood 2001, 391). Furthermore, no textiles produced by the weaving card method seem to have survived from ancient Egypt, making the use of this tool highly uncertain before the Coptic period.

### 3.2.4 Needles

Despite the fact that tailoring and embroidery were not practiced at high levels in ancient Egypt, good quality needles made of different materials are commonly attested in the archaeological record. Copper needles were known since the Predynastic period, with certain examples coming from a burial context at Naqada (Petrie 1917, 53, 66-9, pl. LXV). Certain of these are pointed at both ends, which is a feature that did change over time. 18 copper needles have been recovered from the Worker's Village at Giza, which dates to the 4th Dynasty; they prove that darning and fabric finishing were widely practiced at this site.

Copper and bone netting needles are attested at Kahun but bronze sewing needles are also present, varying in size from 10 to 15 cm (Petrie 1917, 53).[22] Wooden bodkins are also known, which have larger holes than needles and were used to insert ribbons or tapes (Petrie 1890, 28, pl. IX: 27). A bone needle case was also found at this site, which still contained a copper needle and a wooden pin or bodkin.[23] The needle case was wrapped in reeds and fabric and the copper needle still had the linen thread inserted through its eye. Two wooden netting needles were also found at Kahun, one of which (UC28273) still had the thread wound around it. It is however, probably an artifact of later date, perhaps from the Coptic or Islamic eras (Cartwright 1999, 101).

**22** 31 examples of needles in total from Kahun.

**23** Manchester Museum 97; Griffith 1910, 18; Allgrove McDowell 1986, 221; Petrie 1917, 53, pl. LXV.

The site of Gurob brought forth 10 complete bronze needles (as well as 56 needle fragments) and two bodkins, one made of bone and one made of wood (Petrie 1890, 34; 1917, 53, nos. 81-4, pl. LXV). There is also a netting needle (UC 7806)[24] and several wooden bodkins attested from Gurob, however, these are not associated with any datable material (Petrie 1917, 53, nos. 118-22, pl. XLVI). Bone spatulae are sometimes confused with netting needles, but these will be discussed in the section dedicated to them below.

A very large number of objects that should probably be identified as needles come from the Amarna excavations of the ’20s and ’30s. A total of 80 such objects have been reported, with lengths ranging from 4.8 cm to 12.3 cm, but most measure between 8.5 and 11.8 mm. Another 31 bronze needles were analysed by Kemp, who showed that they were different types of tools (Kemp, Vogelsang-Eastwood 2001, 182-3). Only a few examples of these needles are complete and have the eye preserved. One of them has the square top and a small eye, while the others have a flat top that allows for a larger eye. All intact needles are circular in section, which suggests that those with a square section may have been other tools, such as borers (180).[25] Amarna also brought forth a wooden netting needle, cylindrical in shape with two deep carvings that run the length of its shaft, with sharp ends. According to the authors (183) this example is too short to have been used for weaving; therefore, they agree with its identification as a netting needle, while not excluding that such tools in larger sizes may have been fixed to the edges of wooden bars and used as weaving bobbins.

Three large metal needles or bodkins, their ‘eyes’ created by folding over the metal, come from Kôm Rabi’a (Giddy 1999, 178, pl. 38). Six smaller needles were preserved (two of these could be considered bodkins) as well as twelve fragmentary objects that cannot be identified with certainty as needles or pins. These are all made of copper alloy, now highly corroded. Fishing hooks are also attested from this site, giving evidence that both industries, textile production and fishing, were present at this site, as will be discussed later.

### 3.2.5 Bone Spatulae and Other Tools

The spatulae discussed in this section are flat bone objects with a pointed end and a polished surface. Some wooden spatulae of similar shape (and perhaps function) have also survived, as three examples kept at the Neues Museum of Berlin show (Kemp, Vogelsang-Eastwood 2001, 358). Bone

**24** Petrie 1890, 34; 1917, 53 with examples from Kahun and Gurob. See also Quirke 2003.

**25** For example, borers for leather-working.

spatulae are generally recognized as textile production tools, such as pin-beaters for example, but other interpretations such as netting needles or cosmetic tools have been suggested. Almost all spatulae come from domestic contexts that can be dated to the New Kingdom, but the first examples are attested from the Predynastic Period (Petrie, Quibell 1896, 54). The continuity of their manufacture is proven by the publication of some examples from the Worker's Village of Giza, which consist of bone spatulae with rounded or flat edges as well as some pointed tools with traces of wear that should perhaps be categorized as pin-beaters (Tavares 2004, 10).

Thomas defines the Gurob spatulae as "netting needles" (Thomas 1981, 41-3, nos. 123-65, pl. 7),[26] but for the sake of consistency with other similar materials coming from other contexts they will be discussed here. These are 43 bone spatulae (only some of them are illustrated in the site report), in many cases they show wear traces at their pointed end due to the threads moving over them. The shapes are quite varied, but several examples of each type are attested, usually with one sharp end and the other left wide, but rounded. None of these objects has been pierced through. One example from Gurob is made of wood (UC 7713) and it is highly polished.

Twenty bone spatulae of different shapes (although usually flat with one pointed end and the other rounded) come from Kôm Rabi'a (Giddy 1999, 162-3, pls. 35, 87). Their profile can be straight, but it is usually rounded, and often the shape depends on the bone from which it is obtained. In the report, they are called spatulae for weaving or net production. The size varies from 6 to 16 cm in length. Most of the examples from Kôm Rabi'a come from layers attributable to the second half of the 18th Dynasty and the early Ramesside period. A single spatula comes from the previous New Kingdom level, but its particular context contains intrusive materials from later periods (Giddy 1999, 163). The wear and signs of smoothing on the surface of these bone spatulae are highly compatible with the production of woven textiles such as nets or fabric. Signs of wear are located along both the edges and along the narrower part of the spatula, near the rounded end.

Bone spatulae from Amarna are understood by Vogelsang-Eastwood (Kemp, Vogelsang-Eastwood 2001, 358) rather as 'pin-beaters', a category of sharp objects that served to fix small knots or weaving errors. It can be difficult to ascertain for certain which objects were indeed used as pin-beaters, because theoretically any sharply-tipped object would have been usable as such. It is therefore possible that bone spatulae associated with textile (or net) remains or production contexts were used as pin-beaters. A total of 156 objects were catalogued as matching this description, many of which are unfortunately broken. In most cases, they were taken from

26 As well as Petrie (1917, 53, nos. 128-9).

the ribs of animals, which gave them a curved appearance with the inner trabecular structure visible. Most of the intact samples measure between 6.5 and 13.1 cm in length, (the smallest example is 4.8 cm long and the longest example is 18.2 cm) and are highly polished (Kemp, Vogelsang-Eastwood 2001, 368).

The Amarna spatulae/pin-beaters also have a long, flat shape with one sharp end and a flat or rounded end; in one case, an object is attested bearing a tip on both sides. Some have an end which protrudes in a way remarkably similar to a pen-nib. All of the Amarna objects show remarkable signs of wear both on the end which bears the tip, along their sides, and sometimes also on the flat surface; the direction of these wear marks however, is anything but uniform. Using a Scanning Electron Microscope for a deeper analysis of wear signs and superficial smoothing revealed the wear marks to be really deep and thin, more compatible with extended contact with a soft surface than with a one-time effort to smooth the surface (Kemp, Vogelsang-Eastwood 2001, 370). According to Vogelsang-Eastwood the Amarna bone spatulae cannot be considered as netting needles as they are not pierced and are not able to manipulate thread in order to weave nets (Kemp, Vogelsang-Eastwood 2001, 372).

Bone spatulae are known from many other sites. Bone objects with one sharp end, as well as a few other bone implements which were likely related to the weaving process come from Matmar (Brunton 1948, 71, pl. LII). Some beautiful examples of bone spatulae with rounded edges and thin, concave profiles were also found at Buhen (Emery 1979, pl. 42).

### 3.2.6 Net Weights and Loom Weights

As seen in the previous chapter, loom weights were used to keep the warp in tension on a particular kind of warp-weighted loom, which has never been represented in Egypt and whose absence is supposed until the Ptolemaic Period. The horizontal ground loom and the vertical two-beam loom are, however, very well attested in Egypt. If we did not have access to the iconographic documentation for Egypt, which we do have, would the situation be the same? Would have we interpreted the archaeological evidence for textile work in the same way as it has been up to now or would there have been some differences?

The problem, as it relates to the warp-weighted loom, is that we require confirmation of its existence through material certainly attributable to it, preferably without any possible ambiguities. It would seem that in Egypt, such a loom has never existed, however, the large amount of evidence for the warp-weighted loom across the Near East and the Aegean makes us anything but certain. One of the great ambiguities relates to the fact that a stone or terracotta weight may have functioned as a counterweight and

not as a loom weight. Furthermore, even when groups of weights are found together, which is one of the most convincing contexts for recognising the presence of a loom, one could argue that these weights were originally attached to a net. It is still not possible to assert with certainty that the warp-weighted loom was actually in use in Pharaonic Egypt, but excluding any prejudice, the Egyptian evidence does include many weights similar to those found at Levantine sites. Perhaps it is best to say that nothing prevents these objects from having been used as both net weights and loom weights.

Mace (1922, 75) highlighted this issue early on, supporting the idea that loom weights were not at all rare objects in Egypt, and he actually identified dozens of weights, manufactured in clay or stone, at the site of Lisht. The shapes of the Lisht weights easily recall the classic Levantine forms, with conical, bell and discoidal shapes. One weight made of unbaked clay comes from Kahun, and Hall noted that it come from one house with other 'Aegean' materials, and related its presence to that of foreign people (Mace 1922, 75). The site of Kahun, however, has also preserved many nets and – as the written documents indicate that fishing was a major activity at the site – these weights may relate to the fishing industry instead (Cartwright 1999, 100).

Various weights of two types come from Matmar. The first consists of a long cylinder with some incisions towards the ends, the second one is flat with a rounded profile and two through-holes placed towards the upper part. From the photos in the site report, it is also possible to recognise a bell-shaped weight with a horizontal hole passing through it. Most of these weights are made of terracotta, one is made of limestone and five are of unbaked clay (Brunton 1948, 71, pl. LII).

Three types of weights have been recognised at Elephantine. The first one is a baked-clay weight of semi-circular shape: this weight has in fact been flattened; one side remains rounded while the other is straight. It has two holes passing through the flat end, on which there is also an incision useful for fixing to a net. Of this type, 54 examples have been found, with median dimensions of 6.7 × 4.8 × 2.4 cm and a mean weight of 67.4 g (the lightest is 15 g, the heaviest 293 g) (Von Pilgrim 1996, 275, fig. 120). The second type of weight takes a bell-shape and is pierced on the thinner end. In this case as well there is an incision on the upper rim.[27] Eight examples of this second type have been found, 6 of which come from a single context, and they weigh 94.6 g on average (with a min. of 41 g and a max. of 125 g). The third type is represented by cylindrical stone weights with one central incision or two lateral incisions parallel to the base of the cylinder. A single example of this type is attested at Elephantine (Von

27 The discoidal Aegean-type weights also have an upper incision, the function of which has been discussed for a long time. If the incision was only useful to attach fishing nets (it is not useful in the case of a loom), should it be necessary to call into question the use of this Aegean type of weights as well?

Pilgrim 1996, 276, fig. 121). The last identified type shows a rather different morphology (conical or flat) and is characterised by the fact that it can be made from reused ceramic fragments, even those of large dimensions. Although this type varies in shape, almost all examples show some incisions useful for fixing a net (Von Pilgrim 1996, 278, fig. 121). Fishing activity is well-documented at Elephantine, but weaving activity, however, is not. One building (H84) in particular has returned various net weights and other tools related to fishing activity.

From Kôm Rabi'a come 27 weights made of stone and copper alloy and 23 pierced and reused pottery fragments. These re-used sherds have been identified as counterweights by certain scholars, but are discussed in this work as spindle-whorls (Giddy 1999, 193). Most of them are rather rough, especially the pear-shaped horizontally-pierced weights. This category is difficult to recognise as net weights, as they could have been used for many other purposes. Approximately half of the weights are pierced, made of limestone and pear-shaped (Giddy 1999, 195-7, pls. 39-41, 88). Another limestone weight of semi-circular shape with two holes has been identified as net weight. The other weights present at Kôm Rabi'a are considered as weights used in order to weigh goods. The pear-shaped weights are all of Late period. The presence of a spinning bowl and ceramic fragments reused as spindle whorls makes clear that textile production was practiced in this site, but this does not prove that the warp-weighted loom was in use.

From the fortress of Buhen come various objects identifiable as weights. The site has a wide selection of the objects of daily life, generally coming from superficial layers and not from stratified contexts (Emery et al. 1979, 113). The author of the site report interprets these objects as net weights, construction tools (i.e. plumb bobs), or even as weapons. He excludes their usage as loom weights following the idea that the staff of the fortress may have received fabrics and garments as commission.[28] The horizontal pierced weights (Emery et al. 1979, 113, pl. 40) are of limestone and are bell-shaped or conical; there is also one bell-shaped weight in clay. There are some unpierced pear-shaped weights with horizontal incisions in their upper parts; these are made of clay, mud and limestone.[29] More widespread was the production of a series of objects of various shapes: pear-shaped, ovoid, or trapeze-shaped with deep incisions across their surfaces (Emery 1979, 114-15, pls. 40-41); these are made of sandstone, limestone or baked clay and can probably be recognised as net weights.

**28** However, the Deir el-Medina example, discussed in the following chapter, indicates that spinning and weaving activities might be performed also in sites where deliveries of textiles are attested.

**29** Two examples of these show excessive dimensions, and are more than 35 cm in length.

Other weights from Buhen, particularly those in unbaked clay, were surely not used for fishing and could have been used as loom weights. No spindles or spindle whorls come from the fortress, however, numerous pierced discs made of clay and terracotta do, some of which were made from reused ceramic fragments and could have been used as spindle whorls (Emery 1979, 109-11, pl. 39). Furthermore, purpose-made ceramic spools (similar to the Levantine spools) and some bone spatulae are attested at the fortress (Emery 1979, pl. 42). These objects, however, are of difficult interpretation and their usage in textile contexts is uncertain, therefore it is not possible to confirm that textile production occurred at the site of Buhen.

At Amarna, a few similar weights have emerged. Two of the weights are naturally perforated pebbles with some thread still wrapped around them, but it is difficult to determine whether these were weights or counterweights. Two other types of weights, one made of clay formed into a cylinder and perforated, the other made of limestone or sandstone with engraved lines crossing the surface, seem difficult to relate to looms due to their quite low weights (Kemp, Vogelsang-Eastwood 2001, 394). The suggestion of Vogelsang-Eastwood, that some weights could have been used with the two-beam vertical loom in order to vary the tension of the free warp threads, remains interesting. Johl (1924, 49, figs. 33, 57) has reported the use of a couple of weights along with the warp-spacer, in his model of vertical two-beam loom, but weights could also be used to control the tension of the warp beam (Kemp, Vogelsang-Eastwood 2001, 393).

A recent article by Jarmuzek (2010, 17-21) returned to this topic by publishing some weights found at the site of Tell el Retaba in the Wadi Tumilat, which date to the 21st-22nd Dynasties. Sixteen weights were reported, of different shapes, sizes and materials; these are divided into 5 types.[30] The first 4 types are composed of limestone and identified by the author as net weights; only the last type, consisting of two weights of unbaked clay (which could not have been used in water), is considered loom weights. Type 4, or pyramidal weights (Jarmuzek 2010, 20) are identified as loom weights in other areas of the Middle East, but iconographic evidence from Egypt, for example, a model from the tomb of Meket-Ra, shows similar weights being used in connection with fishing nets.

Another type of weight (Type 3) as defined by Jarmuzek (2010, 20) takes a cylindrical shape and corresponds exactly with a weight kept at the Manchester Museum to which part of a net is still attached. Many weights with an upper incision (Type 2) were found in one place at Tell el Retaba, along with a donut-shaped clay weight (Type 5) (Jarmuzek 2010, 18); such weights are attested across the Near East, especially in the prehistoric

30 These weights vary from 35 g to 450 g, but the weight is not provided for all objects.

periods and are not typically associated with the warp-weighted loom. In this case the author considers them as net weights, but their association with a clay weight raises some questions. Is it possible that the weights from Tell el Retaba were part of a single batch and they were actually being used on a loom? It could be that most were net-weights and that the presence of a clay weight is a coincidence. A similar batch of weights in an archaeological context outside Egypt would have been interpreted as a certain proof that textile activities were performed with the aid of a warp-weighted loom. That should always remind us to be very cautious when interpreting the evidence given by such tools, which could have been used for different purposes.

At the current moment, many questions cannot be answered definitively, but a deeper study of the textile-related finds from Egypt might be able to better highlight contexts, associations, distribution, quantities and other elements that indicate the presence (or clarify the absence) of the warp-weighted loom in Egypt. A thorough study of the styles and functional types of net-weights is desirable; to clarify exactly which aspects of their design made them more functional for fishing than for weaving, although it seems possible that certain types of weights could have been used for both activities. Even if the evidence is rather scant, perhaps due to choices made during publication, it is possible that the Egyptians knew of and used the warp-weighted loom in a minor way.

## 3.3 Iconographic Evidence

One advantage of studying the textile production of Ancient Egypt is the preservation of paintings and funerary models that reproduce almost all stages of textile production, from flax harvesting to actual weaving. Despite the schematic methods of representation and artistic conventions, these objects represent a unique and invaluable source of information. The first depiction of a loom appears in the Neolithic on a bowl discovered in a tomb at el-Badari in Middle Egypt. The loom is located at the bottom of the bowl and it seems to be horizontal, with part of the fabric or mat already produced and horizontal bars that could be interpreted as heddles. On the side of the bowl, vertical poles and two standing figures are represented, usually interpreted as figures preparing the warp for the loom (Cortes 2011, 94). The earliest representations of flax harvest began to appear from the Old Kingdom onwards and remained common throughout the Middle and New Kingdoms.[31] During the Middle Kingdom, painted scenes of fibre preparation, spinning and weaving occur on tombs' walls, as well

31 For a wider examination of flax harvest scenes and their social value see Tata (1986, 55-96).

as wooden models, for which a comprehensive bibliography is available: therefore these will be here only briefly described.[32]

### 3.3.1 Middle Kingdom Tomb Paintings

- Tomb of Khety from Beni Hasan, 11th Dynasty: various spinning activities, nets and fabric preparation are represented. Starting from the top, in the second register, six male figures appear, of which three are spinning, each one in a different way. The figure on the left is standing and spins from a ball of yarn on the floor, holding the fibres with his left hand. The figure in the middle is sitting and spins using a bowl, also holding the fibres in his left hand. The third figure sits and spins from a bowl, but this time the thread is suspended on a vertical rod with forked edge. The fourth figure on the right is probably weaving a net, helped by a fifth figure placed in front of him. Behind them, a man weaves a mat. In the inferior register, starting from the left side, there are figures engaged in an unclear activity, but it is likely, that they are preparing the fibres as in the tomb of Daga. The first figure on the left is a woman, crouched down, supplying a bowl with yarn; three spinners stand beside her, one man and two women, each with a couple of spindles and two yarns emerging from a bowl placed on the floor. On the right, three women are probably working on a horizontal loom, which is not preserved but can be speculated on the basis of the similarity with other groups of four women who work on horizontal looms (Newberry, Fraser 1893b, pl. XIII).
- Tomb of Baqt from Beni Hasan, 11th Dynasty: contains a representation similar to that on the tomb of Khety at the same site. Three spinners who use the same techniques seen previously are depicted, as well as a fourth man weaving a net. On the other side of the tomb, two men are preparing balls of yarn. In the inferior register (better preserved than in the tomb of Khety) there is a woman passing fibres between two wooden rods and three figures that seem to be splicing using a trapeze-shaped support or their thighs. Next to these women, a child and two women are spinning, each one with two spindles and a thread, which runs through two bowls on the floor in front of them. Other three women are visible working on a horizontal loom on which some bands are painted. The last four women work on a unique large and smooth loom with a pointed end end (Newberry 1893b, pl. IV).
- Tomb of Khnumhotep (tomb no. 2) from Beni Hasan, 12th Dynasty: in the penultimate register is shown a spinner with a spindle and two

32 Tata 1986; Barber 1991; Vogelsang-Eastwood 2001.

threads coming out from two different bowls placed in front of him; he was once probably helped by a woman crouched down. Other two women, crouched down, work on a horizontal loom (Newberry 1893b, pl. XI).

- Tomb of Djehutyhotep from el-Bersheh, 12th Dynasty: various stages of fibre preparation, spinning and weaving are here represented. In the register on the left, two crouched female figures are engaged in producing thread from which the large ball of yarn opposite them was composed. One of them seems to carry the thread to her mouth and this can be interpreted as an attestation of using saliva to aid in the splicing. In front of each of these figures is placed a bowl from which a thread comes out and is spun by two nearby spinners, one of which stands on a platform. The figures on the right could also be engaged in preparing fibres for spinning, as once again a figure is crouched down in front of a bowl with a spinner standing behind. A woman comes after this and is engaged in stretching out the threads on a three-poled warper fixed to the wall. The last figure, unfortunately incomplete, is crouched down towards an indefinable structure. In the inferior register, on the left, two crouched figures are engaged in pulling threads out from what it seems a case containing various organised balls of yarn. On the right two figures are transferring the warp from the warper fixed on the wall (Newberry 1894, 34-8, pls. XXIV, XXVI).
- Tomb of Daga from Thebes, 11th Dynasty: the painting is in bad condition, but it shows the entire process of fibre production. The description goes from left to right and from the bottom to the top. Down on the left a crouched female figure is passing the fibres through a small rod, likely to remove the residual bark, while on the right another crouched female figure seems to be splicing on her thigh. A third figure is manipulating fibres with her arms stretched in front of her, perhaps using a different system of splicing, while a fourth provides the right quantity of fibre to the bowl for spinning. The spinner on the right is represented with two spindles; the first spindle is rolled on her thigh, while the second one is held in her left hand. The thread comes out from a spinning bowl that is placed behind the spinner. On the upper register appears a warper made of two sets of vertical poles with a standing figure working on it. On the right, a horizontal loom is represented, with two crouched women weaving on it (Davies 1913, 34-5, pl. XXXVII).
- Tomb of Sarenput I from Elephantine, 12th Dynasty: on the left, a crouching female figure prepares the yarn, probably by splicing. Next to her, two spinners appear, unfortunately now incomplete, each one engaged in spinning from two bowls, from which a thread comes out. In the lower register, two women are working on a large horizontal loom (Müller 1940, 47-8, fig. 24).

### 3.3.2 Middle Kingdom Funerary Models

- Meket-Ra (H) from Thebes, 11th Dynasty: a painted and intact funerary model of a spinning and weaving workshop of the Middle Kingdom. Within the workshop, eleven female figures performing all activities related to weaving are represented. Three women appear crouched down on the floor while preparing, on semi-domed supports, the thread for the spinners.[33] The spinners, again three, each have two spindles and pull the thread from bowls, closed on the top except for a hole to let the thread pass through. Once the spindles are full they are given to the two women who prepare the warp on three poles fixed to the wall. In the workshop, there are two horizontal looms, a larger one on which two women work and a smaller one used by a single woman (Winlock 1955, 29-33, pls. 26, 27, 66, 67).
- Gemniemhet from Saqqara, 11th Dynasty: eleven workers are engaged in this model. Two crouched women prepare rough fibres for three women standing and spinning, very similar to those of Meket-Ra's model. Two other women are placed at the opposite angle and are engaged in preparing and spinning fibres. The two horizontal looms are placed to the two extremities of the room, each one used by two women (Firth, Battiscombe 1926, 53, pl. 31c).
- Model from Girgeh, 12th Dynasty: much smaller than the previous model, it shows a woman preparing the warp on two pairs of vertical poles. The model is rather fragmentary and shows four other female figures and two bowls. This artefact has been subject to restorative measures, which have restored part of the original layout but have also compromised its interpretation (Vogelsang-Eastwood 2000, 319-22).
- Usernekhbet from Saqqara, 11th Dynasty: the model shows five female figures. When it was discovered, the weaving tools were scattered across the workshop floor. There are, however, two women engaged in the preparation of fibres in front of a bowl, a woman with two spindles assigned to the task of spinning, and two other female figures crouched down around what remains of a horizontal loom (Quibell, Hayter 1927, 42-3, pl. XXVI; Vogelsang-Eastwood 2001, 325).
- No. 575 from Beni Hasan, 11-12th Dynasties: unlike in other models, the building is not represented here, but only the human figures and their tools have been carved. Close to the edge, there is a spinner with two spindles and a spinning bowl at her back. The spinner is modelled larger than the other two weavers behind her, crouched down around a horizontal ground loom (Garstang 1907, 132-3; Tata 1986, 136-8).

**33** According to the interpretation of Kemp and Vogelsang-Eastwood (Kemp, Vogelsang-Eastwood 2001, 72) who see them like fibres to be prepared.

### 3.3.3 New Kingdom Tomb Paintings

- Tomb of Djehutinefer from Thebes, 18th Dynasty: in the upper left two figures are represented; they are scutching the fibres by making them pass through two wooden rods. Lower, two other figures are preparing a bowl of yarn. The larger figure in the middle is engaged in spinning from two spindles hung from two rings, with the threads coming out of a bowl. On the right two vertical two-beam looms are represented. Beside the first one on the left, which is larger than the other, two male figures are sitting and weaving from the bottom to the top, while at the other loom on the right, only one male figure works (Davies 1929, fig. 1a)
- Tomb of Neferhotep from Thebes, 18th Dynasty: from the tomb of Neferhotep, unfortunately badly preserved, there are two vertical two-beam looms on which two male figures (one on each loom) are working. The looms are rather similar to those of the tomb of Djehutinefer, except for the loom supports, which seem to be on fixed platforms, while in the previous one were made of truncated conical elements (Davies 1933, 1: 38, pls. XLIX, LX).
- Tomb of Neferrenpet from Thebes, 19th Dynasty: from this tomb comes the representation of two vertical V warpers with two standing figures working on each. Furthermore, four aligned vertical two-beam looms are represented. On three of these one worker is engaged, while on the other one two workers are engaged. Four of these are men, while one is a woman (Davies 1948, 49-51, pl. LI).
- The last spinning scene is represented on a limestone ostracon from Deir el-Medina, where there are two spindles suspended by rings and two hands engaged in twisting the spindle. The threads seem to come out of a bowl situated in front of the spinner (Vandier d'Abbadie 1937, 93/94/EEC LXIV).

# 4 Textile Tools at the Museo Egizio in Turin

**Summary** 4.1 Origins and Chronology of the Collection. – 4.2 Hanks of Flax and Balls of Yarn. – 4.3 Spindles. – 4.4 Spindle Whorls. – 4.5 Spinning Bowls. – 4.6 Needles. – 4.7 Spatulae and Other Tools. – 4.8 Parts of Loom. – 4.9 Weights.

## 4.1 Origins and Chronology of the Collection

The so-called 'Mensa Isiaca' – a bronze altar panel decorated in silver, copper and niello – is the first Egyptian, or better, Egyptianizing, piece of great interest that came to Turin around 1626 as part of the Savoia Collection. In 1723, Vittorio Amedeo II donated his private collection to the University of Turin. In 1759, Carlo Emanuele III commissioned Vitaliano Donati to travel to Egypt and the Levant in order to collect antiquities, curiosities and other rare items as well as local plants for the creation of a botanical garden and a Museum of Natural Sciences. Furthermore, Donati was bade to collect any object that could be used to study the 'Mensa Isiaca', which was later discovered to be a creation of the first century AD, probably made in Rome.

In Turin in 1832, three large statues and three hundred smaller objects were added to the original collection. The official birth of the museum dates to 23rd January 1824 with the purchase of the Egyptian artefacts collected by Bernardino Drovetti (Donadoni Roveri 1987, 10). These were stored at the Academy of Sciences where they were partially catalogued, the collection then totalling 5,268 pieces. Drovetti's collection was not the result of excavation work, but of randomly selecting the best-preserved objects one could find. Most of the artefacts date to the New Kingdom or to the following periods, and any secure indication of their origins is completely missing. During the following years, the collection in Turin increased with new objects donated by private citizens and by some exchanges with the civic museum.

In 1894 the Kircher Collection was donated to the museum. In this year, Ernesto Schiaparelli became the director of the museum. Wishing to enrich the collection, he first decided to buy some pieces and then, from 1903 onwards, he commissioned several excavations in Heliopolis, Giza, Bahnasa, Ashmunein, Assiut, Hammamia, Qau el-Kebir, Valley of the Queens, Deir

el-Medina, Gebelein and Aswan (Moiso 2015, 29). After Schiaparelli, the excavations at Gebelein were carried out by Giulio Farina (his work at the Prehistoric necropolis is especially notable) and by Carlo Anti at Tebtynis (Moiso 2015, 34). Aside from excavations, the museum kept increasing its collection due to donations and purchases.

The museum inventory allows easy identification of which collection individual objects belong to: the acronym 'Cat.' relates to Drovetti's collection (and a few objects acquired before the publication of the catalogue of Fabretti et al.), mainly composed of objects whose origins and dates are unknown. 'S.' (Supplement) relates to the Schiaparelli Manuscript Inventory, in which all the objects he found are recorded. A group of objects is also present, whose individual origins are unknown, as it is not possible to connect them to any one of the previous collections; for this reason these objects have been labelled 'Provv.' (Provisional).

The materials related to textile production kept in the Museo Egizio are numerous and well preserved and allow us to acquire much information from them. There are, however, some limitations on our knowledge due to the way the collections were assembled, during a historical moment where excavation methodology and its data collection practices were only beginning. The first and most important issue is that all the objects of this study are missing any precise indication of their origin. We actually know that most of these objects were recovered by Schiaparelli during the Deir el-Medina excavations conducted between 1905 and 1909,[1] but the only information present given in the Manuscript Inventory is "one spindle case".[2]

Some more information, however, can be found in the Manuscript Inventory left by Schiaparelli wherein he recorded that the origin of the spindle case was the kôm, a kind of rubbish and debris hill at the outskirts of the village where Schiaparelli worked in 1906 (Del Vesco, Poole, forthcoming). The only spindles that came from nearby (ancient) houses are the ones from batch S. 9978, found by Schiaparelli in 1909, that is when he continued the excavation of the village. This distribution of finds is confirmed by the reports and diaries of Bruyère's excavation of the same site; he recovered most of the objects related to textile production from a large well, and only in lesser quantities from within the village. It is worth not-

1 The discovery of the Deir el-Medina village and the first excavations there from 1905 to 1909 were carried out by the Italian Ernesto Schiaparelli, while the definitive excavations from 1922 to 1951 were carried out by the French expedition directed by Bernard Bruyère, assisted by the Czechoslovakian Egyptologist Jaroslav Cerny.

2 In Schiaparelli's Manuscript Inventory related to the Deir-el Medina excavations, the number 07526 corresponds to a case of spindles with fragmentary rods, number 07527 to a spindle case with incised marks and the number 07528 to a spindle case with no marks and with small whorls. In the 1909 Inventory, number 9978 corresponds to nine fragmentary spindles.

ing that spinning bowls are totally missing from Schiaparelli's excavation finds from Deir-el Medina while various examples were found in Bruyère's excavations.

A second constraint on our knowledge is the lack of certifiable dates. The Deir el-Medina Worker's Village was built during the New Kingdom under Pharaohs Amenhotep I or Thutmose I, the same period in which the Kings Valley and the Queens Valley began to be used. The village was exploited throughout the New Kingdom until it was abandoned during the 20th Dynasty and once again inhabited during the Ptolemaic age, when Ptolemy IV built a temple there. During the Coptic Period a monastery took root in the disused temple of Hathor. Therefore, it could have been possible that most of the materials surveyed in this catalogue belong to the New Kingdom or to the Ptolemaic Period or even to a later period. It has been suggested that most of this material could belong to the New Kingdom due to its similarity with the materials coming from Amarna, although the persistence of the same artefact types through the centuries does not itself allow for the creation of a reliable typological series. For this reason it has been decided to sample three objects, spindles and spindle whorls, coming from different seasons of Schiaparelli excavations at Deir el-Medina, in order to arrive at a more certain date for these objects, in relation to the material discussed in this monograph. The results of this study date the samples to between the New Kingdom and the beginning of the Third Intermediate Period (give numerical dates c. 1400-1150 BC as well) confirming the initial theory.

| Sample numbers | Calibrated results (2σ confidence level) |
|---|---|
| S7528/20 | 1195BC (9.0%) 1141BC<br>1133BC (86.4%) 920BC |
| S7528/33 | 1389BC (9.8%) 1337BC<br>1320BC (85.6%) 1071BC |
| S9978/5 | 1452BC (93.5%) 1256BC<br>1249BC (1.9%) 1231BC |

## 4.2 Hanks of Flax and Balls of Yarn

The storage rooms of the Museo Egizio houses many hanks of flax and many yarn samples, including rough fibres wrapped in bundles and some already-spun threads, which makes it possible to examine all the different preparation stages of thread. The first hank (no. 263) is a bundle of flax fibres, not yet retted, which means not ready for spinning but already with the seed-case removed. Fibres appear woody and hard because the outer bark is still present. It is not certain that these fibres would have been used for spinning and weaving: they could also have been used for

the production of basketry and matting. The second hank (no. 264) is from a more advanced stage of production. It consists of a set of flax fibres wrapped around and tied back on itself. These fibres have already been scutched and retted, although it is possible to find small bark fragments, rather thin and brown-gold coloured. There are balls of yarn already spun, and in some cases it has been possible to recognise traces of splicing in these; it is likely, however, that all the threads under examination were produced with this technique. It can also be noticed that, in many cases, the balls of yarn preserved are not made of only one thread but of several different threads. These hanks were probably not freshly produced but partially re-used for many different activities.

In most of these cases the thread, single or plied, is s-twisted, but in one hank a thick thread has been found, maybe not originally belonging to that hank, which shows a close z-twist that tends to coil in on itself. The threads range in diameter from 0.03 cm at their thinnest and 0.11 cm for the thickest (the z-wist thread just described). The twist angle, when preserved, has an average of 45°. A similar situation can be found for the balls of yarn, which are all well preserved, but of very different and varied constitution. First, it must be noticed that there is only one real ball of yarn (no. 269) according to our modern standard, and it is still perfectly preserved. It is not possible to distinguish the material over which it was wrapped because of the great amount of thread. The thread is strictly z-twisted and splicing is evident. Some big knots are also present at the end of the thread, as well as some other knots inside the ball of yarn. The thread diameter is about 0.04 cm and its twist between 35° and 40°. It is highly uniform and homogeneous and it might be considered as a final product, even if it was only a medium quality thread, certainly not used for weaving fine clothes. The z-twist might indicate that it would not have been used for weaving, but more probably for sewing, darning other textiles, or producing nets.

An interesting ball of yarn (no. 270) is a small object with a tow core on which a small number of different threads have been wrapped. The threads are all s-twisted and the ply is rather evident (S, 2s[3]). Some threads have a very close twist, but in others it is difficult to see it at all, probably because of the state of preservation. The other balls of yarn in the Museum's collection present similar situations, with different threads wrapped around an object and seem to be, unlike the first two yarn balls discussed, a kind of makeshift solution, but one that nevertheless is frequently used. The threads are, as a matter of fact, wrapped around a ceramic rim fragment (no. 272), under which some rough fibres are positioned to avoid the thread becoming ruined by rubbing against the core, or around some stones (no. 271, no. 273). In all of these last three cases, the thread is z-

**3** Two S-twisted yarns plied in s-direction.

twisted, with two or four cables: in one case it is possible to distinguish the z-ply and an s-twist and in at least another one case it is possible to distinguish the splicing point.

Lastly, a set of yarns have been wrapped around a circular stone (no. 274), which was likely previously used as a stopper. The threads look different from each other, with two or three plies, with single s-twist yarns and z-ply. Their diameter varies from 0.03 to 0.06 cm with small oscillations inside the same yarn, which can be followed only for small segments. The twist angle is varied and depends on the thread preservation conditions; it is attested between 35° and 40,° but also reaches 50° in this example, which is a very wide twist.

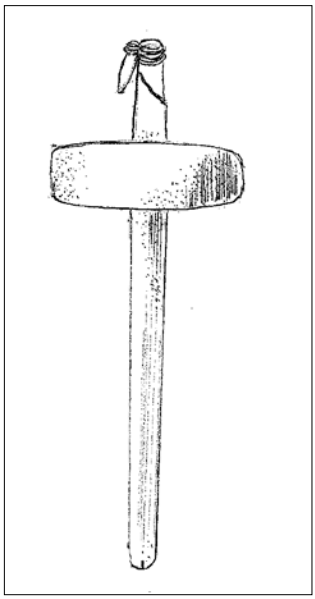
## 4.3 Spindles

The spindles housed in the Museo Egizio are 153 in number, of which 151 still have their spindle whorls attached. They all came from Schiaparelli's excavations at Deir el-Medina and some of them have been sampled for radiocarbon dating and archaeobotanical analysis. The examples preserved intact are very few, only five out of the total (nos. 073, 106, 140, 145, 146) with two nearly intact (nos. 026 and 046). Most of the spindles have one or both ends broken, and there are some spindles of which only one small fragment is preserved inside the spindle whorl hole. These spindles are simple rods, all of them made of wood, of an average length between 20 and 30 cm, but occasionally they reached 40 cm. The average rod diameter is 0.9 cm; many of these objects have diameters ranging between 0.8 and 1 cm.[4] The rod is not strictly cylindrical, but tapers towards the lower end, and certain spindle whorls have hole diameters wider at their tops and smaller at their bottoms to accommodate this (e.g. no. 008 with a upper hole diameter of 0.9 cm and a lower diameter of 0.8 cm). In most cases the rod is wider at its central part and, in these cases, spindle whorls show a reversed ratio between the diameter of their holes at the top and bottom edges (e.g. no. 001 with upper diameter of 0.9 cm and lower hole diameter of 1 cm).

Here are the measurements of the five fully-intact examples of spindles from Deir el-Medina.

- No. 073: l. 22 cm, diam. 1 cm, weight (spindle + spindle whorl) 18 g;
- no. 106: l. 21.1 cm, diam. 1.1 cm, weight (spindle + spindle whorl) 19 g.;
- no. 140: l. 35.8 cm, diam. 1.2 cm, weight (spindle + spindle whorl) 27 g.;

**4** Rare cases are 0.7 cm in diameter and much more rare are those measuring around 0.5 and 1.2 cm.



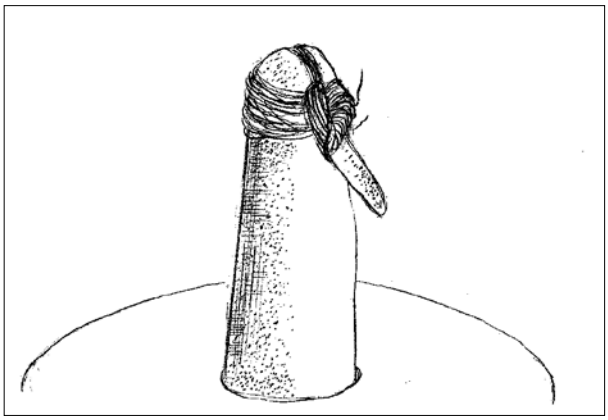


Figure 9. (left) Spindle with a thread attached on the upper part

Figure 10. (up) Thread attached to a spindle through the insertion of a peg

- no. 145: l. 32.4 cm, diam. 1.1, weight (spindle + double spindle whorl) 37 g.;
- no. 146 l. 37.2 cm, diam. 1.1 cm, weight (spindle + double spindle whorl) 31 g.

As shown by this data (which are also confirmed by other semi-intact objects, such as no. 004) two types of spindles must have existed, a very long one which measured between 30 and 40 cm long and a shorter one which measured between 20 and 25 cm long. The weight[5] and the length difference probably signified their use for the spinning of different qualities of thread. As for the spindle whorls relating to these spindles, the amount sampled is too limited to be statistically valid. One can notice, however, that the largest and thickest spindle whorls were associated with the shorter type of spindles, while the longest spindles were related to smaller and thinner spindle whorls. For example, no. 140 has a spindle whorl diameter of 4.6 cm and a thickness of 1.4 cm, which is definitely smaller than the average. In all other cases, the difference is not so evident and it does not seem to be useful to establish a connection between short spindles and big spindle whorls, or long spindles and small spindle whorls.

**5** Examples with double spindle whorls must subtract the weight of the second spindle whorl. Double spindle whorls are thought to have been attached in modern times: there are three wholly intact spindles with double-whorls and four almost-intact examples in this corpus.

The upper tip of the spindle rod can be flat or rounded, and just under the tip starts an incision that helps to fasten the thread. In most cases this incision has a spiral shape which aids the s-twist of the yarn (one of the best examples is on no. 073), but it can also be just a simple deep groove (e.g. no. 096). The other end of the rod is tapered, perhaps to aid in the process of spinning with a suspended spindle. In only one case does the lower part of a spindle get larger and ends with a rounded tip (no. 023).

In all examples preserved with the spindle whorl still attached, the whorl is placed right under the groove, showing that spinning always occurred with the spindle whorl at the top of the spindle, as is supported by the iconographical evidence. Only two examples (nos. 137 and 150) have a spindle whorl in the middle of the rod, and neither of these is of exactly the same type. One group of spindles has spindle whorls placed on the central or lower part of the rods, which are particularly tapered, but as not one of these examples is intact, it is not possible to be certain that this was the original position of the spindle whorls (nos. 002, 003, 007, 008, 009, 013, 023, 075, 137).

Spindles with fibres still present are quite numerous, but it is possible to distinguish individual threads in only some cases, while on others only traces of fibres or their imprints are visible, which do not allow us to recognise their different types of manufacture.[6] When the thread is preserved, some remarks can be made.

- No. 001: at least two different threads preserved, one s-twisted and the other z-twisted;
- no. 026: one thread preserved in the spindle whorl hole; it is s-plied;
- no. 031: the spun yarn is preserved under the spindle whorl wrapped around the spindle shaft, it is splied, while the single twist is not visible. There are also some unspun fibres;
- no. 032: on the upper part of the shaft a thread that attaches a wooden rod is preserved; the threads present are probably plied but this is not certain. It has a final z-twist and its single twist is not visible;
- no. 033: on the upper part of the shaft, under the spindle whorl, a doubled thread with an s-twist is preserved; the single twist is not visible;
- no. 034: the upper edge of the spindle is broken and this was likely also in ancient times because the fibres are wrapped around the broken part; a thread that attaches a wooden rod is preserved. The fibres are characterised by a s-plied yarn but the single twist is not visible. The thread itself is rather encrusted and is partially inserted into the spindle whorl hole;

**6** Spindles bearing traces of threads are: nos. 015, 016, 018, 020, 022, 025, 027, 031, 032, 033, 034, 038, 081, 084, 098, 104, 106, 135, 148, 149.

- no. 038: a couple coils of yarn are preserved under the spindle whorl, but the fibres do not appear to have been twisted or spun;
- no. 098: threads inserted into the spindle whorl hole and preserved on the spindle shaft. The thread appears s-plied;
- no. 135: s-plied threads are attached under the wedge rod which fixes the spindle whorl;
- no. 148: coils of vegetal fibres with no sign of twist or spinning appear in the spindle groove. The knots fixing them to the spindle are clearly visible;
- no. 149: coils of vegetal fibres, hooked with several rotations onto a wooden peg, appear in the groove of the spindle. The fibres on the rod are not twisted, but one part of the thread which is visible has a z-twist.

In most cases, it is difficult to distinguish whether the thread has one or more plied yarns. In some cases, it is clearly evident that the thread is doubled and s-twisted, but in at least two cases a final z-twist can be seen.

## 4.4 Spindle Whorls

Spindle whorls housed at the Museo Egizio are extremely homogenous as to their materials, their shapes and their dimensions. Firstly, all of the spindle whorls in the collection coming from Deir el-Medina are made of wood. This is in contrast to other contexts in Egypt and the Levant, in which ceramic or stone spindle whorls are represented. Unfortunately, it is not possible to ascertain whether this material exclusivity is due to the actual tradition of spinning at Deir el-Medina or to the chance recovery of archaeological materials by the excavators.

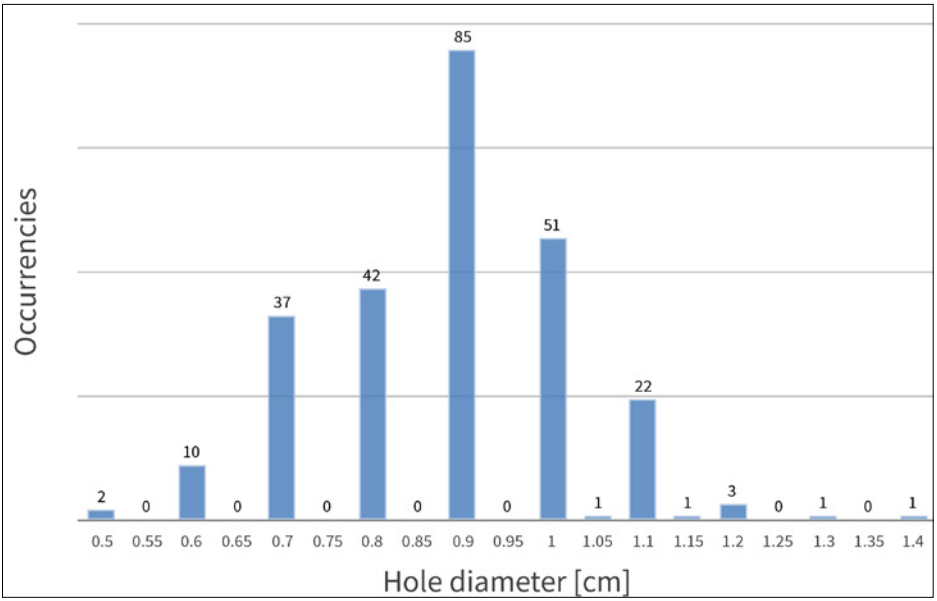
Although wooden spindle whorl production is widely attested at many other Egyptian sites, the use at Deir el-Medina of wood for the tools of daily life instead of the easily available and cheaper clay is striking, especially in a country without an overabundance of wood. This choice could have been guided by technical reasons: spinning vegetal fibres requires large, but not necessarily heavy, spindle whorls.[7] The widespread decision to use wood instead of pottery could have satisfied both of these needs at the same time. The morphology of spindle whorls from this site is also rather homogenous; of the 263 examples held in the Museo Egizio,[8] only three take a truncated conical shape (cat. nos. 148, 149, 258), one a lenticular

7 pers. Com. Andersson Strand.

8 Of those considered in this work of thesis. Ptolemaic and Roman spindle whorls have been excluded; they have a flattened dome shaped.

shape (cat. no. 150) and one is dome-shaped (cat. no. 261). All the others are cylindrical in form. Three of these spindle whorls are without information relating to their origin while all the other spindle whorls here studied, as well as the spindles, come from Deir el-Medina, and were produced during the New Kingdom or at the beginning of the Third Intermediate Period.

The external diameters of these spindle whorls are all rather wide and can vary from a minimum of 3.9 cm to a maximum of 6.1 cm, with the majority between 4.9 cm and 5.6 cm in size.

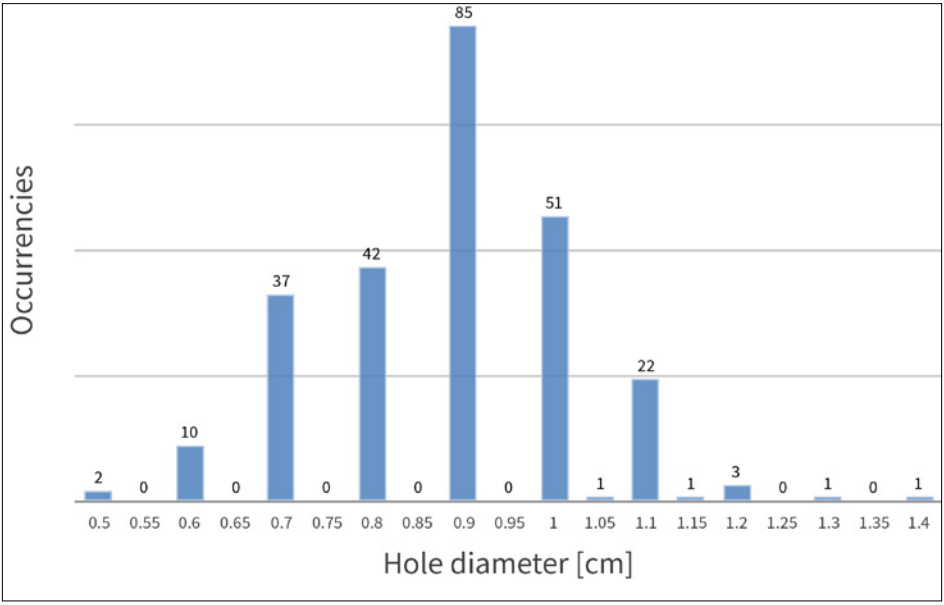



Graph 8. External diameters of spindle whorls

Their hole diameters vary between 0.3 cm and 1.4 cm, with the majority of the diameters ranging between 0.8 and 0.9 cm, as seen in the diagram. As previously noted, some spindle whorls have a slightly conical hole, which allows them to fasten more securely upon the spindle shaft. This expedient does not seem to have been enough to ensure a tight fit; however, as in certain examples vegetable fibres and small pegs have been used as wedges.

On certain spindle whorls some repairs and ancient restoration activities have been executed, as on no. 161, in which a small wooden rod has been inserted to fill a lateral hole. One spindle whorl (no. 228) was never completed and is without a central hole. Its surface has been polished however, and some signs of preparation for the hole are visible.

Some spindle whorls show traces of simple decorations (no. 107), painted or incised, other marks and even hieroglyphic signs are recognisable



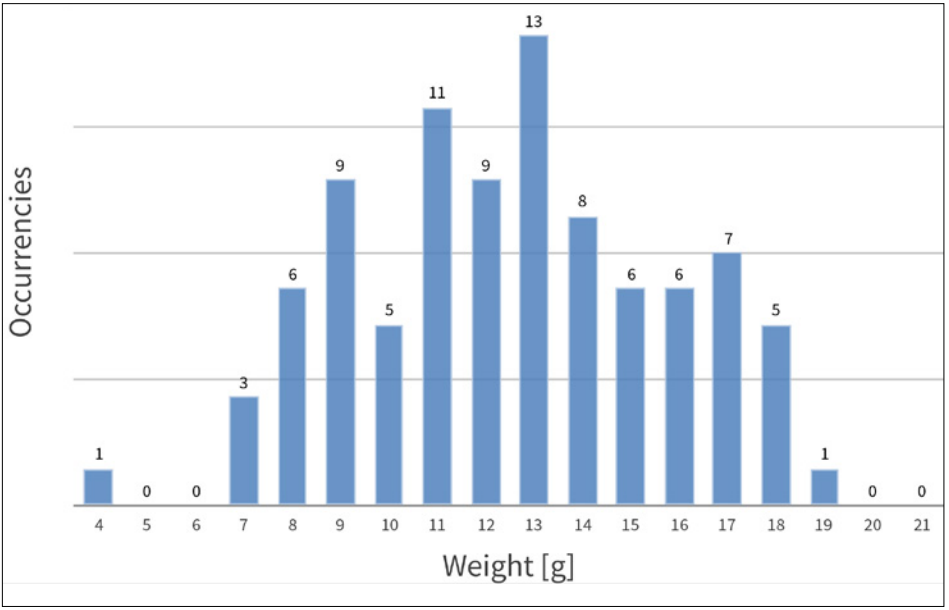

Graph 2. Spindle whorls hole diameters

(e.g. nos. 108, 109, 110). It is generally believed that these signs or marks, incised on several types of Egyptian tools of everyday use (Vogelsang-Eastwood 2000, 285), were connected with the tools' owners or with the workshops of their production, but it is difficult to connect these symbols to precise persons or other categories, especially the abstract and geometric signs (see fig. 10).

The weight of individual spindle whorls must be cautiously considered as the wood is desiccated and likely lighter than it was originally. In this work, only the weight of complete spindle whorls is included, without the spindle shaft, although a weight is provided in the catalogue for all objects. Weights vary between 4g and 19g for intact spindle whorls, with the average range between 11g and 14 g.

The painted decorations consist of simple radial designs and are usually seen on one side or on the edge of the spindle whorl. It is perhaps notable that these decorations, carved or painted, are not placed on the upper side of the spindle whorl, where they would have been visible to the spinner, but are placed on the lower side where the thread is wrapped. Whatever their functions were, it seems that aesthetic value one was not one of the main concerns.

Another interesting element is the existence of a thick layer of encrustation on spindle whorls, which is not present on the other objects coming




Graph 3. Weight of complete spindle whorls without shaft insert in their hole

from Deir el-Medina. The encrustation generally extends from the upper part of the spindle rod onto the superior face of the spindle whorl, leaving the other face clean or covered with only a slight patina. In some cases, upon this encrustation a very thin layer of a whitish substance is present, which does not seem to be paint or plaster. Occasionally on the shaft of a spindle it is possible to find a thin layer of a brown substance, which seems to be clay. As the nature of the sediments of the area within which the finds were made is unknown, it is difficult to say whether this thin clay film is a result of depositional context or part of spindle technology; its presence could perhaps have helped the fibres to adhere to the spindle. It seems probable that the clay film is related to the archaeological context of the find, as clay or mud on a spindle could ruin the thread just produced. Certain spindle whorls from Kahun (David 1986, 234), however, have plastered surfaces which are sometimes decorated, which means that it is not impossible that certain spindles now residing at the Museo Egizio were once given a surface treatment, the purpose of which is now unknown.

In one case, a fabric fragment was still attached to the side of a spindle whorl (no. 106), perhaps due to the long contact between the two items in the archaeological stratum. The fragment measures 1.72 cm × 1.91 cm and is a tabby weave with a sett of 13 × 10 threads per $cm^2$, with the thread S-twisted in both warp and weft?

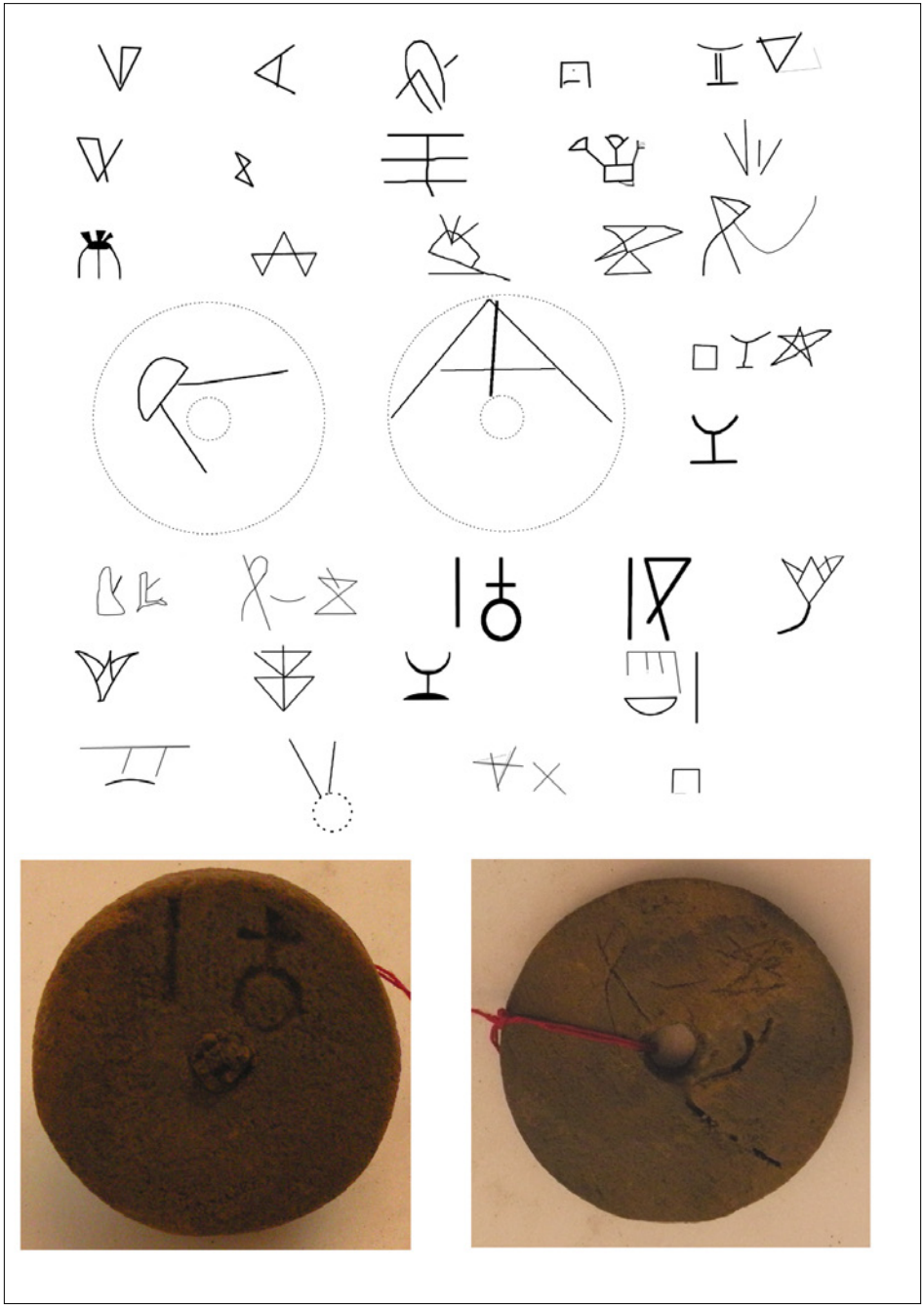


Figure 4. Marks of spindles and spindle whorls from Deir el-Medina

As seen above in the chart, three examples of spindles have undergone radiocarbon dating and their results confirm a New Kingdom date for the sample which comes from the village (S. 9978 of Schiaparelli's Inventory). A slightly later date was provided for the two other samples from the kôm (S. 07528 of Schiaparelli's Inventory). These two contexts were certainly not contemporary, as the results do not show any possible overlap. This means that the spinning activities in evidence at Deir el-Medina were spread over most of the period of the exploitation of the site. However, the number of spindles and spindle whorls recovered, 263, is astonishing even considering the length of time during which they were produced. In addition to the spinning tools here discussed, it should be borne in mind that Bruyère also found a large amount of spinning tools at this site, both from houses and from the great pit. It seems from this data that spinning was a prevalent activity in the village; such a large number of spinning tools is usually expected from workshops or other areas devoted to thread production, rather than villages.

If the textual evidence from Deir el-Medina is taken into account, it can be seen that workers received textiles and cloths (but not raw fibres) as a form of payment and therefore did not need to produce their required textiles themselves. These considerations raise a lot of questions, such as who actually used the spinning tools that have been recovered; are we seeing domestic production on the level of individual households or were certain persons textile production specialists? We do not know how many people were engaged in textile production nor how it was organised. The archaeological documentation shows spinning tools coming from houses or from dumps, and not from any other type of buildings that could be identified as workshops or attached to temples. This evidence points to a domestic-level production, probably organised by the female members of a house,[9] but it is not known whether this production was meant for internal consumption or could have been exchanged for other goods. It may be that this is the normal number of spinning tools to be expected from one single site, (in ideal circumstances wherein organic materials are not affected by decay), and that Deir el-Medina was not exceptional at all.

**9** As Papyrus Salt 124 on Paneb forcing the wives of other workmen to weave for him let understand (Černý 1929, 246; Allam 1973, 283).

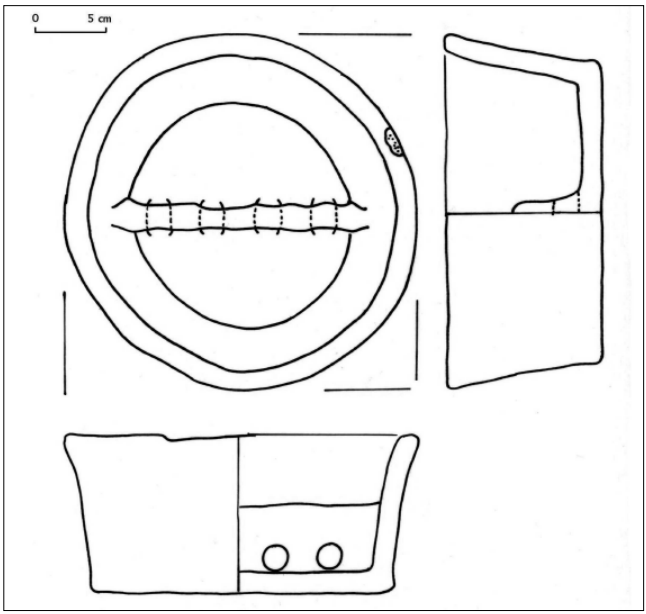



Figure 5. Spinning bowl from Tell el-Farkha (Maczinska 2012, fig. 6)

## 4.5 Spinning Bowls

In the Museo Egizio, there are two bowls with inner loops that can be classed as spinning bowls and both come from Heliopolis but are quite different from each other. The first one (no. 333) takes the classic form of a spinning bowl with two loops joining each other in the centre. It is fragmentary and only the bottom with the two loops and a small part of the wall are preserved. Marks from the potter's wheel can be seen on the outside of the bowl; the loops have been formed separately and added before the bowl was fired. Under the loops, clear traces of wear from the fibres passing through them can be seen.

The second spinning bowl from Heliopolis (no. 332) is missing its rim, but the bottom and most of the walls are preserved, and it is not very deep but quite heavy. The clay from which it was made is dark and contains a large amount of vegetable elements. Its shape is not completely regular; the bottom is flat and the walls are straight, but it shows traces of hand-forming and other small bumps; there are no traces of potter's wheel lines. The external surface was not treated and is rather rough, while the inner surface is carefully polished, especially on one side. Inside, this second bowl is rather peculiar because it is transversally cut by a wide diaphragm, made of the same clay as the bowl, and fixed to the walls and bottom with carefully polished junction points. The central diaphragm has

four holes passing through it. These holes are not identical to each other nor regularly arranged: the two in the centre are close together and set higher, while the lateral holes are lower and further apart.[10]

Compared to the spinning bowls attested in Egypt or in the Southern Levant that have previously been discussed, the second object from Heliopolis presents significant differences. None of the other bowls from the Levant or elsewhere in Egypt possess a central diaphragm; but rather they have a number of loops attached to the bottom of their interiors (as no. 333) or occasionally to their interior walls. The loops found inside these spinning bowls were sometimes joined together, but overall their shape and method of attachment to the bowl are very different to this object. It seems, however, that this second bowl could indeed have functioned as a spinning bowl, as the holes that perforate the 'diaphragm', even if they have no grooves inside them, would have been able to keep the fibres moisturised in water and under sufficient tension while spinning/plying took place. Nevertheless, the difference of manufacture is definitely evident and there might be an alternative explanation for this form.

A perfect match to this bowl comes from Tell el-Farkha, a site in the eastern Nile delta composed of three kôm and spanning a period of occupation from the Predynastic Period to the 4th Dynasty, with the settlement reaching its peak during the Protodynastic Period. Tell el-Farkha has brought forth several fragments of bowls with pierced diaphragms and, starting from the year 2002, even some complete examples with inner holes varying from two to four in number (Mączyńska 2012, 66). All these examples date to the initial phase of Naqada III and come from different trenches within the three kôm. Some fragments have grooves or signs of rubbing inside the holes, as in the more traditionally-shaped spinning bowls (Mączyńska 2012, 67, figs. 6, 10). As for the bowl residing at the Museo Egizio (no. 332), by consulting the Schiaparelli's Inventory[11] it can be noticed that it belongs to a batch composed of pottery coming from what excavator defined as the "Prehistoric Village", which means that the bowl here analysed could actually belong to the Predynastic Period as do the Farkha examples. Also the other example (no. 333) comes from the same batch of materials, unfortunately the New Kingdom and Predynastic levels at this site were directly overlain, which makes the Schiaparelli's

**10** These holes have one side with a regular opening while the other has an irregular opening; their insides are perfectly polished with no trace of groove.

**11** S. 4086. In a part of the inventory it is possible to read "Excavations of the year 1905 under the area of the late period temple. From 5 to 6 m under the *kôm*. Set aside the terracotta objects from the Prehistoric Village". Next to the bowl number a note says: "4077-4098 all material found in the last layer, that is that of the flint, in and over the water. In the same trenches, under the temple area, in the space between the columns, from which the aforementioned objects came, numbers 4047, 4068, 4070, 4074".

"stratigraphy" of this site quite unreliable. An early date could also be the reason for the peculiarly-shaped bowls of Tell el-Farkha and Heliopolis, which appear changed in the later periods. There is no certain evidence that bowls with interior diaphragm were used for spinning already in the Predynastic Period, but their shape and other features make it highly likely that this was their purpose.

The first Egyptian spinning bowls are identified with certainty only for the Middle Kingdom, both in the archeological record and from the iconographic evidence, which raises a question regarding the continuous use of spinning bowls from the Predynastic into the Dynastic period. It is likely that many fragmentary spinning bowls have not been recognized as such by excavators, this could hold true also for the early periods. This was, after all, the case at Tell el-Farkha, where until 2002 fragments of bowls containing diaphragms went unrecognised as objects related to the textile sphere. It is possible that a review of similar materials from other Egyptian sites could offer remarkable surprises as pertains to the chronological continuity of these bowls. Whether or not these objects are to be identified definitively as spinning bowls, the bowls from Tell el-Farkha and the one from Heliopolis kept in the Museo Egizio (no. 332) seem to create a unique category, as they share very similar characteristics.

## 4.6 Needles

At the Museo Egizio 26 bone, bronze and iron needles are stored, most of them with dates and origin unknown. Needles suitable for sewing, with thin diameters and eyes (nos. 324 and 323), as well as the large type of needles or bodkins (no. 311), are attested in the museum's collection. In the museum are also kept certain objects that could have been used for net production, such as nos. 327 and 326, which are curved in shape. A large wooden needle (no. 325) still holds a very thick thread s-cabled in its eye. From the tomb of Kha and Merit at Deir el-Medina two needle cases (nos. 319-20) were recovered, one made of papyrus rods held together with a small rope contained two bronze needles and a small blade, the other case made of papyrus stem had four bronze needles inside it. One of the needles of the first needle case still has some thread inserted through its eye.

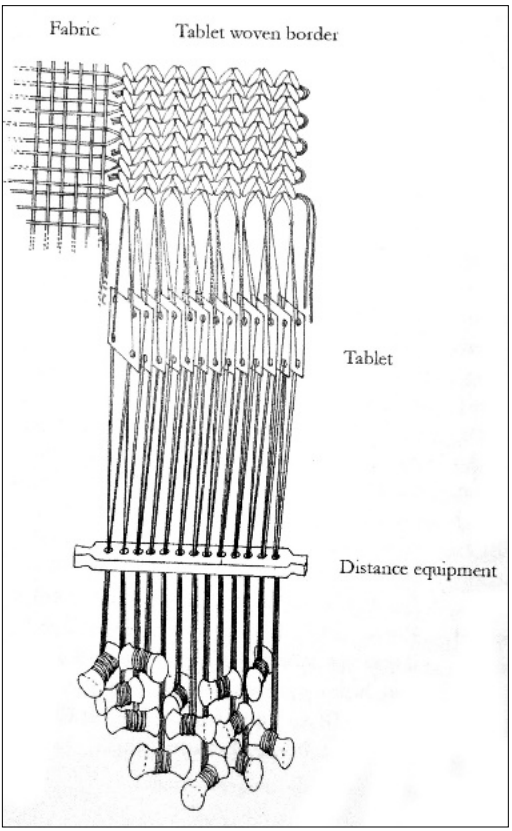



Figure 6. Gleba 2008, fig. 98

## 4.7 Spatulae and Other Tools

35 bone spatulae are stored in the Museo Egizio and can be related to the type already discussed for the Levant and elsewhere in Egypt. The origins of these spatulae are unknown, as Schiaparelli bought them in Egypt, except for one special spatula (no. 275) that probably does not belong to this category. It is actually an ivory object with straight sides, one thin and rounded end and the other end terminating with a fine-toothed comb. This object comes from a tomb context of the First Intermediate Period and is likely to be related with personal care rather than textile production. One of the purchased bone spatulae (no. 277) has very thin edges, one flat face while the other is concave. It shows signs of wear on both faces, especially on the flat surface and on its sides. An intact bone spatula (no. 276) has smoothed surfaces and is of a remarkable size; it is 18.7 cm long. It has one

rounded end and another triangularly-shaped end. It shows many traces of wear, especially on one of its two surfaces and on one side.

Several spatulae of different shapes, dimensions and materials are present in a group of 32 spatulae (Provv. 6465), for which no information of origin is available. One of these is made of wood (no. 291) and is broken at one edge while the other has a triangularly-shaped point. This is one of the largest from this group and measures 17.3 cm of length. Its surface is smooth and shows traces of wear. The other spatulae are all made of bone and, when preserved, show at least one triangularly-shaped point or a pen-nib point like those from Tell el-Amarna. In some cases the other end is round (no. 296), in others one end is flat (no. 286), and in many cases both ends were actually worked to a point, one end into a triangular shape and the other into the 'pen-nib' shape (nos. 297 and 298). Some objects belonging to this group are not really spatulae, but thin and sharp *pin beaters* such as (no. 285), even if their function was probably related to textile production too. The surfaces are extremely smooth on both faces and in many cases the cancellous bone is clearly visible.[12] Not all spatulae show signs of wear but, when they appear, they are especially visible on one side. In no. 295 wear marks are visible on one side as thin parallel lines, which suggest that the tool was always used in the same direction.

## 4.8 Parts of Loom

A wooden warp spacer (no. 329) coming from the Schiaparelli excavations in the Valley of the Queens is generally dated to the time between the New Kingdom and the Late Period. It is broken at the ends and shows 23 deep incisions and 6 half-incisions, which means that only on some teeth, four of them consecutive, these half-incision are created. It seems that these incisions were created by thread rubbing repeatedly on certain areas, due to the threads not being inserted into the pre-made incisions. The warp spacer has a triangular section with well-smoothed sides, while its lower part is not polished. One of the two sides is smoother than the other. On half of the preserved length (near the broken end) there are superficial incisions, while on the other side the incisions are deeper with irregular sides and traces of wear, likely from constant use. None of the warp spacers coming from other sites exhibit this type of wear.

Two wooden slats of unknown origin (nos. 330 and 331) are rather well-preserved (they both measure 1.5 cm wide and 0.9 cm thick); one is 22.2 cm long and the other is 22.5 cm long with 12 small holes passing through it and placed at different distances from each other and not strict-

12 In one case the trabeculae are not visible (no. 295).

ly in a row across the surface.[13] On both slats, the ends are concave and on one there is a mortise joint and on the other a broken tenon (preserved only on one of the two rods), which means that further elements were once added. The surface of both objects is smooth, but the concavity of the ends and the differences between their sizes and those of the holes do not allow us to consider that these two elements were once joined together.

It is difficult to define the use of these objects, and it is not certain at all that their use must be sought in textile production. At first sight they remind one of a mat separator (*hasira*) like the one discovered at Kahun, although they are much smaller than that example; as well, their holes are too small to suit the types of fibres used in the manufacturing of mats. A similar kind of spacer, but of smaller dimensions, was used to manufacture hems woven with weaving tablets in Prehistoric Italy (Gleba 2008, 152-3). As the dating of these Egyptian objects is unknown, it is possible that these objects do not belong to the Pharaonic Period, but to the Coptic or Medieval Periods, when the use of weaving tablets was widespread in Egypt. Objects similar to these slats could also have had other functions, such as embroidery frames, but in this case they would also date later than the Pharaonic Period. If these slats do not in fact relate to textile production, they may have had fibres fastened to them for use as parts of stools or beds.

## 4.9 Weights

The objects kept in the Museo Egizio that might be ascribed to the weight/loom weight category are few in number. For most, indications of their date or origin are missing.

- A flat bell-shaped ceramic weight with two holes (no. 338).
- A truncated pyramid-shaped ceramic weight with one through-hole and a small circular carving on the upper edge (no. 339).
- A pear-shaped weight made of stone (no. 340).
- A dome-shaped weight with a large knot of twine (no. 349). The weight is 4 cm in diameter, 2.2 cm in height and with a hole diameter of 1 cm. If the twine was not preserved, it would have been inserted into the spindle whorls category, to which it probably belonged even if it was used for different activities. Its total weight is of 23 g, twine included, so it would have been a relatively light spindle whorl.
- A group of 7 small limestone weights came from a tomb at Gebelein (nos. 342-8), all of globular shape with slightly flat sides. The surfaces

**13** The two holes closest to the ends are set closer to each other; the average distance between the holes is around 2 cm, meanwhile those at the ends of both rods are only 1.5 cm and 1 cm apart.

are well-polished and chalky. Their dimensions are rather between 3.0-3.9 cm in height with diameters ranging from 4.0 to 4.4 cm. Their weight as well is quite homogeneous, between 46 g and 62 g. Whatever their function originally was, careful attention was paid to their manufacture and standardisation. Based on comparisons with the Levant materials, these could be considered as stone spindle whorls, but the fact that a quantity of them was found together leads us to think that they were used at the same time. No traces of wear due to the rubbing of thread or from insertion on a spindle shaft are visible. Furthermore, textile tools are never placed in Egyptian tombs during the Pharaonic Period, suggesting that their purpose should be sought outside the textile sphere.

# 5 Wood Identification

Taxonomic identification of the wood from which ancient Egyptian spindles and spindle whorls are composed has been achieved, so far, for a small number of objects deriving from the sites of Kahun and Tell el-Amarna, with quite unexpected results. Samples of seventeen spindle whorls and a heddle jack from Middle Kingdom Kahun have been analysed as well as one spindle whorl dating to the New Kingdom from Thebes. Fourteen of these objects were produced using a non-local wood of the *Pinaceae* family, probably the *Abies* genus, but it has not been possible to identify the precise species, due to the absence of specific anatomical features within the wood sample. The *Abies* species is not native to Egypt, normally localised to central European forests, but also occurring in Greece and Turkey.

Its fine texture, straight grain and a low tendency towards warping make this wood suitable for several carpentry and building purposes; it is quite remarkable that this kind of wood has been chosen for the production of small spindle whorls (Cartwright et al. 1998, 96). Four other samples have been recognised as *Ficus sycomorus*,[1] of the *Moraceae* family, a local wood commonly used in Ancient Egypt, for example in the manufacture of coffins. It is a light and soft timber, but it does not bear pressure, crushing or bending (Cartwright et al. 1998, 96). These characteristics do not prohibit its use for the making of spinning tools, especially spindle whorls, which are not subjected to excessive stress. For these reasons (i.e. lightness, local availability and probably cost-effectiveness), this wood would be a more obvious choice for spindle whorls but the archaeological data from Kahun are against this assumption.

Spindle whorls from Tell el-Amarna were analysed by Rainer Gerisch in 2000 (Kemp, Vogelsang-Eastwood 2001, 267-8). In almost all of the 37 examined samples, the orientation of the wood elements follows the cross-section of the spindle whorls, except in one case, which has been cut in a longitudinal direction from the structure of the wood. Most of the spindle whorls show evidence of growth rings typical of coniferous wood and, more specifically, the wide bands of fibres alternating with parenchyma bands, which are characteristic of *Ficus sycomorus* wood. The majority of the samples examined were obtained from sycomore wood but several

1 Not to be confused with sycamore wood.

were made of cedar wood (*Cedrus libani*). In all, 17 spindle whorls are recognised as being made of sycomore, 9 are made of cedar and the exact identity of 6 remain unknown, but these are known to belong to the class *Dicotyledonis* (to which *Ficus Sycomorus* belongs as well as a thousand other species) (Kemp, Vogelsang-Eastwood 2001, tab. 8.2).

Prof. Mauro Rottoli examined on two occasions some of the spinning tools, which are stored at the Museo Egizio and took some samples in order to determine the wood composition, the results of which are shown in Table 2. The majority of the museum objects were covered by a thick layer of encrustation or by a patina, which has prevented their investigation. On some items, however, the wood was completely exposed and some remarks have been possible. In almost all the cases under examination, the wood has been cut following the cross section, as was the case of the Amarna spindle whorls. In ten examples, the whorl surface was completely exposed and growth rings were easily visible: most of these whorls were cut from the central portion of a branch or a small trunk (e.g. S. 07526/012, S. 07526/060), from half of a log (e.g. S. 07526/047, S. 07527/03) and in four examples from a trunk of larger dimensions (S. 07526/009, S. 07526/109, S. 07526/090, 07526/095). Only two items were obtained by cutting the wood in a longitudinal direction (S. 07526/007, S. 07528/038). On one object traces left from its manufacture were very clear because it was not polished.

Most of the spindle whorls have been examined by eye and seem to have the same anatomical characteristics: the cross section exhibits inter-vessel pits very often with coalescent apertures, which are disposed in a radial pattern (e.g. S. 07526/009, S. 07526/097, S. 07526/100, S. 07526/103, S. 07528/025). It is highly probable that they were obtained from the same wood species as the whorl samples, i.e. *Ficus sycomorus*. Only two examples appear completely different from the others: S. 07528/044, which is quite heavy and of a dark colour, and S. 07528/109 which has been extracted from a sturdier wood.

It was not possible to arrive at a correct determination of spindle wood by eye and even observation by microscope occasionally left some doubt, due to the impossibility of observing a sufficiently wide cross-section. Four out of the six samples of spindles have proven to be cedar wood, one of the others was made of yew and one of a non-identified species of the class *Dicotyledonis*.

It is a very remarkable fact that in all the examples examined, from Kahun, Amarna and Deir el-Medina, local woods were used alongside foreign and consequently more expensive woods. Wooden spindles and spindle whorls have the advantage of being able to resist breakage through dropping better than other materials, especially pottery; as well, wood provides the opportunity to create large, but at the same time light, spindle whorls. However, a too-soft wood could easily warp, especially around its hole, and several wedges would then be required to attach it to the spindle, as has

frequently been seen in the case of the Deir el-Medina materials. Spindles had to be strong enough to resist the constant friction with hands and tight of the spinner and the stress involved during the process of spinning that could lead to the breaking of the object. It is not surprising, therefore, that a more resistant wood would have been preferred, even if it was more expensive. The data obtained from Deir el-Medina clearly shows that the best wood was used to make spindle shafts and softer wood was employed for most of the spindle whorls. If this wood was manufactured into spindles and spindle whorls at the village (which seems more likely) or if they were acquired already fabricated from somewhere else is a very interesting question, which will hopefully find an answer by their comparison with other tools found at the Worker's Village.

Table 2: Wood identification of spindles and spindle whorls of Museo Egizio, in Turin, made by M. Rottoli

| | | | | | | |
|---|---|---|---|---|---|---|
| S.07526/027 | Spindle | Partially charred wood | Taxales: Taxaceae | (conifer) | *Taxus baccata* | yew |
| S. 07526/48 | Spindle | Wood | Coniferales: Pinaceae | (conifer) | *Cedrus libani* | Cedar* |
| S. 07526/093 | Spindle | Wood | Coniferales: Pinaceae | (conifer) | *Cedrus libani* | Cedar |
| S .07526/106 | Spindle | Wood | Coniferales: Pinaceae | (conifer) | *Cedrus libani* | Cedar |
| S. 07526/109 | Spindle | Wood | Coniferales: Pinaceae | (conifer) | *Cedrus libani* | Cedar* |
| S. 07528/020 | Spindle whorl | Wood | Dicotyledones: Moraceae | (angiosperm) | *Ficus sycomorus* | Sycomore |
| S. 07528/033 | Spindle whorl | Wood | Dicotyledones: Moraceae | (angiosperm) | *Ficus sycomorus* | Sycomore |
| S. 09978/5 | Spindle | Wood | Dicotyledones | (angiosperm) | ?? | ??** |

* The identification of these two samples retains a slight degree of uncertainty. It is certainly from some type of conifer, but not all typical characteristics of cedar wood are clearly visible. It might be possible, although extremely unlikely, that it is fir (*Abies* sp.).

** Sample S.09978/5 belongs to a broad-leaf tree (angiosperm). The impossibility of observing a cross-cut section makes the identification very difficult even as regards the family classification.

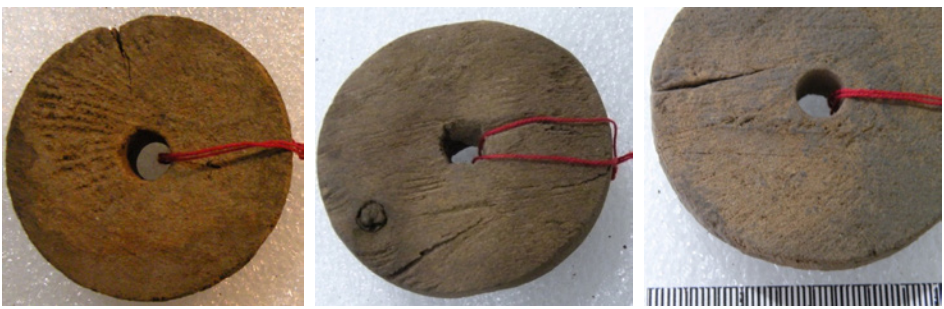


Figure 1. Three examples of wooden spindle whorls from Museo Egizio (S. 0728/025, 38, 39)

# 6 Conclusions

The analysis of the spinning and weaving tools from the Levantine and Egyptian areas revealed a great similarity between the two geographic areas and allowed the drawing-up of many conclusions and the posing of various questions, through a comparison of contexts normally studied separately. Some issues that have been here considered have no firm answers at this time and require further and deeper analysis of the materials under question. One of the lingering problems is constituted by the excavation reports used for this work. First, not all reports explain in an equally detailed way the tools that might be related to textile production, and sometimes the absence of certain objects depends on their lack of recognition as such, or a choice made to exclude mundane or fragmentary objects at the time of publication. Certain categories of objects suffered particularly from these judgement calls, such as stone pierced-discs and spindle whorls made of pottery sherds.

As highlighted during this work, there is no certain identification of these objects with spinning and weaving tools, but in order to carry out a more complete work in the future, it was thought to include all the tools that may have had anything to do with the textile sphere. The precision of the statistical data and their relationship with other tools is, however, lost if particular categories are left out of the excavation reports. This problem is noted for the reports from Levantine sites, but it is even more prevalent for Egyptian site reports, in which many objects are often only schematically reported, lacking data essential for the study of these materials (quantities, exact measurements, etc.). Moreover, the lack of textile-specific studies for the Egyptian area makes it difficult to trace a clear picture of the chronological evolution of weaving tools and techniques.

Despite these objective difficulties, some of the conclusions that have emerged in this work appear to be significant. Firstly, it can be seen that spinning tools, spindle whorls in particular, began to appear in the Levant during the Pre-pottery Neolithic, which is remarkably earlier than in Egypt. The production of spindle whorls later, however, seemed to develop in parallel across the two areas, with stone whorls predominating for both the Levant and Egypt, with a secondary production of ceramic whorls and those made of re-used pottery sherds. Wooden spindle whorls are regularly attested in Egypt from the Middle Kingdom onward, but this production most likely began in a much older era.

Production from stone, though expensive, may be related to spinning technology or to the yarn being produced. For stone and ceramic whorls of equal dimensions, a stone spindle whorl will weigh more than a ceramic example, which does affect the twist in the yarn that it can create. For stone and ceramic whorls of equal weight, a stone example will be necessarily smaller than ceramic or wood examples, so it runs faster and for less than a wooden one. This fact makes small stone spindle whorl less adapt to spin long vegetable fibres, such as flax, than wide and light wooden spindle whorls.

From the Middle Bronze Age onward in the Levant a category of precious bone and ivory spindle whorls – frequently found in tombs and which do not correspond to the objects found in Egypt – began to develop.

During the Pharaonic Period Egyptian spinning was always performed with the spindle whorl placed at the top of the spindle. This fact is well-confirmed by iconographic representations and archaeological finds. In the Levant however, we have no clear evidence for where upon the spindle the spindle whorl was placed. A few scattered pieces of iconographical evidence seem to suggest that in Southeastern Anatolia and Northern Syria, as well as at Susa, spindle whorls were placed at the top of the spindle, at least during the Iron Age. The placement of whorls in the Levant, however, is not possible to argue one way or another.

Interesting and divergent data come from tomb contexts. In the Levantine area, spindle whorls and loom weights are well-attested in tombs, especially those of the Late Bronze Age, which are richly supplied with bone and ivory spindle whorls. In Egypt, however, where objects and scenes of daily life are regularly included as grave goods, spindles, spindle whorls and other tools of textile production are never included. One theory used to explain this is that in Egypt spinning and weaving took place in large workshops (as paintings and models demonstrate) and therefore were activities that had little to do with the daily life of most individuals. A similar explanation has been provided for the Mycenaean area, in which spindles of rare materials and distaffs typical of the Mediterranean area during the Late Bronze Age period are very rarely evidenced. These began to appear as grave goods only after the Dark Ages, likely due to social changes that occurred during the transition from a centralised Palatial redistribution system to the ‘oikos’ system of a small-scale organisation (Borgna 2003, 532).

This explanation, however, does not suit the evidence stemming from either the Levant or Egypt, where it seems that a ‘mixed system’ existed, with private individuals supplying their own family requirements for cloth (and perhaps creating extra for small-scale trade), alongside the great palatial and temple workshops that provided all the textiles for the court and temple, in addition to those used to pay worker’s wages. This situation in Egypt is testified to by the remains from various Worker’s Vil-

lages (excavated at Kahun, Amarna and Deir el-Medina), where families depended directly on the palace and received wages that included fabrics although almost all domestic contexts have also brought forth spinning and weaving tools.

The analysis of Egyptian spinning-related objects showed clearly how frequently wood was used for the creation of these tools, which are completely lost in the Near East. Ancient Near Eastern texts reveal that Levantine textile production was oriented towards the use of wool rather than linen, as opposed to the practice in Egypt; this fact suggests that wooden spindle whorls, so important for spinning linen, might have been less common in the Levantine area than in Egypt, but there is no evidence on which an argumentation may rest (wooden spindle whorls could have been used for the spinning of wool).

The results achieved from the analysis of the weights, in particular comparisons made between the two geographic areas, are also very interesting. Although the difficulty of recognising a loom weight from another type of weight is here acknowledged, we can definitively say that the warp-weighted loom was well-known in Palestine and Jordan in the Early Bronze Age, but not widely used in Syria, where the horizontal ground loom was likely used. Beginning from the Middle Bronze Age, loom weight production is well attested, but appears to decrease in the late phase, even in the Southern Levant, until an almost total absence of loom weights is recorded for the Late Bronze Age. This fact seems to be related to the invention of the vertical two-beam loom, the origins of which are uncertain, but which might be found in the Levant. Levantine sites were aware of both the horizontal ground loom and the vertical warp-weighted loom; therefore it is likely that this new invention, which combines elements of both looms, may have happened there.

At some point between the end of the Middle Bronze Age and the beginning of the Late Bronze Age the new vertical two-beam loom was definitely in use in Egypt, as it began to be represented in tombs of the 18th Dynasty. From the Iron Age onward, Egypt and the Levant seem to follow two very different paths regarding textile creation. The warp-weighted loom is well-documented by countless unbaked or lightly baked clay loom weights throughout the Levantine area during the Iron Age. Small numbers of loom weights seem to have been posited for Egypt, but if the warp-weighted loom was in use there, it did not become a prevalent technology.

The controversy of the warp-weighted loom was highlighted by Mace (1922, 75-6) the excavator who recognised dozens of loom weights at Lisht, early on; but there has not been substantial progress regarding this issue in the last one hundred years. Today's research instead seeks to discover which types of weights are to be recognised as loom weights rather than counterweights (for mats, roofs and so on), as those weights made of unbaked clay require an explanation. Three details are particularly signifi-

cant to this question: the weights in Egypt show both original 'Egyptian' shapes as well as shapes well-known in other areas of the Near East, such as bell-shaped, conical, globular and truncated pyramidal shapes. The second detail is the extremely small number of Egyptian loom weight examples, which may be due also to choices made during the publication of the finds. Thirdly, only some of these potential loom weights come from contexts where other textile production tools are attested.[1]

Egyptologists typically identify all weights (except those made of clay) as net weights, but there is no reason to exclude the stone objects as loom weights. In their simplest conception, both loom and net weights require only a perforated or roughly-shaped pebble. The weights as found, however, are characterised by defined shapes. We assume that these shapes were designed either for fishing or for weighting the warp; but they may have been re-used for other activities.

The Egyptian documentation provides some interesting data, as there are several representations of fishing scenes in which nets and weights are represented. Still, if all the stone weights are to be seen as net weights, how to explain their common association with spindles, spindle whorls, needles, spatulae and other textile production tools? The explanation could be provided by the representations in tomb paintings, which show that the manufacture of threads for nets was carried out with most of the same tools used to create fabric. Following this idea, the recovery of several weights in a group may not be due to the presence of a loom, but to the presence of a net with weights still attached; once the net is decomposed, it would have left traces similar to that of a loom. Such revised interpretations, supported by Egyptian iconographic and archaeological data, causes one to wonder whether all the weights seen in the Levant prior to Iron Age should unquestionably be considered loom weights.

At Ugarit, Jericho and Arslantepe,[2] in the Neolithic and Chalcolitic levels there are certain types of objects that can be defined as weights. A first type is a rounded pebble with a longitudinal engraving that makes it resemble a coffee bean, but which is well-suited for fixing a thread. A second type is formed from a pebble with lateral edges worked in order to make them concave. These are the type that are called *galets à encoches* at Ugarit (De Contenson 1992, 128, pl. CXII). Weights similar to these are also found in Egypt throughout the Pharaonic Period and are the most common types of weights. Currently, it is not possible to take the contexts of all weights into account as well as the proximity of their find-spots to the sea or to fish-bearing watercourses, nor is a reference to the different kinds of weights and their quantities per site and morphometric data

1 The weights from Buhen, for example, are not related to any textile tools or material.

2 Personal communication of Dr. Laurito who is studying one type of these weights.

available. Only in the future it will be possible to create a general picture of their primary function within the Levant, while considering the data provided by the Egyptian area.

The remarkable collection of materials kept in the Museo Egizio has allowed the deepening of this analysis, especially as concerns spindles and spindle whorls, of which a good number of examples have been preserved. It has been possible to verify that there existed at least two types of wooden spindles, both types with a groove on the upper end, and that spindle whorls were placed close to this groove. The two different spindle types were of different weights and therefore had different effects on the quality of the spun fibres. The spindle whorls were all made of wood and almost all of them have a cylindrical shape except for very few truncated conical, lenticular and dome-shaped cases. The weight of the intact spindle whorls is light, between 4 g and 19 g, although desiccation has slightly decreased the weight of the wood. Their wide diameters, however, indicate a production of medium quality, not extremely fine yarn. Dimensions, morphologies and weights of the whorls are, however, quite standardised, although we must consider the possible loss of spindle whorls made of other materials.

It is not possible to claim the same level of standardisation for the hanks and balls of yarn, which show threads of various thicknesses, twist directions, quality and purposes. The frequent use of the technique of splicing can be noticed particularly in the most ruined hanks, because the unravelling thread allows a more detailed analysis, which is difficult for pieces where the twist is still very tight.

Weaving tools are not very numerous in this collection because heddles and other parts of looms are missing (but, as it is not easy to distinguish these from pieces of furniture, it is not impossible that some parts of looms may be present). A warp spacer is in evidence, although incomplete; these are not present in large quantities at any of the sites here considered. Of great interest is the spinning bowl found by Schiaparelli at the prehistoric village of Heliopolis, considered to be of New Kingdom date. The possibility that the bowl should actually be dated to the Predynastic period is raised by the Tell el-Farkha excavations, where a particular type of spinning bowl was manufactured from at least the Naqada III Period onward. The absence of spinning bowls in Old Kingdom contexts could be due to lack or errors in recognising this type of objects.

In conclusion, analysis of the artifacts of the Museo Egizio in Turin has made it possible to clarify some technical issues related to the preparation of textile fibres and the spinning system employed; it also allowed us to recognise that spinning bowls were already being used in the Predynastic Period of Egypt. This study has also raised additional questions about some tools whose function is unclear, such as certain types of weights/spindle whorls, and spacer bars. Comparisons between the techniques of spinning and weaving in the Levantine and Egyptian areas has allowed us to iden-

tify some characteristics of spindle whorls, such as the various materials employed to make them. The comparison between the types of weights in evidence has not only reopened the discussion about whether or not the warp-weighted loom was known in Egypt, but has also raised questions regarding the effectiveness of the methods of loom weight identification for the ancient Near East.

# Catalogue

**001** S. 07526/001
**Spindle** l. 16 cm, diam. 1 cm. **Spindle whorl** diam. 5.1 cm, th. 1.5 cm, hole 0.9 × 1 cm. W. 16 g.
**Material** wood; flax.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle, point broken. Top with a spiral groove. Linen threads (one s-plyed and one z-plied) around the top, with a wooden peg to secure the knot. Cylindrical spindle whorl at the top of the shaft, surface with encrustation and white spots.

**002** S. 07526/002
**Spindle** l. 19 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.3 cm, th. 1.5 cm, hole 0.9 cm. W. 19 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Wooden spindle, point broken. Top with a spiral groove. Cylindrical spindle whorl set on the middle of the shaft.

**003** S. 07526/003
**Spindle** l. 24.9 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.1 cm, th. 0.9 cm, hole 0.9 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Wooden spindle broken at one end, the other tapered to a point. Cylindrical spindle whorl near the preserved point, coarse and irregular.

**004** S. 07526/004
**Spindle** l. 32.4 cm, diam. 0.9 cm. **Spindle whorl** diam. 4.9 cm, th. 1.5 cm, diam. hole 0.8, inf. 0.9. W. 21 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Wooden spindle with almost entire length preserved, but both ends chipped. Cylindrical spindle whorl near one end.

**005** S. 07526/005
**Spindle** l. 16.6 cm, diam. 1 cm. **Spindle whorl** diam. 5.3 cm, th. 1.6 cm, diam. hole 1 cm. W. 22 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Wooden spindle broken at the bottom, while the other one has a groove. Cylindrical spindle whorl near the top of the shaft, well-shaped, with traces of encrustation. Spindle and spindle whorl have burnt marks.

**006** S. 07526/006
**Spindle** l. 10.8 cm, diam. 0.9 cm. **Spindle whorl** diam. 4.5 cm, th. 1.3 cm, diam. hole 0.9 cm. W. 10 g.

**Notes to the Catalogue**

1. Spindle diameter is measured at the place of maximum preserved diameter.
2. Weight of a spindle signifies the weight of the spindle with the spindle whorl (if preserved), as it is not possible to remove spindle whorls from spindle shafts.
3. Hole of spindle whorls: the first number is the measurement of the hole at its top outer surface, the second number is its measurement at the bottom outer surface.

**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Wooden spindle broken at the bottom, while the other one has a groove. Cylindrical spindle whorl, well-shaped, near the top of the shaft. On the lower surface, there are some black lines, probably painted.

**007** S. 07526/007
**Spindle** l. 21 cm, diam. 0.8 cm. **Spindle whorl** diam. 5.8 cm, th. 1.2 cm, hole 0.8 × 0.9 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Wooden spindle broken at the top, while the other end has a tapered point. Cylindrical spindle whorl, near the bottom end. Well-preserved and clean, longitudinal cut of a quite large log/branch.

**008** S. 07526/008
**Spindle** l. 22 cm, diam. 0.9 cm. **Spindle whorl** diam. 4.5 cm, th. 1.3 cm, hole 0.9 × 0.8 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Wooden spindle broken at the top, while the other end has a tapered point. Cylindrical spindle whorl, near the bottom end. Both shaft and whorl have traces of encrustation.

**009** S. 07526/009
**Spindle** l. 16.3 cm, diam. 1 cm. **Spindle whorl** diam. 5.7 cm, th. 1.2 cm, diam. hole 1 × 0.9 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Wooden spindle broken at the top, while the other end has a tapered point. Cylindrical spindle whorl, attached near the bottom end. Shaft with traces of encrustation, whorl with yellowish spots on the side. Whorl is made from quite a large log/branch. Very clear wood vases on its surface.

**010** S. 07526/010
**Spindle** l. 11 cm, diam. 0.9 cm. **Spindle whorl** diam. 4.8 cm, th. 1.6 cm, hole 0.9 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at one end, while the other end has a large rounded point. There are no traces of the groove to fasten the thread. Cylindrical spindle whorl very encrusted on the entire surface and placed near the preserved end.

**011** S. 07526/011
**Spindle** l. 14 cm, diam. 0.8 cm. **Spindle whorl** diam. 4.9 cm, th. 1 cm, hole 0.7 × 0.8 cm. W. 12 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle, broken at both ends, but at the top there are traces of the groove to fasten the thread. Cylindrical spindle whorl at the top of the shaft; upper surface encrusted, lower surface with a slight coating of foreign material.

**012** S. 07526/012
**Spindle** l. 10.9 cm, diam. 0.9 cm. **Spindle whorl** diam. 4.9 cm, th. 1.6 cm, hole 0.9 cm. W. 10 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Wooden spindle, broken at both ends. Cylindrical spindle whorl at one end of the shaft. Spindle and spindle whorl poorly preserved, probably due to insect damage.

**013** S. 07526/013
**Spindle** l. 10.2 cm, diam. 0.9 cm. **Spindle whorl** diam. 5 cm, th. 1.9 cm, hole 0.9 × 0.8 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Wooden spindle broken at the top (?) while the other end tapers to a well-shaped point. Cylindrical spindle whorl near the preserved point. Spindle and spindle whorl slightly encrusted.

**014** S. 07526/014

**Spindle** l. 9.8 cm, diam. 0.8 cm. **Spindle whorl** diam. 4.8 cm, th. 1.8 cm, hole 0.8 cm. W. 20 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle, broken at the bottom. Flat top is well-preserved, with a deep groove for fastening the thread. Cylindrical spindle whorl near the top of the shaft, encrusted on the upper surface.

**015** S. 07526/015

**Spindle** l. 14.7 cm, diam. 1.1 cm. **Spindle whorl** diam. 5 cm, th. 2.1 cm, hole 1.1 cm. W. 20 g.

**Material** wood, vegetal fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle, broken at the bottom. Top with a groove to fasten the thread but which is covered by a thick layer of encrustation; encrusted material covers also remains of fibres that are slightly visible. Cylindrical spindle whorl placed near the top of the shaft, very encrusted and with white spots.

**016** S. 07526/016

**Spindle** l. 11 cm, diam. 1.1 cm. **Spindle whorl** diam. 5.3 cm, th. 1.6 cm, hole 1.1 cm. W. 20 g.

**Material** wood, vegetal fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom. Top with a break along the groove used to fasten the thread, but a thick layer of encrustation covers it; it also covers remains of fibres, slightly visible.
Cylindrical spindle whorl near the top of the shaft, encrusted on its upper surface.

**017** S. 07526/017

**Spindle** l. 10.7 cm, diam. 0.8 cm. **Spindle whorl** diam. 4.1 cm, th. 1.3 cm, hole 0.8 cm. W. 10 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at both ends. Cylindrical spindle whorl placed near one of the broken ends, heavily encrusted on the upper surface. Small and well-shaped.

**018** S. 07526/018

**Spindle** l. 13.8 cm, diam. 1 cm. **Spindle whorl** diam. 4.8 cm, th. 1.7 cm, hole 0.9 × 1 cm. W. 18 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom. Top with groove covered by a thick layer of encrustation, where there are impressions of fibres. Cylindrical spindle whorl, encrusted on the upper surface.

**019** S. 07526/019

**Spindle** l. 10.6 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.5 cm, th. 1.3 cm, hole 0.8 cm x 0.9 cm. W. 18 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at both ends. Cylindrical spindle whorl near one of the broken ends, slightly encrusted on both surfaces.

**020** S. 07526/20

**Spindle** l. 18 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.6 cm, th. 1.6 cm, hole 0.9 cm. W. 21 g.

**Material** wood, vegetal fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom. Cylindrical spindle whorl placed near the top of the shaft, with a thick layer of encrustation on the upper surface. Lower surface clear with marks from manufacture. Inside the hole, there are visible traces of vegetal fibres, which appear on all sides of the hole.

**021** S. 07526/021

**Spindle** l. 16.4 cm, diam. 1 cm. **Spindle whorl** diam. 5.5 cm, th. 1 cm, hole 1 cm. W. 16 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at both ends. Cylindrical spindle whorl, very thin and well-shaped, placed at the top of the shaft.

**022** S. 07526/022

**Spindle** l. 14.5 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.1 cm, th. 1.5 cm, hole 0.9 cm. W. 19 g.

**Material** wood, vegetal fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom. Top with a groove highly encrusted and with traces of fibres. Cylindrical spindle whorl at the top of the shaft, well-shaped and with a thick layer of encrustation. There are traces of pink paint (?).

**023** S. 07526/023

**Spindle** l. 27.4 cm, diam. 1.3 cm. **Spindle whorl** diam. 5 cm, th. 1.2 cm, hole 1 × 1.1 cm. W. 23 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at one end, while the other end, only partially preserved, is thick and rounded. Cylindrical spindle whorl placed near the middle of the shaft with a thin layer of patina. On the shaft, under the spindle whorl, there is an incised mark.

**024** S. 07526/025

**Spindle** l. 14.8 cm, diam. 1 cm. **Spindle whorl** diam. 5.3 cm, th. 1.5 cm, hole 1. W. 22 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle, broken at both ends. Cylindrical spindle whorl covered with a thin layer of patina on both sides.

**025** S. 07526/026

**Spindle** l. 12.5 cm, diam. 1 cm. **Spindle whorl** diam. 5.4 cm, th. 1.6 cm, hole 1 cm. W. 18 g.

**Material** wood, vegetal fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, while the other end is flat with a groove to fasten the thread. Near the groove, the shaft is heavily encrusted. Cylindrical spindle whorl near the top of the shaft, with a thick layer of encrustation on the upper surface and on the side.

**026** S. 07526/027

**Spindle** l. 20.3 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.5 cm, th. 1.5 cm, hole 0.9 cm. W. 19 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle almost complete, part of the shaft is missing, but the entire length is preserved. Flat top with a long spiral groove. The shaft is encrusted and has a thread stuck in the hole of the spindle whorl. The thread is made of linen, is plyed and has an s-twist. On the shaft, there are traces of burning. Cylindrical spindle whorl, well-shaped, near the top of the spindle.

**027** S. 07526/028

**Spindle** l. 7.6 cm, diam. 0.9 cm. **Spindle whorl** diam. 4.4 cm, th. 1.1 cm, hole 0.9 cm. W. 8.8 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle missing the lower end, while the top is rounded and has a spiral groove. Cylindrical spindle whorl, very worn, placed near the top of the shaft. Both shaft and spindle whorl bear traces of encrustation.

**028** S. 07526/029

**Spindle** l. 7.7 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.1 cm, th. 1.2 cm, hole 0.8 cm. W. 10.5 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at both ends. Cylindrical spindle whorl, which should have been near the top of the shaft. Both shaft and spindle whorl have traces of encrustation.

**029** S. 07526/030

**Spindle** l. 7.7 cm, diam. 1.1 cm. **Spindle whorl** diam. 5.2 cm, th. 1.6 cm, hole 1.1 × 1 cm. W. 16 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at both ends. Cylindrical spindle whorl with a surface covered by a thick

layer of a white encrustation, while the other surface is clean.

**030** S. 07526/031

**Spindle** l. 5.1 cm, diam. 0.9 cm. **Spindle whorl** diam. 5 cm, th. 0.8 cm, hole 0.9 cm. W. 16 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the end of the shaft, while the top is flat and presents a cylindrical groove. Shaft is broken immediately under the spindle whorl; on the side of the whorl there are two incisions. Furthermore, the spindle whorl has two cracks across it, one of which is very deep and almost arrives at its hole.

**031** S. 07526/032

**Spindle** l. 6.4 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.8 cm, th. 0.9 cm, hole 0.9 cm. W. 16 g.

**Material** wood, vegetal fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, while top is flat and has a groove. Under the spindle whorl, around the shaft, part of a linen yarn is still preserved: it is s-plyed; its single twist is not visible. Beside the yarn, there are also non-spun fibres. A cylindrical spindle whorl sits near the top of the shaft; it has a break across it and traces of yellow paint (?) on its upper surface.

**032** S. 07526/033

**Spindle** l. 14.6 cm, diam. 0.7 cm. **Spindle whorl** diam. 4.5 cm, th. 1.5 cm, hole 0.7 cm. W. 13 g.

**Material** wood; vegetable fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, top rounded with a groove to fasten the thread. On the upper part of the shaft there is a thread that holds a wooden peg; yarn is plied with a z-twist, direction of single twist is not visible. Cylindrical spindle whorl placed near the top of the shaft, with a whitish layer of encrustation on the upper surface, while the lower surface is clean. It is secured to the spindle by fibres and/or wooden fragments visible inside the hole.

**033** S. 07526/034

**Spindle** l. 17.4 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.3 cm, th. 1.4 cm, hole 0.9 cm. W. 18 g.

**Material** wood; vegetable fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with rounded top and groove to fasten the thread. Near the top, under the spindle whorl, there is a single s-plied, thread; single twist not visible. A cylindrical spindle whorl is placed near the top of the shaft, with a thick layer of encrustation on its upper surface, while the lower surface is clean with an incised mark.

**034** S. 07526/035

**Spindle** l. 15 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.2 cm, th. 1.1 cm, hole 0.9 cm. W. 15 g.

**Material** wood; vegetable fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom. Top was likely broken in ancient times, as a thread is fastened to the break; this thread holds a wooden peg and is s-plied, single twist not visible. The yarn is quite encrusted and partly stuck in the hole of the spindle whorl. Cylindrical spindle whorl placed near the top of the shaft, with a thick layer of encrustation on the upper surface, while lower surface and side show a thin layer of patina. From the lower side of the hole emerges a yarn.

**035** S. 07526/036

**Spindle** l. 13.3 cm, diam. 0.9 cm. **Spindle whorl** diam. 4.4 cm, th. 1.7 cm, hole. 0.8 × 0.9 cm. W. 15 g.

**Material** wood; vegetable fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with flat top and an incised groove. Cylindrical spindle whorl near the top of the shaft, small and thick, with a lateral break, and a very worn surface.

**036** S. 07526/037

**Spindle** l. 12.9 cm, diam. 1 cm. **Spindle whorl** diam. 4.8 cm, th. 1.4 cm, hole. 0.9 × 1 cm. W. 15 g.

**Material** wood; vegetable fibres.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, with a flat top and an incised groove. Cylindrical spindle whorl placed near the top of the shaft, with upper surface covered by a thick coat of encrustation.

**037** S. 07526/038
**Spindle** l. 14.4 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.1 cm, th. 1.8 cm, hole 0.9 cm. W. 16 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, with a flat top and a groove to fasten the thread. Shaft grows thicker towards the break. Cylindrical spindle whorl placed near the top of the shaft, with the upper surface covered by a thick layer of encrustation with whitish efflorescence.

**038** S. 07526/039
**Spindle** l. 15.7 cm, diam. 0.9 cm. **Spindle whorl** diam. 4.8 cm, th. 1.3 cm, hole 0.9 cm. W. 16 g.
**Material** wood; vegetable fibres.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, with a flat top and an incised groove. On the shaft, under the spindle whorl, there are traces of unspun fibres, which make two complete rotations, but there is no twist seen in them. Cylindrical spindle whorl placed near the top of the shaft, with the upper surface highly encrusted. Deep break on the side.

**039** S. 07526/040
**Spindle** l. 11.7 cm, diam. 0.8 cm. **Spindle whorl** diam. 5.5 cm, th. 1.8 cm, hole 0.8 cm. W. 14 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, with rounded top and incised groove. Cylindrical spindle whorl near the top of the shaft, not encrusted.

**040** S. 07526/041
**Spindle** l. 10 cm, diam. 0.8 cm. **Spindle whorl** diam. 4.9 cm, th. 1.2 cm, hole 0.8 cm. W. 12 g.
**Material** wood; vegetable fibres.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, with a flat top and an incised groove. On the shaft a mark is incised. A cylindrical spindle whorl is set near the top of the shaft; encrusted on the upper surface.

**041** S. 07526/042
**Spindle** l. 9.7 cm, diam. 0.9 cm. **Spindle whorl** diam. 4.8 cm, th. 1.4 cm, hole 0.9 cm. W. 13 g.
**Material** wood; vegetable fibres.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at both ends with fibre traces on the shaft. Cylindrical spindle whorl near the top (?) of the shaft, with one surface covered by a thick layer of encrustation.

**042** S. 07526/043
**Spindle** l. 9.4 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.3 cm, th. 1.8 cm, hole 0.8 × 0.9 cm. W. 18 g.
**Material** wood; vegetable fibres.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at both ends. Cylindrical spindle whorl, with one surface covered by a thick layer of encrustation.

**043** S. 07526/044
**Spindle** l. 8.9 cm, diam. 0.7 cm. **Spindle whorl** diam. 5.2 cm, th. 1.6 cm, hole 0.7 cm. W. 16 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at both ends. Cylindrical spindle whorl attached, with one surface covered by a thick layer of whitish encrustation.

**044** S. 07526/045
**Spindle** l. 15.4 cm, diam. 1.2 cm. **Spindle whorl** diam. 5.2 cm, th. 1.4 cm, hole 1.2 cm. W. 16 g.

**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, with flat top and an incised groove. Cylindrical spindle whorl near the top of the shaft covered by a thin patina.

**045** S. 07526/046
**Spindle** l. 19 cm, diam. 1 cm. **Spindle whorl** diam. 5.4 cm, th. 1.6 cm, hole 0.9 × 1 cm. W. 17 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, while top is broken along the groove used to fasten the thread. Cylindrical spindle whorl near the top of the shaft, with a large hole on the side, probably produced by insects.

**046** S. 07526/047
**Spindle** l. 21.4 cm, diam. 1 cm. **Spindle whorl** diam. 5.1 cm, th. 1.1 cm, hole 1 cm. W. 14 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle almost complete, point missing, while top is broken along the groove to fasten the thread. A cylindrical spindle whorl is placed near the top of the shaft, with clean surfaces and four radial incisions on its lower side.

**047** S. 07526/048
**Spindle** l. 21.7 cm. **Spindle whorl** diam. 5.5 cm, th. 1.4 cm, hole 0.9 × 1 cm. W. 14 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, with rounded top and a groove to fasten the yarn. Cylindrical spindle whorl on the top of the shaft; on the lower surface there is a mark.

**048** S. 07526/049
**Spindle** l. 5.4 cm, diam. 1 cm. **Spindle whorl** diam. 5.3 cm, th. 1.8 cm, hole 1 cm. W. 17 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at both ends. Cylindrical spindle whorl highly worn but clear of encrustation. On one side there are traces of a pinkish paint.

**049** S. 07526/050
**Spindle** l. 5.7 cm, diam. 0.8 cm. **Spindle whorl** diam. 4.5 cm, th. 2.1 cm, hole 0.8 cm. W. 14.4 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken immediately under the spindle whorl, flat top preserved with an incised groove to fasten the thread. Cylindrical spindle whorl placed near the top of the shaft, quite thick and with a thin layer of patina on the lower surface.

**050** S. 07526/051
**Spindle** l. 11.1 cm, diam. 1.2 cm. **Spindle whorl** diam. 6.1 cm, th. 1.5 cm, hole 1.1 cm. W. 17.5 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, with flat top and incised groove. Cylindrical spindle whorl placed near the top, covered by a thin layer of patina.

**051** S. 07526/052
**Spindle** l. 11 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.1 cm, th. 1.6 cm, hole 0.9 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, with flat top and incised groove. Cylindrical spindle whorl placed near the top, covered by a thin layer of patina. Small wedges of wood in the hole that fastens the spindle whorl.

**052** S. 07526/053
**Spindle** l. 7.6 cm, diam. 0.7 cm. **Spindle whorl** diam. 4.8 cm, th. 1.9 cm, hole 0.7 cm. W. 12 g.
**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at both ends. Cylindrical spindle whorl, quite thick and clean. Wood slightly warped.

**053** S. 07526/054
**Spindle** l. 8.9 cm, diam. 0.8 cm. **Spindle whorl** diam. 5.5cm, th. 1.5 cm, hole 0.8 cm. W. 12.8 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle whorl broken at the bottom, with rounded but chipped top and an incised groove to fasten the threads. Cylindrical spindle whorl placed near the top of the shaft, quite encrusted and with a mark incised on the lower surface.

**054** S. 07526/055
**Spindle** l. 18 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.2 cm, th. 1.5 cm, hole 0.9 cm. W. 21 g.
Wooden spindle broken at both ends, but most of its shaft is preserved. At the top, there are still traces of the groove to fasten the fibres. Cylindrical spindle whorl placed near the top of shaft, quite encrusted on its whole surface.

**055** S. 07526/056
**Spindle** l. 11 cm, diam. 0.8 cm. **Spindle whorl** diam. 5 cm, th. 1.5 cm, hole 0.8 cm. W. 14 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at one end, while the other ends with a sharp point. Spindle whorl is placed near the break and has two short incised lines on one surface.

**056** S. 07526/057
Spindle l. 19.1 cm, diam. 0.8 cm. **Spindle whorl** diam. 4.4 cm, th. 1.3 cm, hole 0.8 cm. W. 22 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at both ends, the upper one along the groove to fasten the thread. Cylindrical spindle whorl placed near the top of the shaft, slightly encrusted and with a lateral break.

**057** S. 07526/058
**Spindle** l. 10.9 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.8 cm, th. 1.1 cm, hole 0.9 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, with rounded top and an incised spiral groove to fasten the fibres. Cylindrical spindle whorl placed near the top of the shaft, covered by a very thin patina. On the lower surface some marks (?) are incised.

**058** S. 07526/059
**Spindle** l. 11.4 cm. **Spindle whorl** diam. 4.2 cm, th. 1.2 cm, hole 0.6 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, with rounded top and a spiral groove to fasten the thread. Cylindrical spindle whorl placed near the top of the shaft, covered by a thin layer of patina. On the lower surface there are traces of the manufacturing process.

**059** S. 07526/060
**Spindle** l. 16.9 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.7 cm, th. 1.3 cm, hole 0.9 cm. W. 16 g.
**Material** wood, vegetable fibres.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at both ends, but most of the shaft probably preserved. Cylindrical spindle whorl placed near one end of the shaft, covered by a thin layer of patina and with a lateral break. Hole warped on its edges. Flax fibres are visible in the lower part of the hole.

**060** S. 07526/061
**Spindle** l. 21.7 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.2 cm, th. 1.3 cm, hole 0.9 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with rounded top and a very well-preserved spiral groove. Shaft almost complete. Cylindrical spindle whorl placed near the top of the shaft, covered by a thin layer of patina on the upper surface and with a lateral break.

**061** S. 07526/062

**Spindle** l. 15.4 cm, diam. 0.8 cm. **Spindle whorl** diam. 4.8 cm, th. 1.5 cm, hole 0.8 cm. W. 15 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at one end, the other seems to finish with a sharp point. Cylindrical spindle whorl placed near sharp tip and covered by a thin layer of patina. On this side there is an incised mark.

**062** S. 07526/063

**Spindle** l. 11.7 cm, diam. 1 cm. **Spindle whorl** diam. 4.6 cm, th. 1.6 cm, hole 0.9 cm. W. 16 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina

Wooden spindle broken at the bottom, while top is flat with an incised groove on it. Cylindrical spindle whorl placed near the top of the shaft; on the lower surface, there is an incised mark.

**063** S. 07526/064

**Spindle** l. 6.8 cm, diam. 0.8 cm. **Spindle whorl** diam. 4.9 cm, th. 1.4 cm, hole 0.8 cm. W. 12 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina

Wooden spindle broken at the bottom, with rounded top and spiral groove. Cylindrical spindle whorl placed near the top of the shaft covered by a thin layer of patina.

**064** S. 07526/065

**Spindle** l. 9.2 cm, diam. 1 cm. **Spindle whorl** diam. 5.5 cm, th. 1.4 cm, hole 1 cm. W. 15 g.

**Material** wood; vegetable fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina

Wooden spindle broken at both ends. Near one of the break there is an incised mark. Cylindrical spindle whorl placed near the top of the shaft encrusted on the upper surface with whitish material. Between shaft and spindle whorl there are traces of vegetable fibres.

**065** S. 07526/066

**Spindle** l. 11.4 cm, diam. 0.8 cm. **Spindle whorl** diam. 5.2 cm, th. 1.8 cm, hole 0.8 cm. W. 17 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, while the other end is rounded, with a spiral groove, but highly encrusted. Cylindrical spindle whorl placed near the top of the shaft with a thick layer of encrustation on the upper surface. Some incisions (wear marks?) on the lower surface.

**066** S. 07526/067

**Spindle** l. 10 cm, diam. 1 cm. **Spindle whorl** diam. 5.1 cm, th. 1.9 cm, hole 0.8 cm. W. 18 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina

Wooden spindle broken at the bottom with a rounded end with an incised spiral groove. Cylindrical spindle whorl placed near the top of the shaft, slightly encrusted and cracked.

**067** S. 07526/068

**Spindle** l. 6.6 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.1 cm, th. 1.1 cm, hole 0.9 cm. W. 10.5 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at both ends. Cylindrical spindle whorl, large and flat, with some marks on one surface, some of them covered by a whitish substance.

**068** S. 07526/069

**Spindle** l. 9.9 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.4 cm, th. 1.2 cm, hole 0.7 cm. W. 14 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with flat top and an incised spiral groove. Wood perfectly preserved. Cylindrical spindle whorl placed near the top of the shaft covered by a thin patina and some traces of a pinkish paint.

**069** S. 07526/070

**Spindle** l. 15.6 cm, diam. 1 cm. **Spindle whorl** diam. 4.8 cm, th. 1.5 cm, hole 1 cm. W. 15 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at both ends, with rounded top and spiral groove. Thick traces of encrustation on the top. Cylindrical spindle whorl placed near the top of the shaft, encrusted on the upper surface.

**070** S. 07526/071

**Spindle** l. 8.6 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.6 cm, th. 1.5 cm, hole 0.7 cm. W. 14 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina

Wooden spindle broken at both ends. Cylindrical spindle whorl placed near the top of the shaft with encrustation on the upper surface.

**071** S. 07526/072

**Spindle** l. 8.8 cm, diam. 0.8 cm. **Spindle whorl** diam. 4 cm, th. 1.8 cm, hole 0.8 cm. W. 12 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina

Wooden spindle broken at the bottom, while the other end is slightly pointed and has a small groove to fasten the thread. Cylindrical spindle whorl placed near the top of the shaft with lateral breaks. Encrusted on the upper surface.

**072** S. 07526/073

**Spindle** l. 3.9 cm, diam. 0.8 cm. **Spindle whorl** diam. 5.3 cm, th. 1.1 cm, hole 0.8 cm. W. 8.5 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina

Wooden spindle broken at the bottom immediately under the spindle whorl, with a flat top and a groove to fasten the thread. Cylindrical spindle whorl, large and flat, encrusted on the upper surface. On the lower surface are traces of painted radial lines.

**073** S. 07526/074

**Spindle** l. 22 cm, diam. 1 cm. **Spindle whorl** diam. 5 cm, th. 2.1 cm, hole 1 cm. W. 18 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina

Complete wooden spindle, pointed bottom and rounded top. On the top, there is a long spiral groove. Cylindrical spindle whorl placed near the top of the shaft.

**074** S. 07526/075

**Spindle** l. 12.7 cm, diam. 1 cm. **Spindle whorl** diam. 5.5 cm, th. 1.4 cm, hole 1 cm. W. 17 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina

Wooden spindle broken at the bottom, while top is rounded with a spiral groove. Cylindrical spindle whorl placed near the top of the shaft. Cylindrical spindle whorl, not very well shaped, is completely clean and with a mark incised on the lower surface.

**075** S. 07526/076

**Spindle** l. 18.8 cm, diam. 0.8 cm. **Spindle whorl** diam. 4.6 cm, th. 1.1 cm, hole 0.8 cm. W. 14 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina

Wooden spindle broken at the top (probably), while the other end tapered to a rounded point. Cylindrical spindle whorl placed almost at the

middle of the surviving length of the shaft, quite near to the point. Small hole on one surface.

**076** S. 07526/077

**Spindle** l. 14.6 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.2 cm, th. 1.2 cm, hole 0.9 cm. W. 16 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at both ends. Cylindrical spindle whorl placed near the top of the shaft (only partly preserved) with encrustation on the upper surface.

**077** S. 07526/078

**Spindle** l. 14.2 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.1 cm, th. 1.2 cm, hole 0.9 cm. W. 18 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with rounded top and an incised spiral groove. Cylindrical spindle whorl placed near the top of the shaft, with a very thick layer of encrustation, which partly covers the upper part of the shaft too.

**078** S. 07526/079

**Spindle** l. 7.8 cm, diam. 0.7 cm. **Spindle whorl** diam. 5.3 cm, th. 1.4 cm, hole 0.7 cm. W. 15 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with a very well-preserved flat top and a spiral groove. Cylindrical spindle whorl, not perfectly rounded, placed near the top of the shaft and slightly encrusted on the upper surface.

**079** S. 07526/080

**Spindle** l. 10.3 cm, diam. 0.8 cm. **Spindle whorl** diam. 4.9 cm, th. 1.3 cm, hole 0.8 cm. W. 13 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with top that still preserves the groove to fasten the thread. Wood very worn. Cylindrical spindle whorl placed near the top of the shaft, chipped laterally.

**080** S. 07526/081

**Spindle** l. 8.5 cm, diam. 0.7 cm. **Spindle whorl** diam. 4.6 cm, th. 1.3 cm, hole 0.7 cm. W. 9 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina

Wooden spindle broken at both ends. Well-shaped cylindrical spindle whorl.

**081** S. 07526/082

**Spindle** l. 11.1 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.4 cm, th. 1.4 cm, hole 0.9 cm. W. 8 g.

**Material** wood, vegetable fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina

Wooden spindle broken at the bottom, while top is partially broken along the spiral groove. This groove still preserves some vegetable fibres and threads under a layer of encrustation. Cylindrical spindle whorl placed near the top of the shaft, upper surface encrusted, lower surface clean with traces of manufacture and three small holes (probably caused by insects).

**082** S. 07526/083

**Spindle** l. 8.6 cm, diam. 0.8 cm. **Spindle whorl** diam. 5.3 cm, th. 1.4 cm, hole 0.8 cm. W. 13

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina

Wooden spindle broken at the bottom, with rounded top and large, spiral groove to fasten the thread. Cylindrical spindle whorl placed near the top of the shaft with a thin patina on its surface.

**083** S. 07526/084

**Spindle** l. 9 cm, diam. 0.7 cm. **Spindle whorl** diam. 4.4 cm, th. 1.4 cm, hole 0.7 cm. W. 9.8 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with a flat top and a groove. Cylindrical spindle whorl placed

near the top of the shaft, one face encrusted, the other covered by a thin patina.

**084** S. 07526/085

**Spindle** l. 4.6 cm, diam. 0.8 cm. **Spindle whorl** diam. 5.2 cm, th. 1.4 cm, hole 0.8 cm. W. 15 g.

**Material** wood, vegetable fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, immediately under the spindle whorl, rounded top with a groove. Cylindrical spindle whorl placed near the top of the shaft, with a very thick layer of encrustation, which covers its upper surface and part of the shaft. Traces of fibres under the encrustation and a small fragment of wood attached to it. Lower surface covered with just a thin patina.

**085** S. 07526/086

**Spindle** l. 12.2 cm, diam. 0.7 cm. **Spindle whorl** diam. 4.6 cm, th. 1.5 cm, hole 0.7 cm. W. 11.7 g.

**Material** wood, vegetable fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom and rounded top with spiral groove, which is much encrusted. Traces of vegetable fibres under the encrustation. Cylindrical spindle whorl placed near the top of the shaft, with a thick layer of encrustation on the upper surface, while a thin patina covers the lower surface.

**086** S. 07526/087

**Spindle** l. 10.2 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.4 cm, th. 1.6 cm, hole 0.9 cm. W. 18.5 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with a flat top and a cylindrical groove. Cylindrical spindle whorl once placed at the top of the shaft (there is still an area of different colour on the wood), now near the break. Surfaces quite clean.

**087** S. 07526/088

**Spindle** l. 13 cm, diam. 0.7 cm. **Spindle whorl** diam. 5.6 cm, th. 1.2 cm, hole 0.7 cm. W. 15 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at both ends. Cylindrical spindle whorl placed near one of the breaks in the shaft and slightly encrusted.

**088** S. 07526/089

**Spindle** l. 10 cm, diam. 0.7 cm. **Spindle whorl** diam. 5.5 cm, th. 1.1 cm, hole 0.7 cm. W. 12 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at both ends. Cylindrical spindle whorl placed near one of the breaks in the shaft, clean but extremely worn. Incised mark on one surface.

**089** S. 07526/090

**Spindle** l. 8.2 cm, diam. 0.8 cm. **Spindle whorl** diam. 5 cm, th. 1.4 cm, hole 0.8 cm. W. 11 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with rounded top and spiral groove to fasten the thread. The shaft's wood has been extracted from a large log, which is evident from the growth rings. Cylindrical spindle whorl placed near the top of the shaft, with clear surfaces.

**090** S. 07526/091

**Spindle** l. 9.7 cm, diam. 0.8 cm. **Spindle whorl** diam. 5.3 cm, th. 1.4 cm, hole 0.8 cm. W. 16 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with flat top and a spiral groove. Wood and top well preserved. Cylindrical spindle whorl placed near the top of the shaft, with the upper surface quite worn.

**091** S. 07526/092

**Spindle** l. 17.8 cm, diam. 1 cm. **Spindle whorl** diam. 5.1 cm, th. 1.6 cm, hole 0.8 cm. W. 21 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with a flat top, partially broken along the groove. Covered by a thick layer of encrustation. Cylindrical spindle whorl placed near the top of the shaft, very encrusted on the upper surface, less on the lower.

**092** S. 07526/093

**Spindle** l. 21 cm, diam. max 1 cm. **Spindle whorl** diam. 5.7 cm, th. 1.7 cm, hole 0.9 × 1 cm. W. 20 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken and cracked at the bottom, with a flat top and a long, almost vertical, groove. Cylindrical spindle whorl placed near the top of the shaft, with a thick layer of encrustation.

**093** S. 07526/094

**Spindle** l. 15 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.7 cm, th. 1.7 cm, hole 0.9 cm. W. 19 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with a flat top and a small groove. Cylindrical spindle whorl placed near the (probable) centre of the shaft, with a large lateral break. A thick layer of encrustation covers the upper surface while the lower surface is clean.

**094** S. 07526/095

**Spindle** l. 18.4 cm, diam. 1.1 cm. **Spindle whorl** diam. 5.4 cm, th. 1.8 cm, hole 0.9 × 1 cm. W. 19 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken and cracked at the bottom, with a flat top and a spiral groove. The spindle has been extracted from a large log; there are 3-4 visible rings. Cylindrical spindle whorl placed near top of the shaft, highly worn. Spindle and spindle whorl are made of different woods.

**095** S. 07526/096

**Spindle** l. 11.3 cm, diam. 1.1 cm. **Spindle whorl** diam. 5.4 cm, th. 1.6 cm, hole 0.9 cm. W. 17 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with a rounded top and a spiral groove. Cylindrical spindle whorl placed near the top of the shaft. Mark on the upper surface.

**096** S. 07526/097

**Spindle** l. 9.5 cm, diam. 1 cm. **Spindle whorl** diam. 5.5 cm, th. 1.2 cm, hole 0.9 cm. W. 15 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with a flat top and a spiral groove. Cylindrical spindle whorl placed near the top of the shaft, clean and with evident wood pores.

**097** S. 07526/098

**Spindle** l. 8.1 cm, diam. 1.1 cm. **Spindle whorl** diam. 4.7 cm, th. 1.4 cm, hole 1 cm. W. 11 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at both ends. Cylindrical spindle whorl, quite irregular in shape with whitish encrustation on the surface.

**098** S. 07526/099

**Spindle** l. 9.8 cm, diam. 1 cm. **Spindle whorl** diam. 4.9 cm, th. 1.7 cm, hole 0.9 cm. W. 15 g.

**Material** wood, vegetable fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom end, with a rounded top and a spiral groove. Head covered by encrustation and whitish efflorescence. Cylindrical spindle whorl placed near the top of the shaft. On the upper part of the shaft there is a thread pre-

served for a few centimetres, which continues in the hole of the spindle whorl. Thread is s-plyed.

**099** S. 07526/100

**Spindle** l. 8.9 cm, diam. 1 cm. **Spindle whorl** diam. 4.8 cm, th. 1.5 cm, hole 0.8 × 0.9 cm. W 13 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with an incomplete top and a spiral groove. Cylindrical spindle whorl placed near the top of the shaft, quite clean and with visible wood pores.

**100** S. 07526/101

**Spindle** l. 5.6 cm, diam. 1.1 cm. **Spindle whorl** diam. 5.4 cm, th. 1.5 cm, hole 0.9 × 1.1 cm. W. 16 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at both ends. Cylindrical spindle whorl, well-shaped, with one encrusted side and the other one clean.

**101** S. 07526/102

**Spindle** l. 3.8 cm, diam. 0.8 cm. **Spindle whorl** diam. 5.1 cm, th. 1.1 cm, hole 0.8 cm. W. 13 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with a flat top and a spiral groove. Cylindrical spindle whorl placed near the top of the shaft, with the upper surface very encrusted. On the lower surface a mark is incised. Chipped on the side.

**102** S. 07526/103

**Spindle** l. 4.2 cm, diam. 0.8 cm. **Spindle whorl** diam. 5 cm, th. 1.5 cm, diam. hole 0.8 cm. W. 12 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at both ends, but a spiral groove is preserved. Cylindrical spindle whorl placed near the top of the shaft, chipped on the side. The upper surface is encrusted while the lower one is clean and wood pores are visible.

**103** S. 07526/104

**Spindle** l. 5.8 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.7 cm, th. 1.2 cm, diam. hole 0.9 cm. W. 13 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at both ends. Cylindrical spindle whorl slightly encrusted on both sides.

**104** S. 07526/105

**Spindle** l. 5.7 cm, diam. 0.85 cm. **Spindle whorl** diam. 4.8 cm, th. 2.1 cm, hole 0.9 cm. W. 12 g.

**Material** wood, vegetable fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with a rounded top and a spiral groove. Domed spindle whorl, with large and thick engraving on the lower surface, along the external diameter. It is placed near the top of the shaft. Upper part of the spindle and spindle whorl show a thick layer of encrustation, from which traces of fibres appear. In the hole there are wedges to fasten the spindle whorl to the shaft.

**105** S. 07526/107

**Spindle** l. 3.7 cm, diam. 0.6 cm. **Spindle whorl** diam. 5 cm, th. 1.6 cm, hole 0.6 cm. W. 14.5 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with a rounded top and a spiral groove. Cylindrical spindle whorl, roughly cut, placed near the top of the shaft. Encrusted on the upper surface, clean on the other side with evident traces of manufacture.

**106** S. 07526/108

**Spindle** l. 21.1 cm, diam. 1.1 cm. **Spindle whorl** diam. 5.8 cm, th. 2.2 cm, hole 1.3 × 1.1 cm. W. 19 g.

**Material** wood, vegetable fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle, complete. Flat top with a very long spiral groove to fasten fibres and a pointed end. Shaft shows several spots, probably due to mold. Cylindrical spindle whorl, remarkably worn, placed near top of the shaft, with encrustations on the upper surface and several holes probably caused by insects. Inside the hole, there are wedges and remains of threads. On the side of the spindle whorl a textile fragment is preserved, probably attached by encrustation. It measures 1.72 × 1.91 cm; it is a tabby weave with a count of 13 × 10 threads per $cm^2$. Thread is s-twist.

**107** S. 07526/109

**Spindle** l. 25.5 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.6 cm, th. 1.3 cm, hole 0.8 × 0.9 cm. W. 21 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, with a flat top and a spiral groove. Shaft almost complete. Cylindrical spindle whorl placed near the top of the shaft, with both surfaces covered by a thin patina.

**108** S. 07527/05

**Spindle** l. 7 cm, diam. 1.1 cm. **Spindle whorl** diam. 5.2 cm, th. 1.9 cm, diam. 1.1 cm. W. 19 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom near the spindle whorl, with a flat top and a spiral groove. Cylindrical spindle whorl placed near the top of the shaft, with encrusted upper surface and a mark incised on the lower surface.

**109** S. 07527/08

**Spindle** diam. 0.8 cm. **Spindle whorl** diam. 5.4 cm, th. 1.2 cm, hole 0.8 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends. Cylindrical spindle whorl with lateral crack filled by a little wooden peg. Other smaller cracks are also present. Mark incised on the lower surface.

**110** S. 07527/12

**Spindle** l. 4.6 cm, diam. 0.8 cm. **Spindle whorl** diam. 5 cm, th. 1.7 cm, hole 0.8 cm. W. 10.7 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, immediately under the spindle whorl, with a rounded top and a spiral groove. Cylindrical spindle whorl placed near the top of the shaft, with encrusted upper surface and several marks incised on the lower surface.

**111** S. 07527/15

**Spindle** l. 5.1, diam. 1 cm. **Spindle whorl** diam. 4.9 cm, th. 1.7 cm, hole 1 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, immediately under the spindle whorl, with cracked top and a spiral groove. Cylindrical spindle whorl placed near the top of the shaft, with worn upper surface and a lotus flower incised on the lower surface.

**112** S. 07528/049

**Spindle** l. 3.2 cm, diam. 0.7 cm. **Spindle whorl** diam. 5 cm, th. 1.3 cm, hole 0.7 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends. Cylindrical spindle whorl, well-shaped, with one surface more encrusted than the other one.

**113** S. 07528/052

**Spindle whorl** diam. 5.1 cm, th. 1.4 cm, hole 0.7 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends preserved inside the hole. Cylindrical spindle whorl, well-shaped, with one surface encrusted.

**114** S. 07528/054

**Spindle** l. 1.8 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.3 cm, th. 1.8 cm, hole 0.9 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends. Cylindrical spindle whorl, warped, with a long radial crack to the central hole. Covered by a thin patina.

**115** S. 07528/065

**Spindle** l. 2.2 cm, diam. 0.9 cm. **Spindle whorl** diam. 5 cm, th. 1.6 cm, hole 0.9 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of spindle broken at both ends. Cylindrical spindle whorl covered by encrustation.

**116** S. 07528/067

**Spindle whorl** diam. 5.2 cm, th. 1.2 cm, hole 0.8 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with a fragment of spindle preserved inside the hole. Encrusted surface with whitish efforescences.

**117** S. 07528/069

**Spindle** l. 2.3 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.3 cm, th. 1.3 cm, hole 0.9 cm. W. 14 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small part of wooden spindle broken at both ends. Cylindrical spindle whorl covered on one surface by encrustation and whitish efflorescences.

**118** S. 07528/071

**Spindle** diam. 0.9 cm. **Spindle whorl** diam. 5.4 cm, th. 1.1 cm, hole 0.9 cm. W. 8 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of spindle broken at both ends. Cylindrical spindle whorl with long radial fracture, covered by a thin patina.

**119** S. 07528/072

**Spindle** l. 3.4 cm, diam. 0.9 cm. **Spindle whorl** diam. 5.5 cm, th. 1.1 cm, hole 0.9 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends with traces of a spiral groove. Cylindrical spindle whorl, complete, covered by encrustation.

**120** S. 07528/080

**Spindle** l. 1.3, diam.0.9 cm. **Spindle whorl** diam. 5.1 cm, th. 1.5 cm, hole 0.9 × 0.7 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends. Cylindrical spindle whorl covered by encrustation.

**121** S. 07528/084

**Spindle** l. 1.4, diam. 0.9 cm. **Spindle whorl** diam. 4.9 cm, th. 1.4 cm, hole 0.9 cm. W. 12 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends. Cylindrical spindle whorl encrusted on one side, covered by a thin patina and whitish efflorescence on the other. Incised mark.

**122** S. 07528/085

**Spindle** l. 3.3 cm, diam. 0.7 cm. **Spindle whorl** diam. 4.5 cm, th. 2 cm, hole 0.7 cm. W. 14 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends. Cylindrical spindle whorl, warped, with a radial crack to the hole.

**123** S. 07528/086

**Spindle** l. 3.7 cm, diam. 1.1 cm. **Spindle whorl** diam. 5.8 cm, th. 1.7 cm, hole 1 × 1.1 cm. W. 16 g.
**Material** wood, vegetable fibres.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle with a groove for fastening the fibres still preserved. Cylindrical spindle whorl encrusted on the surface, with traces of vegetable fibres inside the hole.

**124** S. 07528/087

**Spindle** l. 2.4 cm, diam. 1 cm. **Spindle whorl** diam. 5.4 cm, th. 1 cm, hole 0.9 cm. W. 12 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends. Cylindrical spindle whorl with traces of manufacture.

**125** S. 07528/088

**Spindle** l. 2.8 cm, diam. 1 cm. **Spindle whorl** diam. 5.2 cm, th. 1 cm, hole 1.4 cm. W. 9 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends. Cylindrical spindle with lateral crack and encrusted surface.

**126** S. 07528/090

**Spindle** diam. 0.8 cm. **Spindle whorl** diam. 4.9 cm, th. 1.9 cm, hole 0.8 cm. W. 11.6 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends. Cylindrical spindle whorl, warped, with traces of encrustation.

**127** S. 07528/091

**Spindle** l. 5.2 cm, diam. 1.1 cm. **Spindle whorl** diam. 5.6 cm, th. 1.7 cm, hole 0.9 cm. W. 17 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Fragment of wooden spindle broken at both ends. Cylindrical spindle whorl, warped, with traces of encrustation.

**128** S. 07528/094

**Spindle** l. 4 cm, diam. 0.7 cm. **Spindle whorl** diam. 4.7 cm, th. 1 cm, hole 0.7 cm. W. 5.7 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends. Cylindrical spindle whorl, warped, with traces of encrustation. Five thin radial lines incised near the edge, perhaps a mark.

**129** S. 07528/095

**Spindle** l. 3.5, diam. 0.9 cm. **Spindle whorl** diam. 5.2 cm, th. 1.8 cm, hole 0.9 cm. W. 21.8.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends. Cylindrical spindle whorl slightly encrusted.

**130** S. 07528/097

**Spindle** l. 3.1 cm, diam. 0.9 cm. **Spindle whorl** diam. 4.8 cm, th. 2 cm, hole 0.9 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends. Cylindrical spindle whorl with a thin layer of encrustation.

**131** S. 07528/098

**Spindle** l. 1 cm, diam. 0.6 cm. **Spindle whorl** diam. 4.9 cm, th. 1.9 cm, hole 0.6 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends. Cylindrical spindle whorl with a radial crack.

**132** S. 07528/100

**Spindle** l. 3.4 g, diam. 0.7 cm. **Spindle whorl** diam. 5.2 cm, th. 1.6 cm, hole 0.7 cm. W. 13.8 g.
**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends. Cylindrical spindle whorl covered by a thick layer of encrustation on one side while the other is clean.

**133** S. 07528/101
**Spindle** l. 2.5 diam. 0.9 cm. **Spindle whorl** diam. 5.5 cm, th. 1.3 cm, hole 0.9 cm. W. 14.8 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken immediately under the spindle whorl. Top preserved with groove to fasten fibres. Cylindrical spindle whorl with encrustation and two radial cracks.

**134** S. 07528/102
**Spindle** l. 3.8, diam. 0.7 cm. **Spindle whorl** diam. 5 cm, th. 1.5 cm, hole 0.7 cm. W. 14.6 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of wooden spindle broken at both ends. Cylindrical spindle whorl with a thin layer of patina, made of different wood from that of the shaft.

**135** S. 09978/1
**Spindle** l. 20.3 cm, diam 1 cm. **Spindle whorl** diam. 4.4 cm, th. 1.9 cm, hole 1 cm. W. 20 g.
**Material** wood, vegetable fibres.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle, well-preserved, with only the bottom missing. Flat top with a coarse groove with which to fasten fibres. Cylindrical spindle whorl, thicker than most others. It shows a crack on the side with a peg in it, probably an ancient restoration. Wooden wedges are quite visible, which fasten the whorl to the shaft. Under one wedge a thread is caught and is s-plyed.

**136** S. 09978/2
**Spindle** l. 12.5, diam. 0.9 cm. **Spindle whorl** diam. 5.1 cm, th. 1.6 cm, hole 0.9 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at both ends. Cylindrical spindle whorl covered by a whitish substance on one surface and on the side.

**137** S. 09978/4
**Spindle** l. 15.8 cm, diam. 0.8 cm. **Spindle whorl** diam. 4.9 cm, th. 2.1 cm, hole 0.8 cm. W. 14 g (only whorl 12 g.).
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle badly preserved. Tapering towards one end with no traces of the groove. Cylindrical spindle whorl with some cracks and holes. Surface covered by encrustation and a white-yellowish substance. On one side an incised mark is present. Whorl complete but not firmly fastened on the shaft.

**138** S. 09978/5
**Spindle** l. 27 cm, diam. 1 cm. **Spindle whorl** diam. 5.4 cm, th. 1.4 cm, hole 1 cm. W. 24 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle well preserved. Flat top with a spiral groove to fasten the thread. It is covered by a thick layer of encrustation that leaves the groove clean. Cylindrical spindle whorl placed near top of the shaft and covered by a thick layer of encrustation and whitish efflorescence.

**139** S. 09978/6
**Spindle** l. 17.4 cm, diam.0.9 cm. **Spindle whorl** diam. 5.5 cm, th. 1.4 cm, hole 0.9 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, with flat top and a spiral groove to fasten the thread. Cylindrical spindle whorl placed near the top of the shaft and deep lateral break. Upper surface encrusted, lower surface quite clean. Hole of the whorl irregular and it is fastened to the shaft with wooden wedges and vegetable fibres.

**140** S. 09978/7

**Spindle** l. 35.8 cm, diam.1.2 cm. **Spindle whorl** diam. 4.6 cm, th. 1.4 cm, hole 1.2 cm. W. 27 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle, complete and well-preserved. Flat top with a spiral groove to fasten the thread, while the other end tapers to a point. Traces of brown encrustation are preserved on the top, on the shaft and inside the groove. A cylindrical spindle whorl is placed near the top of the shaft, is chipped and with a lateral hole.

**141** S. 09978/8

**Spindle** l. 23.8 cm, diam.0.8 cm. **Spindle whorl** diam. 5.4 cm, th. 1.6 cm, hole 0.8 cm. W. 22 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom. Pointed top with a spiral groove to fasten the thread. Both spindle and spindle whorl are covered by a thick layer of encrustation. Cylindrical spindle whorl placed near the top of the shaft with a small hole on the lower surface.

**142** S. 09978/9

**Spindle** l. 19.9 cm, diam. 1 cm. **Spindle whorl** diam. 5.4 cm, th. 1.3 cm, hole 1 cm. W. 16 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle, badly preserved and broken at the bottom. Flat top with a spiral groove to fasten the thread. Cylindrical spindle whorl placed near the top of the shaft, the whorl has a large lateral break and a hole.

**143** S. 09978/1 (bis)

**Spindle** l. 30.5 cm, diam. max. 1.1 cm. **Spindle whorl 1** diam. 4.8 cm, th. 1.8 cm, hole 0.8 × 1 cm. **Spindle whorl 2** diam. 6 cm, th. 1.5 cm, hole 1.05 cm.
**Total weight** 34 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle, badly preserved and broken at the bottom. Flat top with a spiral groove to fasten the thread. Two spindle whorls are attached to the shaft, but it is not possible to determine if one was added at a later time, but it is highly probable.
**Spindle whorl 1** Cylindrical, upper surface encrusted, side and lower surface only partially encrusted. Placed near the top of the shaft.
**Spindle whorl 2** Cylindrical, warped hole but without wedges. Upper surface clean, lower surface and side encrusted (normally the contrary is seen).
**Bibliography** Donadoni Roveri 1987, 188, tav. 260; 1988, 109; 2001, 18.

**144** S. 09978/4 bis

**Spindle** l. 25.7 cm, diam. 1 cm.
**Spindle whorl 1** diam. 4.7 cm, th.1.2 cm, hole 0.9 × 0.8 cm. **Spindle whorl 2** diam. 3.8 × 4 cm, th. 0.9 cm, diam. hole 0.9 × 1. cm.
**Total weight** 18g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at one end while two spindle whorls are attached at the other end, which tapers to a point. Two spindle whorls are preserved but probably did not originally belong to this spindle. Shaft quite encrusted.
**Spindle whorl 1** Cylindrical with a warp hole without wedges to adapt it to the shaft. Several breaks are present, one filled with a whitish substance.
**Spindle whorl 2** Cylindrical but very warped, hole is not in the centre and it is deformed, probably by previous wedges, here not present. Encrustation not present but surface covered by areas of whitish efflorescence.
**Bibliography** Donadoni Roveri 1987, 188, tav. 260; 1988, 109; 2001, 18.

**145** S. 09978/3 bis

**Spindle** l. 32.4 cm, diam. 1.1 cm. **Spindle whorl 1** diam. 5.4 cm, th. 1.1 cm, hole 0.9 cm (irregular). **Spindle whorl 2** diam. 5.1 cm, th. 2 cm, hole 1.1 cm. W. 37 g.
**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle slightly chipped at the top along the groove used to fasten the thread and also at the bottom, which is rounded and not pointed. Shaft is encrusted with two breaks, perhaps due to a restoration. It shows two spindle whorls on the shaft, one in the **origin**al position, near the groove, the other one probably added at a later time.

**Spindle whorl 1** Cylindrical, fastened to the shaft with wooden wedges. A light patina covers all sides and whitish efflorescences are present on the upper surface.

**Spindle whorl 2** Cylindrical, hole irregular. It shows encrustation on all sides and a lateral break. Lower surface is much more worn than the upper.

**Bibliography** Donadoni Roveri 1987, 188, tav. 260; 1988, 109; 2001, 18.

**146** S. 09978/5 bis

**Spindle** l. 37.2 cm, diam. 1.1 cm. **Spindle whorl 1**: diam. 4.7 cm, th. 1.6 cm, hole 0.8 cm. **Spindle whorl 2** diam. 4.7 cm, th. 1.7 cm, hole 1 cm. W. 31 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle, complete. Flat top with a spiral groove to fasten fibres and tapered towards the bottom. Both spindle whorls are placed near top of the shaft and cover the groove. Shaft slightly encrusted.

**Spindle whorl 1** cylindrical with irregular hole. Very encrusted on all sides, especially the lower one (in contrast to the other objects). Lateral break with wooden peg.

**Spindle whorl 2** Cylindrical, complete, with a thin patina on all sides.

**Bibliography** Donadoni Roveri 1987, 188, tav. 260; 1988, 109; 2001, 18.

**147** S. 09978/2

**Spindle** l. 34 cm, diam. 0.9 cm. **Spindle whorl 1** diam. 5.5 cm, th. 1.5 cm, hole 1.3, very irregular. **Spindle whorl 2** diam. 5.3 cm, th. 1.2 cm, hole 1.1 cm. W. 30 g.

**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken and chipped at the bottom. Rounded top with a spiral groove, very well shaped. Spindle whorls do not seem to belong to this shaft but to be added at a later time.

**Spindle whorl 1** Cylindrical, with one side of the hole large and irregular, while the other side is regular. All sides slightly encrusted with a lateral break.

**Spindle whorl 2** Cylindrical, with a chipped side. Small holes on all surfaces, perhaps caused by insects, and a lateral break. Lower surface with an incised cross.

**Bibliography** Donadoni Roveri 1988, 109. Donadoni Roveri 1987, 188, tav. 260.

**147** Provv. 4654/1

**Spindle** l. 12.7 cm, diam. 0.8 cm. **Spindle whorl** diam. 4.8 cm, th. 1.8 cm, hole 0.8 cm. W. 15 g.

**Material** wood, vegetable fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom with a flat top and a deep groove to fasten the threads. Some rounds of vegetable fibres, not twisted, are preserved on the groove. Knots to fasten the fibres are visible. Cylindrical spindle whorl placed near the top of the shaft. Traces of vegetable fibres are present also in the lower side of the hole, but difficult to see.

**149** Provv. 4654/2

**Spindle** l. 21 cm, diam. 0.8 cm. **Spindle whorl** diam 4.6 cm, th. 2.2 cm, diam. 0.8 cm. W. 14 g.

**Material** wood, vegetable fibres.

**Chronology** New Kingdom. **Origin** Deir el-Medina.

Wooden spindle broken at the bottom, with a rounded top and a deep groove to fasten the thread. Some rounds/coils of threads are preserved upon the groove and are fastened with several coils around a wooden peg. Fibres on the peg do not show twist, but a point of z-twist thread is also visible. Truncated cone spindle whorl is placed near the top of the shaft and fastened by visible wooden wedges.

**150** Provv. 4655

**Spindle** l. 21 cm, diam. 0.9 cm. **Spindle whorl** diam. 3.4 cm, th. 1.5 cm, hole 0.9 cm. W. 15 g.
**Material** wood.
**Chronology** unknown. **Origin** unknown.
Wooden spindle broken at both ends, but top still preserves traces of the groove used to fasten the thread. Biconical spindle whorl, flattened with convex profile, placed at the middle of the shaft.

**151** Provv. 4664

**Spindle** l. 7.5 cm, diam. 0.9 cm. **Spindle whorl** diam. 3.9 cm, th. 1.8 cm, hole 0.9 cm. W. 18 g.
**Material** wood.
**Chronology** unknown. **Origin** unknown.
Wooden spindle broken at both ends. Cylindrical spindle whorl with rounded edges on one side. The rounded surface is very worn and covered by a greyish patina; it also shows a lateral break and several small holes probably caused by insects.

**152** S. 07526/024

**Spindle** l. 8.4 cm, diam. 1 cm. W. 3.1 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at the bottom, while top is flat and has a deep spiral groove.

**153** S. 07526/106

**Spindle** l. 10.2 cm, diam. 0.9 cm. W. 2.8 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Wooden spindle broken at both ends.

**154** S. 09966/01

**Size** l. 15.2, diam. max. 3 cm
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrically-shaped object with tapering ends, of uncertain employment.

**155** S. 09966/02

**Size** l. 15.5, diam. 1.7 cm
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrically-shaped object with tapering ends, of uncertain employment.

**156** S. 07527/01

**Spindle whorl** diam. 5 cm, th. 1.3 cm, hole 0.7 cm. W. 7 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl partially broken. Clean surfaces with a mark incised on one side.

**157** S. 07527/02

**Spindle whorl** diam. 5 cm, th. 1.1 cm, hole 0.9 cm. W. 8.3 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, with an incised mark on one surface. One surface encrusted the other covered by a patina. One side of the hole is warped.

**158** S. 07527/03

**Spindle whorl** diam. 6 cm, th. 1.2 cm, hole 0.8. W. 17 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with an incised mark on one surface. On the same side there are several thin incised lines, but no precise sign is recognisable. One side of the hole is warped (same side of mark).

**159** S. 07527/04

**Spindle whorl** diam. 5.4, th. 1.3 cm, hole 0.7 cm. W. 8 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, with a mark on one side and a lateral break. Covered by a thin patina.

**160** S. 07527/06

**Spindle whorl** diam. 5.1, th. 1.8 cm, hole 0.8 cm. W. 11.9 g.

**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with an incised mark on one side and several small notches on the opposite surface. Clean surface. Cut from the central part of a tree trunk.

**161** S. 07527/07
**Spindle whorl** diam. 5.5 cm, th. 1.7 cm, hole 0.9 cm. W. 15.8 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, with three marks incised on one side; the other surface is covered by a thin patina.

**162** S. 07527/09
**Spindle whorl** diam. 5.1 cm, th. 1.9 cm, hole 1 cm. W. 17 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, with marks on both sides. One surface encrusted.

**163** S. 07527/10
**Spindle whorl** diam. 5.4, th. 1 cm, hole 0.6 cm. W. 8 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, with a mark incised on one side. Surface clean and hole warped.

**164** S. 07527/11
**Spindle whorl** diam. 6.2 cm, th. 1.2 cm, hole 0.8 cm. W. 18 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, with several marks incised on one side. Warped hole and holes caused by animals. Both surfaces are clean.

**165** S. 07527/13
**Spindle whorl** diam. 4.9 cm, th. 1.3 cm, hole 0.8 cm. W. 10.4 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, with marks on one side. Surfaces not encrusted but with traces of burning.

**166** S. 07527/14
**Spindle whorl** diam. 4.9 cm, th. 1.7 cm, hole 0.9 cm. W. 13.3 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with a mark incised on one side and on the same side several thin incised lines. Tree rings visible, cut from a large trunk.

**167** S. 07528/001
**Spindle whorl** diam. 5.4 cm, th. 1.3 cm, hole 0.8 cm. W.13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with a radial break that continues to the hole. On the surface there are dots of a thick whitish substance, perhaps stucco or paint.

**168** S. 07528/002
**Spindle whorl** diam. 5.1 cm, th. 1.4 cm, hole 1 × 0.8 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl chipped laterally. Encrusted on one surface, the other shows traces of manufacture.

**169** S. 07528/003
**Spindle whorl** diam. 5.1 cm, th. 1.6 cm, hole 0.7 × 0.8 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, with several holes probably caused by insects.

**170** S. 07528/004
**Spindle whorl** diam. 4.4 cm, th. 1.7 cm, hole 0.7 x 0.9 cm. W. 11 g.

**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, covered by a thin patina.

**171** S. 07528/005
**Spindle whorl** diam. 5.7 cm, th. 1.5 cm, hole 0.9 × 1.1 cm. W. 18 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, with several holes probably caused by insects.

**172** S. 07528/006
**Spindle whorl** diam. 5.5 cm, th. 1.2 cm, diam. hole 1 × 1.1 cm. W. 16 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete. One side show traces of a whitish substance. Warped hole.

**173** S. 07528/007
**Spindle whorl** diam. 5.3 cm, th. 1.6 cm, hole 0.6 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl with oval hole.

**174** S. 07528/008
**Spindle whorl** diam. 5.4 cm, th. 1.1 cm, hole 0.9 cm. W. 13.7 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl with deep lateral break that continues to the central hole. Whitish efflorescence is present on both sides.

**175** S. 07528/009
**Spindle whorl** diam. 6 cm, th. 1.3 cm, hole 0.9 cm. W. 18 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, well preserved and well-shaped. One side is covered by a thin patina.

**176** S. 07528/010
**Spindle whorl** diam. 5.3 cm, th. 1.5 cm, hole 0.7 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, badly preserved, with small lateral breaks.

**177** S. 07528/011
**Spindle whorl** diam. 5 cm, th. 1.6 cm, hole 0.9 × 1 cm. W. 10 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, well preserved with both surfaces slightly encrusted.

**178** S. 07528/012
**Spindle whorl** diam. 5.4 cm, th. 1.7 cm, hole 1 cm. W. 12 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl broken in two parts, badly restored with glue.

**179** S. 07528/013
**Spindle whorl** diam. 5.1 cm, th. 1.9 cm, hole 0.8 cm. W. 14 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete but slightly warped, one surface covered by a thin patina.

**180** S. 07528/014
**Spindle whorl** diam. 5.9 cm, th. 1.6 cm, hole 1 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, with several holes probably caused by insects; warped hole.

**181** S. 07528/015
**Spindle whorl** diam. 5.9 cm, th. 1.6 cm, hole 0.9. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, well-polished on both sides. One surface shows traces of brown encrustation, while the other may have yellowish paint.

**182** S. 07528/016
**Spindle whorl** diam. 5.1 cm, th. 1.6 cm, hole 0.7 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl with lateral crack. One surface is covered by a thick layer of encrustation, the other one by patina.

**183** S. 07528/017
**Spindle whorl** diam. 4 cm, th. 1.4 cm, hole 0.7 × 1 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl with lateral crack. One surface is covered by a thick layer of encrustation, the other by a thin patina.

**184** S. 07528/018
**Spindle whorl** diam. 5.3 cm, th. 1.7 cm, hole 0.7 × 1.1 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl with lateral crack. One side is encrusted.

**185** S. 07528/019
**Spindle whorl** diam. 4.8 cm, th. 1.2 cm, hole 0.5 × 0.7 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, with one surface covered by a thin layer of patina; the other one is encrusted and shows incised marks.

**186** S. 07528/020
**Spindle whorl** diam. 5.9 cm, th. 1.2 cm, hole 1 cm. W. 14 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, chipped, with a lateral break that continues to the central hole and another smaller fracture. One side is covered by a thin patina; the other one is encrusted and shows thin incisions, but no precise pattern is visible.

**187** S. 07528/021
**Spindle whorl** diam. 4.5 cm, th.1.9 cm, hole 1 cm. W. 10 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl with a deep fracture that continues to the central hole, which is quite warped near this crack. One surface is slightly encrusted, the other one shows whitish efflorescence near the hole.

**188** S. 07528/022
**Spindle whorl** diam. 5.6 cm, th. 1 cm, hole 0.7 cm. W. 9 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, well-shaped, but badly preserved and one surface highly worn. Clean and made of an unusual type of wood.

**189** S. 07528/023
**Spindle whorl** diam. 6.1 cm, th. 1.1 cm, hole 0.7 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, with one surface highly encrusted, the other one with a thin patina.

**190** S. 07528/024
**Spindle whorl** diam. 5.8 cm, th. 1.6 cm, hole 0.7 cm. W. 14 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina

Cylindrical spindle whorl, complete, with one side covered by a thick layer of encrustation.

**191** S. 07528/025
**Spindle whorl** diam. 5.2 cm, th. 1.3 cm, hole 0.7 cm. W. 14 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, with one side covered by encrustation and the other clean, with wood vases evident.

**192** S. 07528/026
**Spindle whorl** diam. 4.9 cm, th. 1.9 cm, hole 0.9 cm. W. 12 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, with one side covered by a thick layer of encrustation, the other one by a thin patina.

**193** S. 07528/027
**Spindle whorl** diam. 5.6 cm, th. 1 cm, hole 1 cm. W. 9 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete and clean.

**194** S. 07528/028
**Spindle whorl** diam. 6.2 cm, th. 1.3 cm, hole 0.8 cm. W. 18.7 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, with both sides covered with a thin patina and whitish encrustation.

**195** S. 07528/029
**Spindle whorl** diam. 5.4 cm, th. 1.6 cm, hole 0.9 cm. W. 17 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl with deep lateral crack. One side is encrusted and covered by a thick layer of whitish encrustation.

**196** S. 07528/030
**Spindle whorl** diam. 5.8 cm, th. 1.6 cm, hole1 × 1.2 cm. W. 17 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl with one side covered by a thick layer of encrustation and the other one by a thin patina.

**197** S. 07528/031
**Spindle whorl** diam. 5.1 cm, th. 1.6 cm, hole 0.9 × 0.7 cm. W. 12 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl with two deep lateral cracks that continue to the central hole. Worn surfaces and a yellowish spot on one side.

**198** S. 07528/032
**Spindle whorl** diam. 5.4 cm, th. 1.7 cm, hole 0.9 cm. W. 14 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, with one surface clean and the other covered by a thin patina.

**199** S. 07528/033
**Spindle whorl** diam. 5.2 cm, th. 1.2 cm, hole 0.9 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl with a deep lateral break. One side is covered by a thin patina and the other is clean.

**200** S. 07528/034
**Spindle whorl** diam. 5.6 cm, th. 1.2 cm, hole 0.9 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, broken, with the two fragments now poorly attached with glue. Worn and badly preserved.

**201** S. 07528/035
**Spindle whorl** diam. 4.5 cm, th. 1.6 cm, hole 0.7 × 0.9 cm. W. 10 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete. One surface and side are covered by brown encrustation, the other surface by greyish encrustation.

**202** S. 07528/036
**Spindle whorl** diam. 5.8 cm, th. 1.2 cm, hole 0.9 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete but quite worn. Elliptical, warped hole on both sides and surface covered by traces of encrustation.

**203** S. 07528/037
**Spindle whorl** diam. 5.7 cm, th. 1.4 cm, hole 0.9 × 1.1 cm. W. 14 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, with a warped polygonal hole, probably due to the insertion of several wedges.

**204** S. 07528/038
**Spindle whorl** diam. 5.7 cm, th. 1.3 cm, hole 0.7 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, slightly warped. It does not show traces of encrustation but spots of patina on the surface. One side has a knot. It was made from a longitudinal cut of a log.

**205** S. 07528/039
**Spindle whorl** diam. 6 cm, th. 1.3 cm, hole 0.7 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl with small lateral break. One side is covered by a thick layer of encrustation, the other one by patina. On this side, traces of manufacture are visible as well as the wood vases.

**206** S. 07528/040
**Spindle whorl** diam. 4.6 cm, th. 1.7 cm, hole 0.7 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, small and thick, completely preserved. One side is covered by a thick layer of encrustation.

**207** S. 07528/041
**Spindle whorl** diam. 5.6 cm, th. 1.3 cm, hole 1 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, one side covered by a thick layer of encrustation; the other one clean and with marks from its manufacture.

**208** S. 07528/042
**Spindle whorl** diam. 4.8 cm, th. 1.6 cm, hole 0.6 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl very well preserved. One side is covered by a thin layer of encrustation.

**209** S. 07528/043
**Spindle whorl** diam. 5.7 cm, th. 1.6 cm, hole 0.8 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with a deep lateral crack. One side is covered by a thick layer of encrustation and a break 'stopped' by a wooden peg, perhaps an ancient attempt of restoration. Hole is warped, worn by usage and wedges.

**210** S. 07528/044
**Spindle whorl** diam. 5.5 cm, th. 1.3 cm, hole 0.9 cm. W. 16 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.

Cylindrical spindle whorl with a deep lateral break. Badly preserved with darkened spots and whitish efflorescence. Different wood from other spindle whorls. One side shows signs of manufacture.

**211** S. 07528/045
**Spindle whorl** diam. 5 cm, th. 1.4 cm, hole 0.9 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with a small lateral fracture. One side is covered by a thick layer of encrustation and its hole is warped by ancient wedges.

**212** S. 07528/046
**Spindle whorl** diam. 5.1 cm, th. 1.2 cm, hole 0.5 × 0.7 cm. W. 12 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, with small hole. One side is covered by a thick layer of encrustation and whitish efflorescence. It shows also probable traces of yellowish paint.

**213** S. 07528/047
**Spindle whorl** diam. 4.8 cm, th. 1.2 cm, hole 0.8 × 0.6 cm. W. 7 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl with a lateral break and highly worn surfaces. One side is covered by a thin patina. Hole is warped by ancient wedges.

**214** S. 07528/048
**Spindle whorl** diam. 5.1 cm, th. 1.8 cm, hole 0.8 cm. W. 16 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with lateral crack and traces of encrustation.

**215** S. 07528/050
**Spindle whorl** diam. 4.7 cm, th. 1.7 cm, hole 1 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with a deep lateral crack that continues to the hole. One side is covered by a thick layer of encrustation.

**216** S. 07528/051
**Spindle whorl** diam. 5.8 cm, th. 1.5 cm, hole 0.9 cm. W. 16 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, with whitish encrustation on both surfaces. Traces of a yellowish paint (?) are visible on one surface and on side. On the same surface are present traces of burning.

**217** S. 07528/053
**Spindle whorl** diam. 4.9 cm, th. 1.7 cm, hole 0.9 × 0.8 cm. W. 9 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, with traces of encrustation.

**218** S. 07528/055
**Spindle whorl** diam. 6.1 cm, th. 1.2 cm, hole 1 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete and with encrusted surfaces. Hole is highly warped on one side probably due to ancient wedges.

**219** S. 07528/056
**Spindle whorl** diam. 5.4 cm, th. 1.6 cm, hole 1 × 0.8 cm. W. 17 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with a thick layer of encrustation and traces of yellowish paint (?).

**220** S. 07528/057
**Spindle whorl** diam. 5.4 cm, th. 1.2 cm, hole 0.7 cm. W. 12 g.
**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with small lateral crack that originates from the central hole. Highly worn surfaces with traces of encrustation.

**221** S. 07528/058
**Spindle whorl** diam. 5.2 cm, th. 1.4 cm, hole 0.9 cm. W. 10 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, broken on one side with traces of encrustation.

**222** S. 07528/059
**Spindle whorl** diam. 6 cm, th. 1.1 cm, hole 1.1 × 1.3 cm. W. 12 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with lateral breaks and holes caused probably by insects. Central hole quite irregular. Both surfaces are covered by thick layer of encrustation and on one side there are spots of a whitish substance.

**223** S. 07528/060
**Spindle whorl** diam. 5.1 cm, th. 1.3 cm, hole 0.6 cm. W. 9 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, with small, warped and off-center hole. Covered with encrustation.

**224** S. 07528/061
**Spindle whorl** diam. 5.1 cm, th. 1.4 cm, hole 1 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, warped and badly preserved. Warped hole due to ancient wedges.

**225** S. 07528/062
**Spindle whorl** diam. 4.8 cm, th. 1.3 cm, hole 8 × 0.6 cm. W. 12 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl with lateral breaks. One side is covered by a thick layer of encrustation.

**226** S. 07528/063
**Spindle whorl** diam. 5.2 cm, th. 1.4 cm, hole 0.9 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl completely ruined with a big central hole, and a smaller on the surface, probably caused by insects.

**227** S. 07528/064
**Spindle whorl** diam. 3.8 cm, th. 0.9 cm, hole 0.5 cm. W. 4 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, small and ruined or worn, with an oval central hole.

**228** S. 07528/066
**Spindle whorl** diam. 4.9 cm, th. 1.7 cm, hole 0.5 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with deep lateral break that continues to the central hole. One surface is covered by a thick layer of encrustation.

**229** S. 07528/068
**Spindle whorl** diam. 5.9 cm, th. 1.3 cm. W. 16 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, unfinished. One side shows signs of the preparation for making the central hole.

**230** S. 07528/070
**Spindle whorl** diam. 5.6 cm, th. 1.8 cm, hole 0.9 cm. W. 18 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina

Cylindrical spindle whorl with lateral break. One side shows traces of encrustation.

**231** S. 07528/073
**Spindle whorl** diam. 4.4 cm, th. 1.6 cm, hole 1 cm. W. 7 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Small cylindrical spindle whorl, badly preserved, with yellowish traces on both surfaces around its hole, and other holes likely caused by insects.

**232** S. 07528/074
**Spindle whorl** diam. 5.7 cm, th. 1.4 cm, hole 0.6 cm. W. 16 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, well-preserved. Encrusted on both surfaces.

**233** S. 07528/075
**Spindle whorl** diam. 5.3 cm, th. 1.6 cm, hole 0.7 cm. W. 14 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, quite worn but without encrustation.

**234** S. 07528/076
**Spindle whorl** diam. 4.9 cm, th. 1.6 cm, hole 0.9 cm. W. 12 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, heavily encrusted.

**235** S. 07528/077
**Spindle whorl** diam. 5.5 cm, th. 1.5 cm, hole 1 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with yellowish traces on the surface and other traces of encrustation. Oval hole.

**236** S. 07528/078
**Spindle whorl** diam. 4.9 cm, th. 1.2 cm, hole 0.7 cm. W. 9 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, badly preserved, with lateral breaks and encrustation.

**237** S. 07528/079
**Spindle whorl** diam. 4 cm, th. 0.9 cm, hole 0.6 cm. W. 6.6 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Small spindle whorl, complete, with four radial lines painted with a pink colour.

**238** S. 07528/081
**Spindle whorl** diam. 5 cm, th. 1.6 cm, hole 1 cm. W. 16 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl broken and now composed of two fragments.

**239** S. 07528/082
**Spindle whorl** diam. 5.2 cm, th. 1.4 cm, hole 1 cm. W. 10 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, slightly warped, with lateral breaks. Encrustations and whitish efflorescence on the surface.

**240** S. 07528/083
**Spindle whorl** diam. 5.2 cm, th. 1.5 cm, hole 0.9 cm. W. 10 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl badly preserved and made of a dark wood.

**241** S. 07528/089
**Spindle whorl** diam. 5.1 cm, th. 1.4 cm, hole 0.9 × 0.7 cm. W. 14 g.
**Material** wood.

**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, with traces of encrustation on one side.

**242** S. 07528/092
**Spindle whorl** diam. 4.2 cm, th. 1.1 cm, hole 0.5 cm. W. 8 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, with heavy encrustation on the surface.

**243** S. 07528/093
**Spindle whorl** diam. 3.9 cm, th. 1.6 cm, hole 0.6 cm. W. 8 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl decorated by four radial lines painted in black and another line decorates the external edge.

**244** S. 07528/096
**Spindle whorl** diam. 4.9 cm, th. 1.3 cm, hole 0.7 cm. W. 15 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with a deep lateral fracture and a thick layer of encrustation.

**245** S. 07528/099
**Spindle whorl** diam. 4.7 cm, th. 1.3 cm, hole 0.8 cm. W. 8.3 cm.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl only partially preserved with side chipped. Warped hole likely due to ancient wedges. One hole on the surface. Both sides are covered by whitish efflorescence.

**246** S. 07528/103
**Spindle whorl** diam. 5.6 cm, th. 1 cm, hole 0.9 cm. W. 9 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, with small lateral break and free of encrustation. Irregular central hole.

**247** S. 07528/104
**Spindle whorl** diam. 5.5 cm, th. 1.1 cm, hole 0.7 cm. W. 12 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, with warped central hole probably due to ancient wedges. Clean surfaces.

**248** S. 07528/105
**Spindle whorl** diam. 5.1 cm, th. 1.2 cm, hole 0.7 cm. W. 11 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete, with one surface covered by encrustation and an incised mark. Highly worn.

**249** S. 07528/106
**Spindle whorl** diam. 5.8 cm, th. 1.5 cm, hole 0.9 cm. W. 17 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl with lateral breaks and encrusted on the surface. Two radial lines are painted in black.

**250** S. 07528/107
**Spindle whorl** diam. 4.7 cm, th. 1.7 cm, hole 0.9 cm. W. 12 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, encrusted on the surface and with cross-shaped incisions.

**251** S. 07528/108
**Spindle whorl** diam. 5.8 cm, th.1.6 cm, hole 0.8 × 1 cm. W. 17 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.

Cylindrical spindle whorl, complete, encrusted on the surface and with incised marks near the edge.

**252** S. 07528/109
**Spindle whorl** diam. 5.1 cm, th. 1.6 cm, hole 0.7 cm. W. 12 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, warped and partially missing, likely due to insects. Central hole warped by ancient wedges. Different wood, more compact.

**253** S. 07528/110
**Spindle whorl** diam. 4.6 cm, th. 1.2 cm. W. 5 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl completely lacking the central part, probably due to insects. Traces of encrustation are also present.

**254** S. 07528/111
**Spindle whorl** diam. 4.9 cm, th. 1.6 cm, hole 0.9 cm. W. 10 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, encrusted on the surface and with small holes probably caused by insects.

**255** S. 07528/112
**Spindle whorl** diam. 5.4 cm, th. 1.2 cm, hole 0.8 cm. W. 8 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl only partially preserved probably due to insects.

**256** S. 07528/113
**Spindle whorl** diam. 5.6 cm, th. 1.5 cm, hole 0.8 × 0.6 cm. W. 9 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, complete, encrusted and with a small perforation likely caused by insects.

**257** S. 07528/114
**Spindle whorl** diam. 4.3 cm, th. 1.3 cm, hole 0.5 cm. W. 9 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Cylindrical spindle whorl, complete and well- preserved. Encrusted on the surface.

**258** S. 07528/115
**Spindle whorl** diam. 4.2 cm, th. 1.6 cm, hole 0.6 × 0.5 cm. W. 7 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina
Truncated cone spindle whorl, complete, with marks from its manufacture on the surface.

**259** S. 07528/116
**Spindle whorl** diam. 4.4 cm, th. 1.2 cm. W. 3 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Small fragment of a cylindrical spindle whorl.

**260** S. 09978/3
**Spindle whorl** diam. 4.7 cm, th. 1.8 cm, hole 0.8 cm. W. 13 g.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, encrusted on the surface.

**261** S. 07594/05
**Spindle whorl** diam. 4.2 cm, th. 1.8 cm.
**Material** wood.
**Chronology** unknown. **Origin** Deir el-Medina.
Dome-shaped spindle whorl, complete and encrusted on the surface. Several concentric lines are incised around the hole. Similar to those of the Roman Period.

**262** S. 07587/09
**Spindle whorl** diam. 4 cm, th. 2.5 cm.
**Material** wood.
**Chronology** New Kingdom. **Origin** Deir el-Medina.
Cylindrical spindle whorl, broken and only partially preserved.

**263** Provv. 3683/1
**Bundle of flax** 8 × 38 × 16 cm
**Material** flax.
**Chronology** unknown. **Origin** unknown.
Bundle of flax fibres, not prepared for spinning. They are thick and with the woody bark still preserved.

**264** Provv. 3576/2
**Hanks of flax** 7 × 47.5 × 17 cm
**Material** flax.
**Chronology** unknown. **Origin** unknown.
Huge hank of flax with several knots to fasten the fibres, already prepared, retted (maybe) and scutched. Some fragments of wood still visible.
**Bibliography** D'Amicone 2006, 30.

**265** Cat. 6481/1
**Skein of flax** 27 × 17 cm
**Material** flax.
**Chronology** unknown. **Origin** unknown.
Spun linen threads, rolled up in a skein. Yarns are s-plied; single twist not visible but probably single threads were not spun. Several points of splicing and knots are visible. Thread diameter is quite regular with an average of 0.4 mm. Twist angle is 32°.
**Bibliography** Fabretti et al. 1882, no. 6481.

**266** S. 9999/1 and 2
**Two skeins of linen** 19 × 4.5 cm and 16 × 2.5 cm
**Material** linen.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina.
Two skeins of linen threads with visible splicing points. Thread is worn in several areas and is losing its twist, which is s-plied.
1) Made up of different threads. The best preserved is z-twist, without plying. Average diameter is 0.9-1 mm, twist angle (where preserved) is 33°. Another thread is s-plied; average diameter is 0.3 mm and twist angle is 30°.
2) Where thread is well-preserved, an s-plied structure is visible with several points of splicing. Very irregular diameter, with an average of 0.7 mm, twist angle between 35 and 38°.
**Bibliography** Borla, Oliva 2015, fig. 299.

**267** S. 07792
**Linen skein** 3 × 13 × 7.5 cm
**Material** linen.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina.
Small skein of linen with drier fibres than the others. Made up of several threads, one plied and one single, both with s-twist. Several knots are visible as well as at least three threads but there could be more.
**Thread 1** Plied thread, average diameter of 0.4 mm, angle 40-45°.
**Thread 2** Single thread, average diameter 0.3 mm and variable twist angle, due to the poor preservation of the thread.
**Filo 3** Single thread, average diameter 0.3 mm, twist angle 35°.

**268** S. 7787
**Linen skein** 2.5 × 7 × 5.4 cm
**Material** flax.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina.
Small and irregular skein of linen thread, which lost its original twist at several points. Might be made up of different threads.
S-twist and s-plied (where visible). Average diameter 0.3 mm, twist angle 35° but at several points 45° due to the poor conditions of its preservation.

**269** S. 7791
**Ball of yarn** diameter 4 cm.
**Material** flax.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina.
Linen ball of thread perfectly preserved and tightly wound up. It shows one knot at the end of the yarn and several smaller knots on the inside. Thread is z-plied, single twist not visible or not present at all. Some splicing points are visible. Thread diameter 0.04 cm, twist angle between 35-40°.
**Bibliography** Borla, Oliva 2015, fig. 299; Donadoni Roveri 2001, 32.

**270** S. 07788
**Ball of yarn** 2 × 3 cm
**Material** linen
**Chronology** New Kingdom (?). **Origin** Deir el-Medina.
Linen ball of yarn wound around tow; composed of several threads around the core, some strictly twisted, others with a very loose twist. All threads are s-twisted, some also s-plied. Some knots are visible at the end of the thread. Threads have a

diameter between 0.3 and 0.5 mm, twist angle 35°, in some cases between 45 and 50°.

**271** S. 07790
**Ball of yarn** 1 × 2 × 3.5 cm
**Material** linen, pottery.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina
Small ball of yarn wound around a broken pottery rim. Under the thread, which is perfectly preserved, there are unspun vegetable fibres. Twist is quite tight and is z-cabled, s-plied. (2S, 4Z), single twist not visible. Thread diameter 0.3-0.4 mm, at some points 0.6 mm; twist angle 35°.
**Bibliography** D'Amicone 2006, 25.

**272** S. 7789
**Ball of yarn** 3 × 6.5 × 5 cm
**Material** linen, stone.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina.
Linen ball of yarn wound around a stone, made up of several different threads, at least one brownish thread and one thicker whitish thread. Both are strictly z-plied, s-twist (z, 2s). Whitish thread is loosely spun with a diameter of 0.6-0.7 mm, angle 45-50°. Brownish thread is tightly spun, splicing points and knots are visible; diameter 0.3-0.4 mm, max. 0.6 mm, twist angle 30-35°. It has a lustrous appearance.
**Bibliography** D'Amicone 2006, 25.

**273** S. 7793
**Ball of yarn** 1.2 × 3.5 cm
**Material** linen, stone.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina.
Small ball of linen yarn wound around a limestone pebble. Thread is tightly twisted and quite even. It is not clear if there are several threads or whether the same thread was broken and wound around the same stone. Single twist not visible, z-plied. Thread diameter 0.5-0.6 mm, twist angle 35-45°.
**Bibliography** Borla, Oliva 2015, fig. 299.

**274** S. 7794
**Stopper** 2 × 5 cm
**Material** vegetable fibres, pottery.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina.
Pottery sherd of rounded shape, probably originally a stopper. Vegetable fibres and short linen threads are wound around it. Threads are z-twist and s-plied, in one case they are cabled (2z, 4s), but single twists are not visible. A similar item, S. 8185 (not part of this catalogue) shows only folded raw fibres.

**275** S. 13022
**Spatula** l. 10.5 cm
**Material** ivory
**Chronology** First Intermediate Period
**Origin** Gebelein, Tomb of Iti and Neferu
Small ivory spatula with one rounded end and the other with very tiny teeth (comb?). In a female burial.
**Bibliography** D'Amicone, Fontanella 2007, 261; D'Amicone 2006, 94 no. 27.

**276** S. 01124
**Spatula** 18.7 × 5.8 × 0.6 cm.
**Material** bone.
**Chronology** not known. **Origin** not known.
Leaf-shaped bone spatula, one narrow and rounded end the other larger and with a small point. Smooth and polished surface with wear traces on the lower side, especially on one edge. Rounded and smooth edges.

**277** S. 1101/01
**Spatula** 8.5 × 2.3 × 0.4 cm.
**Material** bone.
**Chronology** not known. **Origin** not known.
Small bone spatula broken in two pieces and lacking one end. Preserved point is chipped, but was quite rounded. Curved shaped with thin edges. Both sides are smooth and polished with wear traces, especially on one side.

**278** Provv. 6465/01
**Spatula** 8.6 × 2.3 × 0.4 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula, with one side highly polished and the other with visible but slightly smooth cancellous bone. Both ends are broken, but one still preserves an overall triangular shape. Edges are quite thick. No visible wear traces are present on the surface.

**279** Provv. 6465/02
**Spatula** 11.6 × 2.9 × 0.4 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula polished on both sides but with worn surface. Cancellous bone is not exposed. One end is broken, the other one has convex sides that form a sort of pen-nib point. No wear traces are noticeable.

**280** Provv. 6465/03
**Spatula** 7.6 × 2 × 0.4 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula almost complete, with one smooth and polished side and the other with the cancellous bone completely exposed. One end is rounded but chipped and the other exhibits a pen-nib point. No wear traces are noticeable.

**281** Provv. 6465/04
**Spatula** 7 × 1.9 × 0.4 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula broken at both ends and polished on both sides, with no cancellous bone visible. One end was probably point-shaped and wear traces are evident on this part. Slighly convex profile.

**282** Provv. 6465/05
**Spatula** 7 × 1.6 × 0.5 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula broken at one end, the other one is chipped but a pen-nib shape is visible. One side has been polished the other one has cancellous bone exposed. The object has not been cleaned and it is quite encrusted, but wear traces are nevertheless evident. Slightly convex profile.

**283** Provv. 6465/06
**Spatula** 6.9 × 1.2 × 0.2 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula broken at one end, while the other end has a large point. Its shaft has straight sides for most of its length. One side is polished, on the other one cancellous bone can be seen, it is less smooth near the preserved end. No wear traces are visible. Slightly convex profile.

**284** Provv. 6465/07
**Spatula** 8.2 × 1.3 × 0.4 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula, broken at one end, the other with a pen-nib point. One side is polished and the other has cancellous bone exposed, but it is quite smooth, especially near the point. It has a slightly convex profile and is thicker on one side.

**285** Provv. 6465/08
**Spatula** 12.3 × 1.1 × 0.4 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula, broken at one end while the other one has a pen-nib point. One side is smooth, the other one has cancellous bone exposed. It has a very convex profile. The object has not been cleaned and it is quite encrusted.

**286** Provv. 6465/09
**Spatula** 6.6 × 1.6 × 0.5 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula almost complete, with just a small part of the point missing. One end has a pen-nib point while the other is flat. Both surfaces are smooth and there is no cancellous bone visible. There are no visible wear signs. Flat profile.

**287** Provv. 6465/10
**Spatula** 6.6 × 2 × 0.5 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula almost complete. One end has a triangular point while the other is rounded but chipped. One side is smooth while the other has cancellous bone exposed, polished only near the edges. No wear traces are detectable. Flat profile.

**288** Provv. 6465/11
**Spatula** 7.1 × 1.3 × 0.3 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Narrow bone spatula broken at both ends, curved shape and concave profile. One side is smooth while the other one has cancellous bone exposed. On the smooth side, thin and parallel wear traces are visible.

**289** Provv. 6465/12
**Spatula** (?) 4.1 × 1 × 0.3 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Broken fragment of a rib, one side has cancellous bone exposed. Broken at both ends. It might be part of a spatula. Flat profile.

**290** Provv. 6465/13
**Spatula** 10.6 × 1 × 0.3 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Long and narrow bone spatula, one end missing, the other with an elongated pen-nib point. One side is smooth, while the other shows cancellous bone. The object has not been cleaned but wear traces are nevertheless detectable. Slightly concave profile.

**291** Provv. 6465/14
**Spatula** (?) 17.3 × 2.7 × 0.4 cm
**Material** wood.
**Chronology** not known. **Origin** not known.
Wooden spatula, broken at one end, while the other one has a triangular point. One side is smooth and shows traces of wear. Flat profile.

**292** Provv. 6465/15
**Spatula** 11.1 × 2.2 × 0.4 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula broken at one end, while the other has a long and beautifully preserved pen-nib point. One side is smooth and the other has cancellous bone preserved. No wear traces are visible. Flat in profile but lower side slightly concave in transverse direction.

**293** Provv. 6465/16
**Spatula** 9.2 × 1.5 × 0.2 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula broken at one end, while the other has a very long and thin pen-nib point. One side is smooth, the other has cancellous bone exposed, except for the point. Cancellous bone still rough near the broken part but increasingly smooth toward the point, which indicates that it was used principally at its point. No wear traces are clearly visible. Flat profile.

**294** Provv. 6465/17
**Spatula** 8 × 1.5 × 0.25 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula with one rounded end and the other with a chipped pen-nib point. One side is smooth, the other has the cancellous bone exposed. No wear traces are visible. Flat profile.

**295** Provv. 6465/18
**Spatula** 6.9 × 2.3 × 0.2 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Fragment of beautiful bone spatula, broken at one end while the other has a chipped pen-nib point. It is carefully polished on both sides. Wear traces are visible near the point, probably caused by a sharp tool. Flat profile.

**296** Provv. 6465/19
**Spatula** 6.1 × 2.6 × 0.3 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula broken at one end, which should have been pointed. The other end is large and rounded. One side is smooth, the other has cancellous bone exposed, but is almost completely worn away. Wear traces are visible. Flat profile.

**297** Provv. 6465/20
**Spatula** 7.6 × 2.8 × 0.3 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula almost complete, one end has a chipped pen-nib point, the other a triangular point. One side is smooth, the other has cancellous bone exposed. Cancellous bone still rough near the broken end but increasingly smooth toward the point, which indicates that it was used principally at the point. Wear traces are visible near point and edges. Flat profile.

**298** Provv. 6465/21
**Spatula** 9 × 1.6 × 0.3 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Singular bone spatula almost complete, tapering toward the rounded end and with a broken pen-nib point on the largest end. One side is smooth, the other has cancellous bone exposed.

**299** Provv. 6465/22
**Spatula** 6.8 × 1.5 × 0.4 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula broken at one end and missing part of one side. The other end has a pen-nib point. One side is smooth while the other has cancellous bone exposed. Transversally convex profile.

**300** Provv. 6465/23
**Spatula** 12.4 × 1.1 × 0.4 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Fragment of bone spatula, one end and side missing. Pointed end preserved, one side smooth the other with cancellous bone preserved. Longitudinally concave profile.

**301** Provv. 6465/24
**Spatula** 6.9 × 1.6 × 0.3 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Narrow bone spatula broken at one end, the other has a long triangular point. One side is smooth, while the other has cancellous bone preserved, especially on the central part, due to the concave profile. One side has clear evidence of wear traces. Flat profile, transversally concave.

**302** Provv. 6465/25
**Spatula** 6.4 × 1.2 × 0.4 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Long and narrow point of a spatula, missing the other end. One side is smooth while the other has cancellous bone still preserved, but almost worn away near the point. Wear traces on one side. Flat profile.

**303** Provv. 6465/26
**Spatula** 6.4 × 1.2 × 0.4 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula almost complete, tapering toward the rounded end and with a broken pen-nib point on the largest end, similar to P. 6465/21. Both sides are smooth. Slightly concave profile.

**304** Provv. 6465/27
**Spatula** 7.7 × 2.2 × 0.4 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula broken at one end, the other end has a chipped pen-nib point. One side is smooth, while the other has cancellous bone preserved. Flat profile.

**305** Provv. 6465/28
**Spatula** 9.4 × 1.6 × 0.3 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Long and narrow bone spatula, broken at both ends. One side is smooth and the other has cancellous bone exposed.

**306** Provv. 6465/29
**Spatula** 7.7 × 2.2 × 0.4 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Bone spatula, almost complete, only small fragments missing. One end is rounded, the other has a pen-nib point. It is very thin and smooth on both sides. Concave profile.

**307** Provv. 6465/30
**Spatula** 5.4 × 1 × 0.3 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Small fragment of a bone spatula, with part of a triangular point preserved. One side is smooth and the other has cancellous bone exposed.

**308** Provv. 6465/31
**Spatula** 8.2 × 1 × 0.2 cm
**Material** bone.
**Chronology** not known. **Origin** not known.
Long and narrow bone spatula, almost complete, point chipped. One end is rounded, the other has a pen-nib point. One side is smooth and the other has cancellous bone exposed. Flat profile.

**309** Provv. 6465/32
Missile point.

**310** S. 11053
**Needle** 15.5 × 0.5 cm
**Material** iron
**Chronology** not known. **Origin** Assiut
Long iron needle with oval eye.

**311** Provv. 4613
**Needle** 13.2 × 0.9 cm
**Material** wood.
**Chronology** not known. **Origin** not known.
Long and thick wooden needle or bodkin with oval eye and flat head.

**313** Provv. 4373
**Needle** 11.5 × 0.5 cm
**Material** wood.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina (?)
Wooden needle with oval eye and flat head.

**314** Provv. 5191
**Needle** 18.3 × 0.6 cm
**Material** iron.
**Chronology** New Kingdom (?). **Origin** not known.
Long and thin iron needle with eye made by folding the metal over.

**315** Provv. 5534
**Needle** 19.2 × 0.4 × 1.2 cm
**Material** bronze.
**Chronology** New Kingdom (?). **Origin** not known.
Long and thin bronze needle with a very large and round eye.

**316** S. 01498
**Needle** (?) 11 cm
**Material** bronze.
**Chronology** New Kingdom (?). **Origin** not known.
Long and thin needle (?) with no traces of eye but both ends pointed.

**317** Cat. 6336
**Needle** (?) 17.6 × 0.8 × 0.2 cm.
**Material** bronze.
**Chronology** Late Period (?). **Origin** not known.
Long, large and flat needle or bodkin.
**Bibliography** Donadoni Roveri 2001, 32.

**318** Cat. 6337
**Needle** 8.5 × 0.4
**Material** bronze.
**Chronology** New Kingdom (?). **Origin** not known.
Bronze needle with oval eye and round section.

**319** S. 08379
**Needle case** (with two needles and a blade): 14.8 × 2.8 × 1.9 cm
**Materials** Bronze – vegetable fibres – papyrus
**Chronology** New Kingdom - Amenhotep II - Amenhotep III
**Origin** Deir el-Medina / Tomb of Kha (TT8)
Two bronze needles and a small razor fixed in a needle case made of papyrus reeds joined by twine (made of two yarns very loosely s-twist, each of them s-plied, z-cabled). One of the two needles has preserved a piece of thread in the eye (final twist z and knotted). Both have small, round eyes.
**Bibliography** Donadoni 1987, 197, tav. 285. Donadoni Roveri 2001, 33. Schiaparelli 1927, 77, fig. 43, 5.

**320** S. 08496
**Needle case** (and four needles) 16 × 4.1 × 3.3 cm
**Materials** bronze and papyrus reed
**Chronology** New Kingdom, Amenhotep II, Amenhotep III
**Origin** Deir el-Medina/Tomb of Kha (TT8)
Four bronze needles fixed in a piece of papyrus reed. Thin and round in section with very small circular eyes.
**Bibliography** Schiaparelli 1927, 77, fig. 43.5.

**321** S. 09947
**Needle** (?) 6.3 × 0.3 cm
**Material** bronze.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina.
Small bronze needle, however no traces of its eye are visible.

**322** S. 09946
**Needle** 10.2 × 0.2 cm
**Material** bronze.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina.
Long and thin needle, round in section, point and eye perfectly preserved. Extremely small eye.
**Bibliography** Donadoni Roveri 1987, 204, tav. 283.

**323** S. 09945
**Needle** 12.8 × 0.2 cm
**Material** bronze.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina.
Long and thin needle with round section, point and eye perfectly preserved.

**324** S. 07619
**Needle** 9.5 × 0.2 cm
**Material** bronze.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina.
Long and thin needle with round section, point and eye perfectly preserved.

**325** S. 07796
**Bodkin** 9.5 × 1.2 cm
**Material** wood, linen.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina.
Wooden needle or bodkin with flat head where a quite crude eye is carved. Inside the eye a knotted thread is preserved. Final twist s, each thread made of several threads (at least three single and one double), and twist in z direction. Single and double threads have an s twist.
**Bibliography** Borla, Oliva 2015, fig. 299.

**326** S. 07566
**Bodkin** 16.5 × 1.2 cm
**Material** wood.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina.
Wood bodkin, bent and with a round eye.

**327** S. 09975
**Bodkin** 12 × 1.8 cm
**Material** wood.
**Chronology** New Kingdom (?). **Origin** Deir el-Medina.
Wooden bodkin, bent with round eye.

**329** S. 05979
**Warp spacer** 22.2 × 2.4 × 1.7 cm
**Material** wood
**Chronology** New Kingdom, Late Period (?). **Origin** Valley of the Queens.
Wooden warp spacer, broken at one end and the other is flat. It has a triangular section and the upper part has 23 deep notches and 6 half-notches. Sides are polished while flat base is rough.
**Bibliography** Borla, Oliva 2015, fig. 298.

**330** Provv. 4335/1
**Wood object** 22.2 × 1.5 × 1.8 cm
**Material** wood.
**Chronology** not known. **Origin** not known.
Thin wooden lath with 12 large through-holes. Both ends are concave, but one has a mortise and the other probably the remains of a tenon. Surface much worn.

**331** Provv. 4335/2
**Wood object** 22.2 × 1.5 × 0.9 cm
**Material** wood.
**Chronology** not known. **Origin** not known.
Thin wooden lath with 12 small through-holes. Both ends are concave, but one has a mortise and the other the remains of a tenon.

**332** S. 04086
**Spinning bowl** 15.8 × 5.6 cm
**Material** Pottery
**Chronology** Predynastic. **Origin** Heliopolis
Pottery bowl with base, part of walls and central diaphragm preserved. Thick walls with coarse temper inclusions of vegetal material. Shape quite irregular, hand-made.
**Bibliography** Borla, Oliva 2015, fig. 297.

**333** S. 04087
**Spinning bowl** 14 × 5.6 cm
**Material** Pottery
**Chronology** New Kingdom. **Origin** Heliopolis
Pottery bowl with base, part of walls and two central loops preserved.

**334** Provv. 485
**Weight** 7.1 × 5.4 × 1.7. W. 64g + x
**Material** pottery.
**Chronology** Not known. **Origin** not known.
Pottery loomweight of discoid elliptical shape with two through-holes near the top. Partially broken.

**335** Cat. 6391
**Weight** 5.7 × 5.4. W. 44 g.
**Material** pottery.
**Chronology** not known. **Origin** not known.

Pottery loomweight of truncated pyramidal shape with a through-hole near the top, which is not flat but shows a little groove. Chipped.
**Bibliography** Fabretti et al. 1888.

**336** Provv. 6638
**Weight** 3.5 × 4.3 × 1.4 cm. W. 27 g.
**Material** limestone.
**Chronology** not known. **Origin** not known.
Pear-shaped limestone loom weight with a through-hole near the top.

**337** S. 17051/01
**Weight** diam. 4.2 cm, h. 3.9 cm, hole 1.1 cm. W. 48 g.
**Material** Limestone.
**Chronology** Middle Kingdom. **Origin** Gebelein, tomb 1.
Globular weight, vertically perforated, with flattened lower surface. No. 123.

**338** S. 17051/02
**Weight** diam. 4.1 cm, h. 3 cm, hole 1.1 cm. W. 46 g.
**Material** Limestone.
**Chronology** Middle Kingdom. **Origin** Gebelein, tomb 1.
Globular weight, vertically perforated, with flattened lower surface.

**339** S. 17051/03
**Weight** diam. 4.4 cm, h. 3.4 cm, hole 1.2 cm. W. 59 g.
**Material** Limestone.
**Chronology** Middle Kingdom. **Origin** Gebelein, tomb 1.
Globular weight, vertically perforated, with flattened lower surface. No. 125.

**340** S. 17051/04
**Weight** diam. 4.4 cm, h. 3.5 cm, hole 1.2 cm. W. 59 g.
**Material** Limestone.
**Chronology** Middle Kingdom. **Origin** Gebelein, tomb 1.
Globular weight, vertically perforated, with flattened lower surface.

**341** S. 17051/05
**Weight** diam. 4.2 cm, h. 3.3 cm, hole 1.2 cm. W. 61 g.
**Material** Limestone.
**Chronology** Middle Kingdom. **Origin** Gebelein, tomb 1.
Globular weight, vertically perforated, with flattened lower surface.

**342** S. 17051/06
**Weight** diam. 4 cm, h. 3.8 cm, hole 1.2 cm. W. 60 g.
**Material** Limestone.
**Chronology** Middle Kingdom. **Origin** Gebelein, tomb 1.
Globular weight, vertically perforated, with flattened lower surface.

**343** S. 17051/07
**Weight** diam. 4 cm, h. 3.5 cm, hole 1.2 cm. W. 50 g.
**Material** Limestone.
**Chronology** Middle Kingdom. **Origin** Gebelein, tomb 1.
Globular weight, vertically perforated, with flattened lower surface.

**344** Provv. 4489
**Weight** diam. 4 cm, h. 2.2 cm, hole 0.9 cm. W. 23 g. **Yarn length** 24 cm.
**Material** wood; vegetable fibres.
**Chronology** not known. **Origin** not known.
Weight or spindle whorl, dome-shaped, with thick thread passing through the hole.

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# Plates

Plate 1. Map of Egypt

Plate 2. Map of Levant

Plate 3. Tomb paintings: 1) Beni Hasan tomb of Baqt (Newberry 1893b: pl. IV); 2) Beni Hasan tomb of Baqt (Newberry 1893b, pl. IV); 3) ostracon from Deir el-Medina (Vandier d'Abbadie 1937, pl. LXIV); 4) Thebes tomb of Daga (Davies 1913, pl. XXXVII); 5) Thebes tomb of Neferrenpet (Davies 1948, pl. XXXV).

Plate 4. Hanks of flax 1) no. 266; 2) no. 265.

Plate 5. Balls of yarn: 1) no. 264; 2) no. 270; 3,5) no. 7789; 4) no. 7790.

Plate 6. Balls of yarn: 1) no. 269; 2) no. 273; 3) no. 268.

Plate 7. Spindles: 1) no. 107; 2) no. 108; 3) no. 144; 4) no. 140.

Plate 8. Details of pegs attached to spindles to fasten the thread: 1) no. 032; 2) no. 149; 3,4) no. 001.

Plate 9. Details of encrusted spindles and wooden wedges: 1) no. 020; 2) no. 037; 3) no. 026; 4) no. 050; 5) no.139.

Plate 10. Spindle whorls and weights: 1) 194; 2) no. 126; no. 3) no. 237; 4) no. 258; 5) no. 163; 6) no. 229; 7) no. 337-43.

Plate 11. Spinning bowls: 1) no. 332; 2) no. 333 @Museo Egizio, Torino.

Plate 12. Spacers: 1-2) no. 329; 3-4) 330; 5) 331.

Plate 13. Bone spatulae: 1) no. 278; 2) no. 279; 3) no. 280; 4) no. 291; 5) no. 292; 6) no. 293.

Plate 14. Bone spatulae: 1) no. 294; 2) no. 295; 3) no. 296; 4) no. 297; 5) no. 305; 6) no. 306; 7) no. 307; 8) 276.

Plate 15. Details of spatulae: 1) no. 277; 2) no. 276; 3) no. 291; 4) no. 301; 5) no. 280.

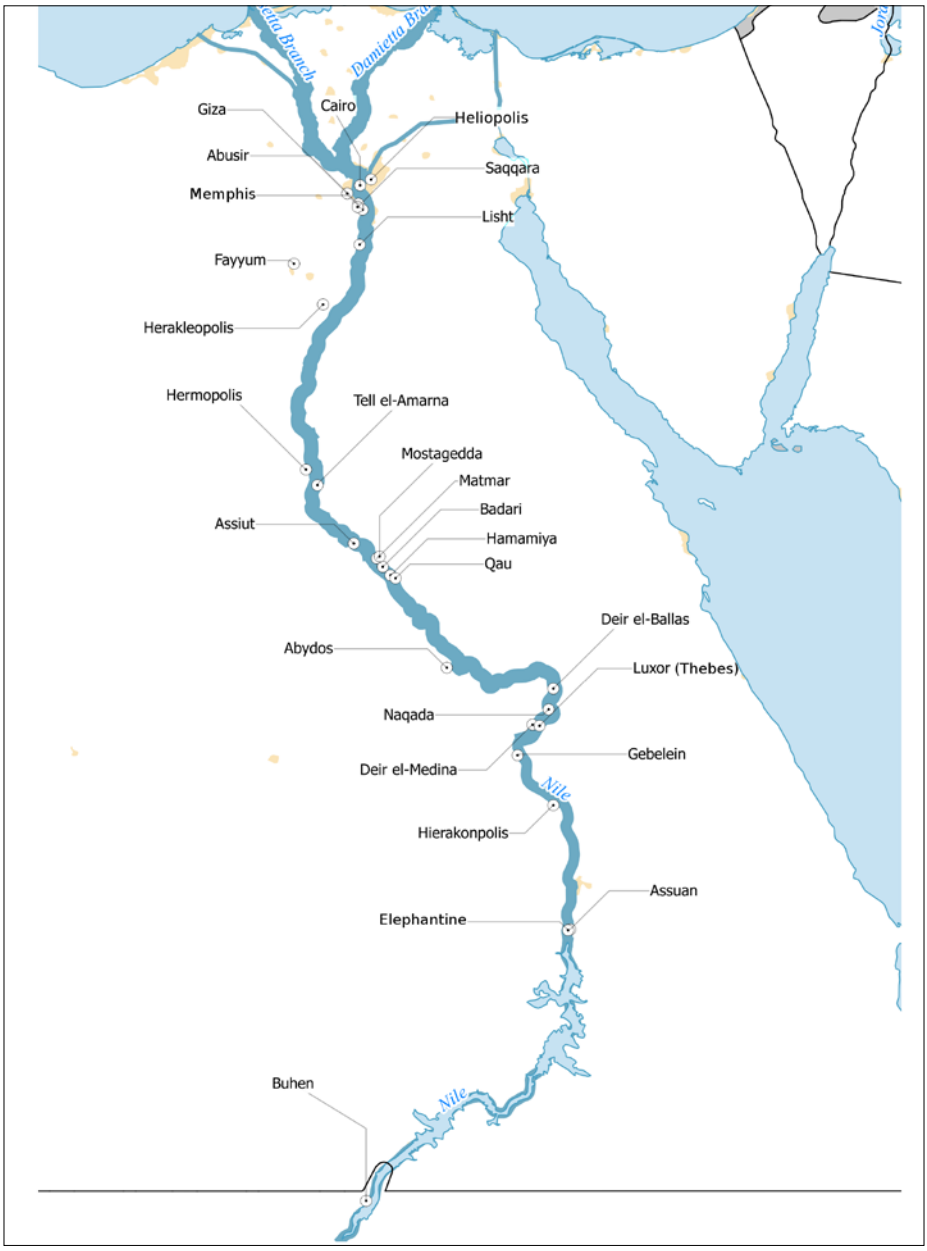

Damietta Branch
Giza
Cairo
Heliopolis
Abusir
Saqqara
Memphis
Lisht
Fayyum
Herakleopolis
Hermopolis
Tell el-Amarna
Mostagedda
Matmar
Badari
Assiut
Hamamiya
Qau
Deir el-Ballas
Abydos
Luxor (Thebes)
Naqada
Gebelein
Deir el-Medina
Nile
Hierakonpolis
Assuan
Elephantine
Buhen
Nile

Plate 1.

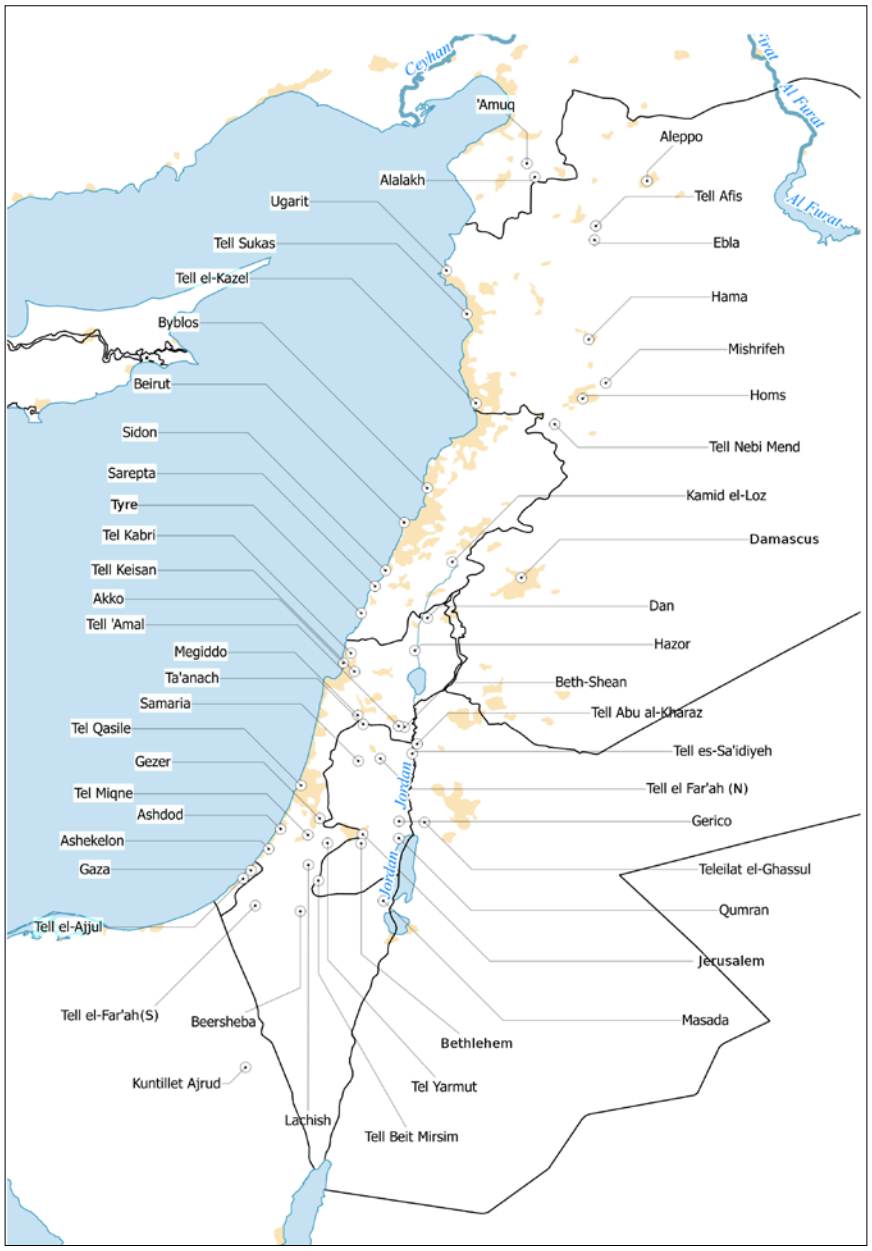
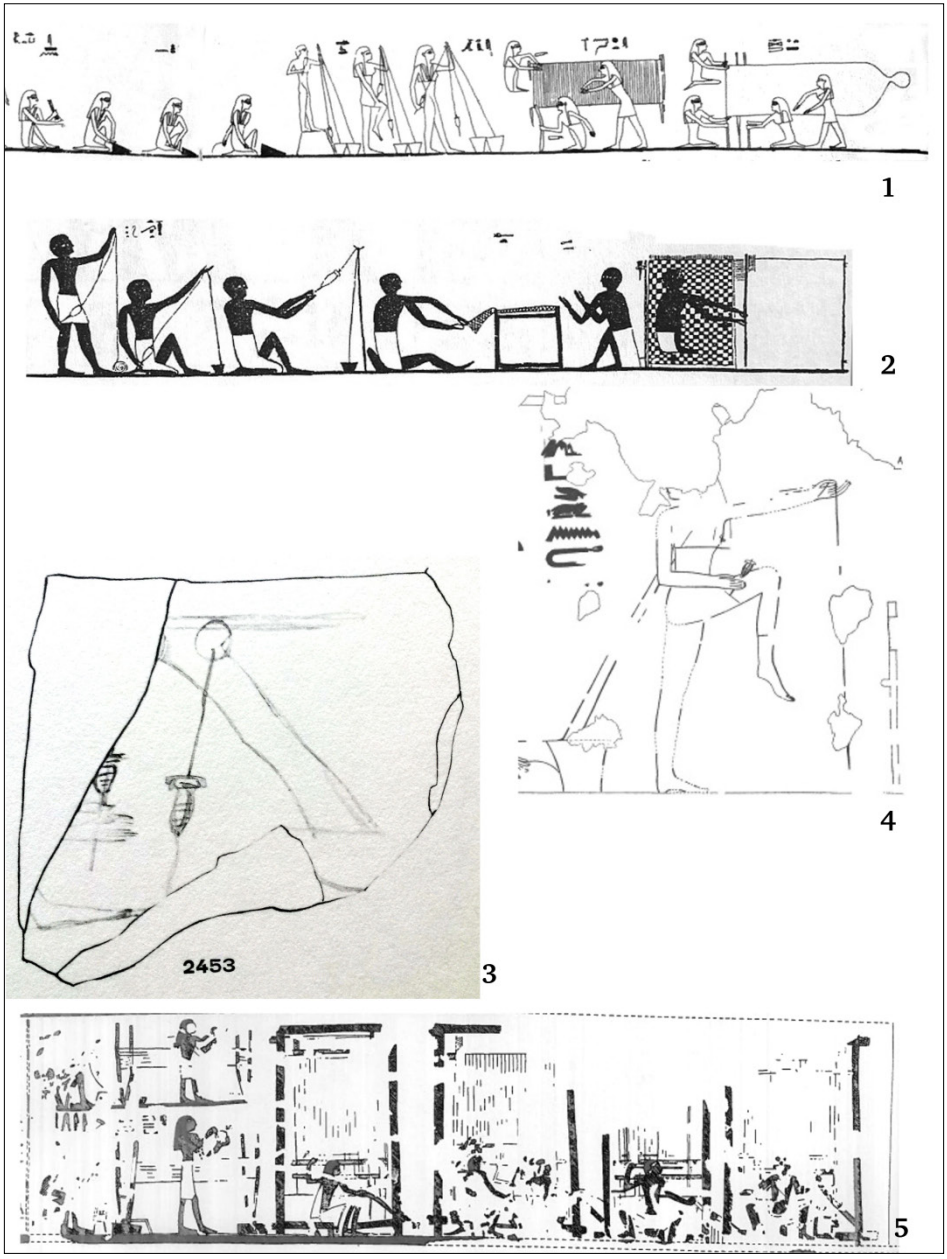

Ceyhan
'Amuq
Aleppo
Alalakh
Tell Afis
Ugarit
Ebla
Tell Sukas
Tell el-Kazel
Hama
Byblos
Mishrifeh
Beirut
Homs
Sidon
Tell Nebi Mend
Sarepta
Kamid el-Loz
Tyre
Damascus
Tel Kabri
Tell Keisan
Dan
Akko
Tell 'Amal
Hazor
Megiddo
Beth-Shean
Ta'anach
Tell Abu al-Kharaz
Samaria
Tel Qasile
Tell es-Sa'idiyeh
Gezer
Tell el Far'ah (N)
Tel Miqne
Gerico
Ashdod
Ashekelon
Teleilat el-Ghassul
Gaza
Jordan
Qumran
Tell el-Ajjul
Jerusalem
Tell el-Far'ah(S)
Masada
Beersheba
Bethlehem
Kuntillet Ajrud
Tel Yarmut
Lachish
Tell Beit Mirsim

Plate 2.

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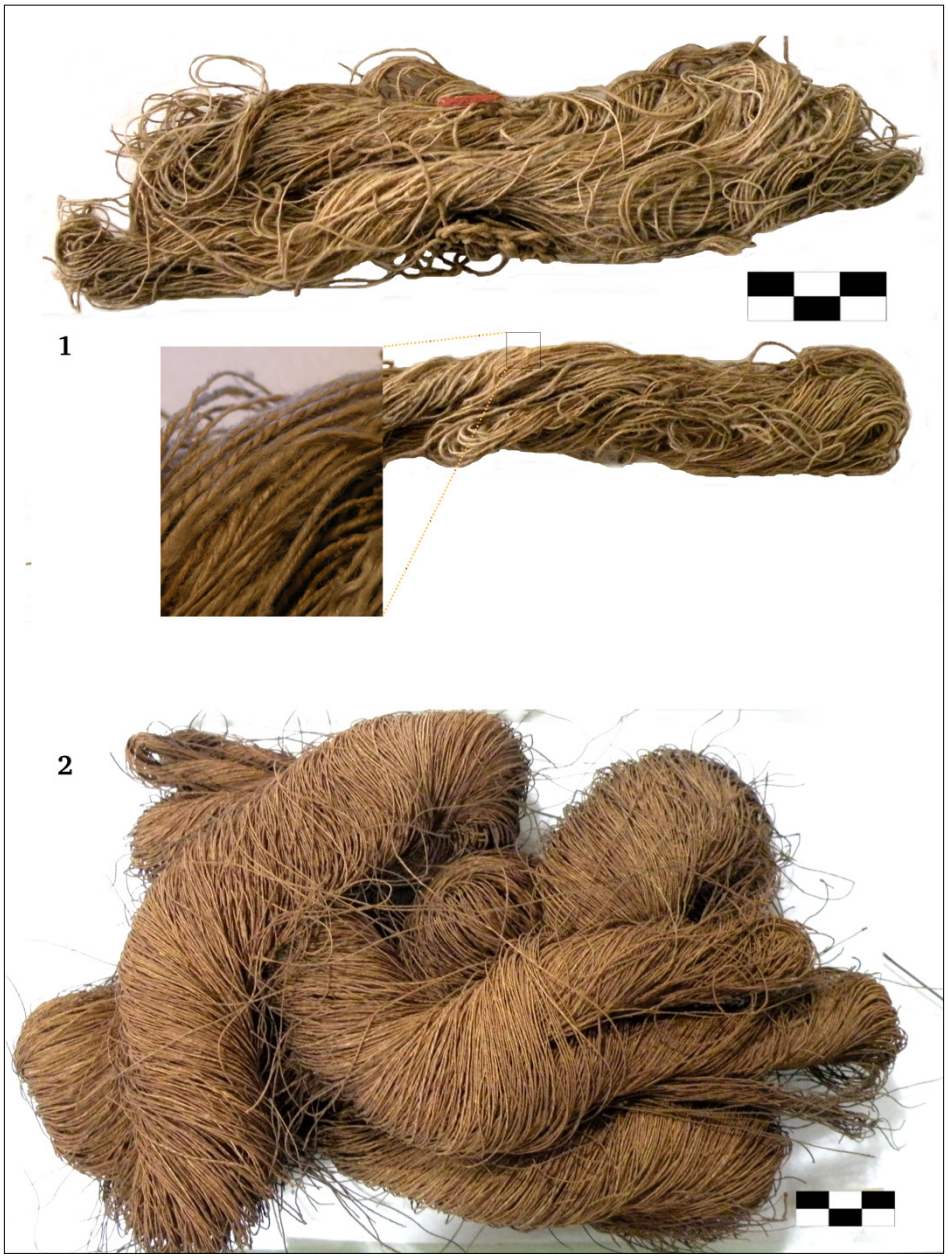


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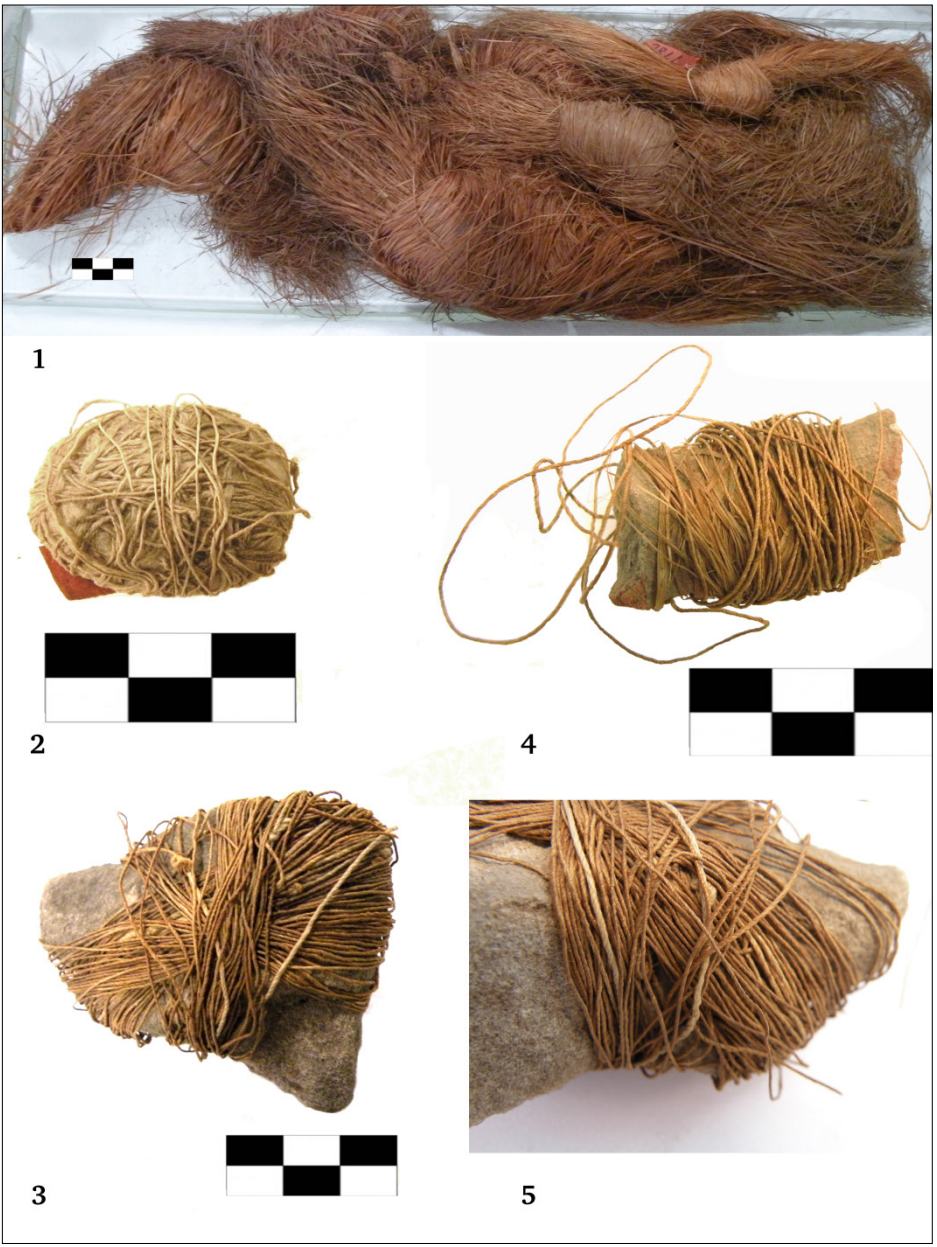


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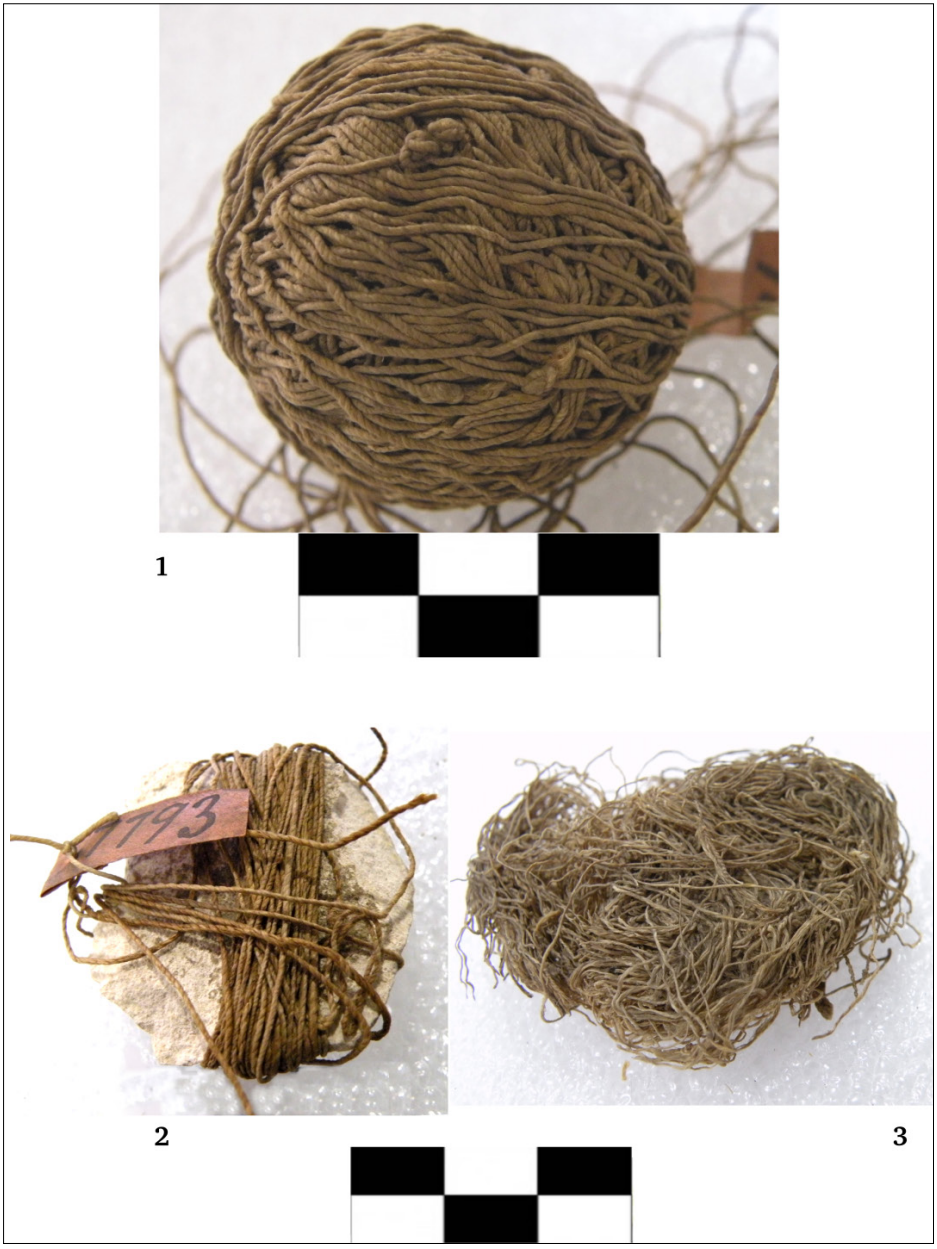


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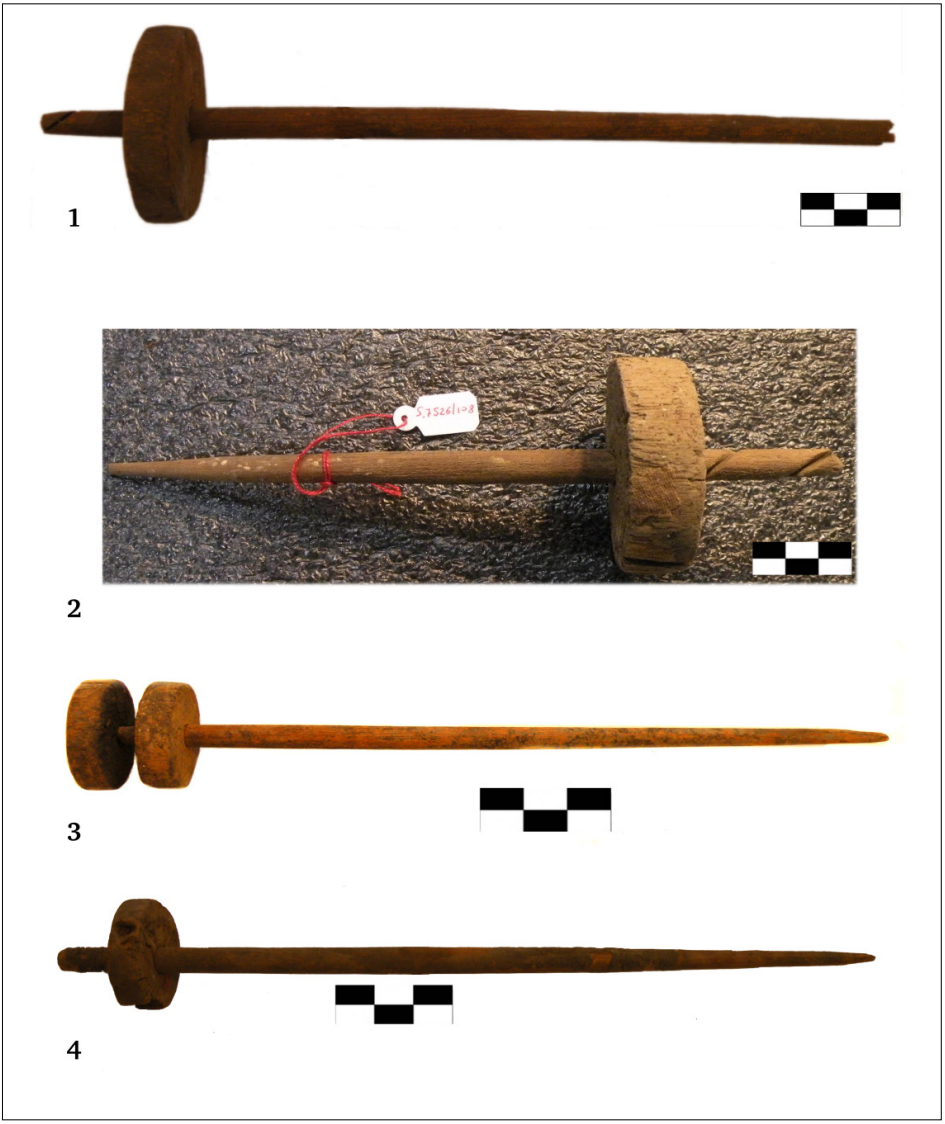
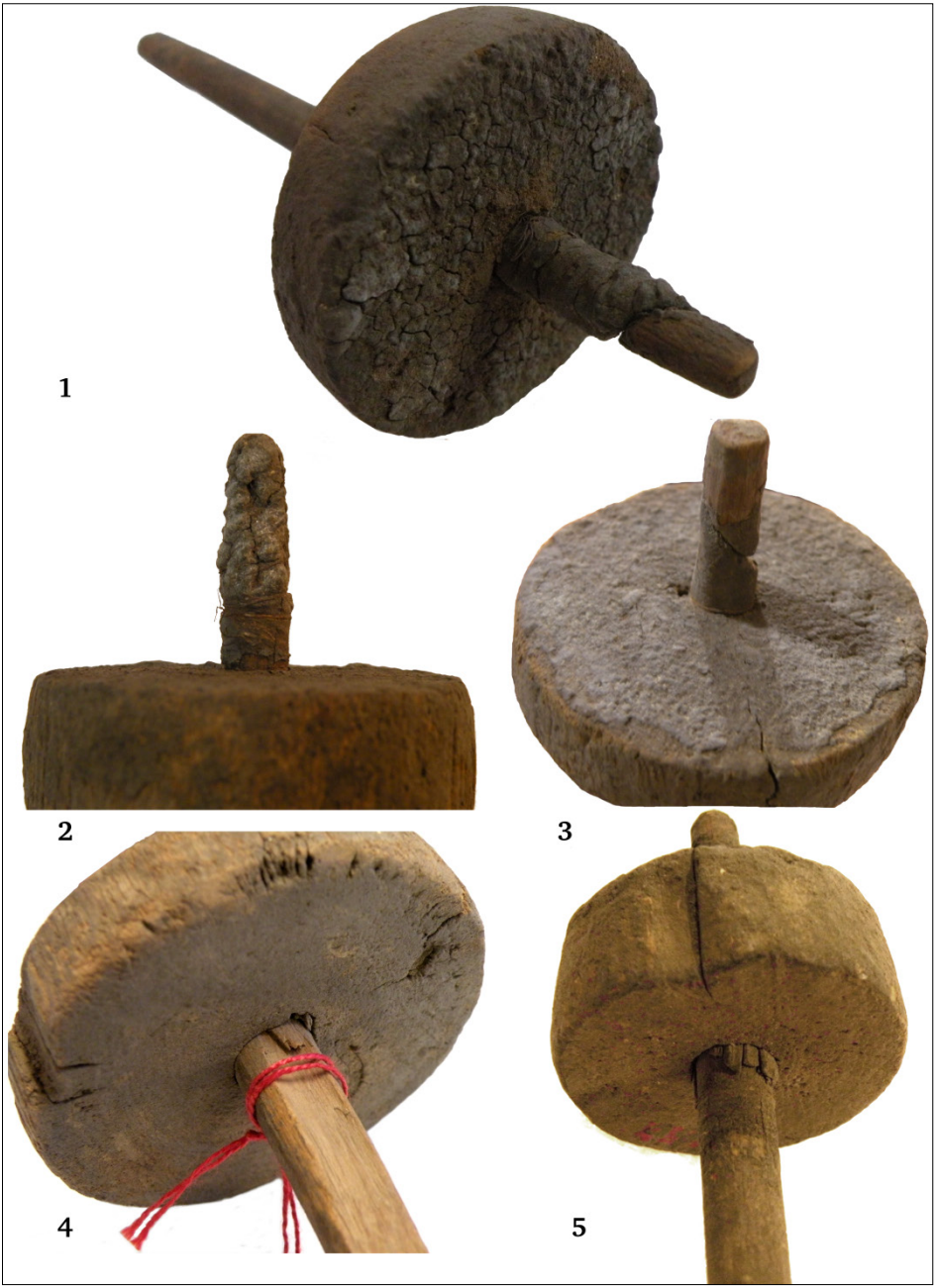



Plate 7.


Plate 8.

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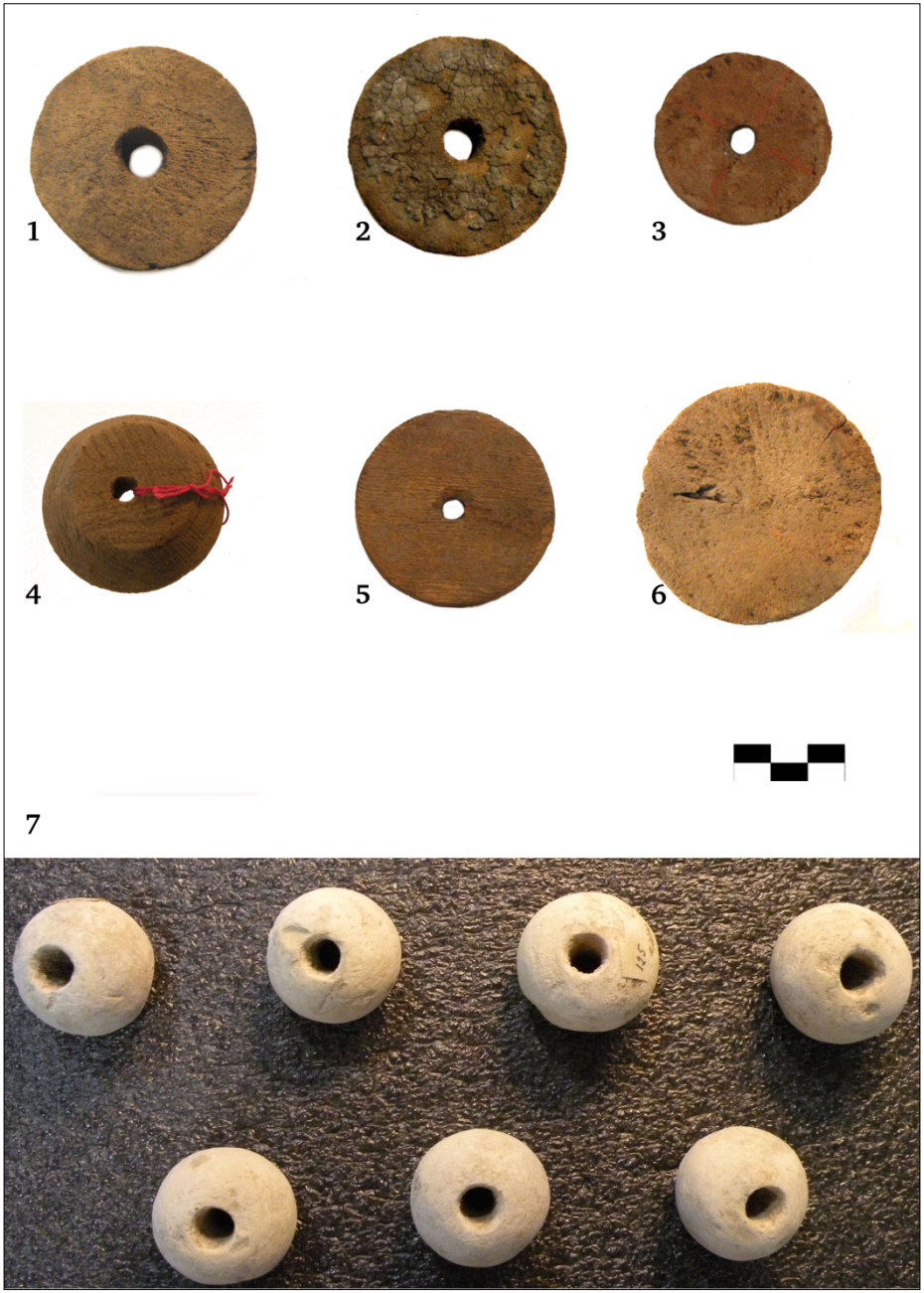


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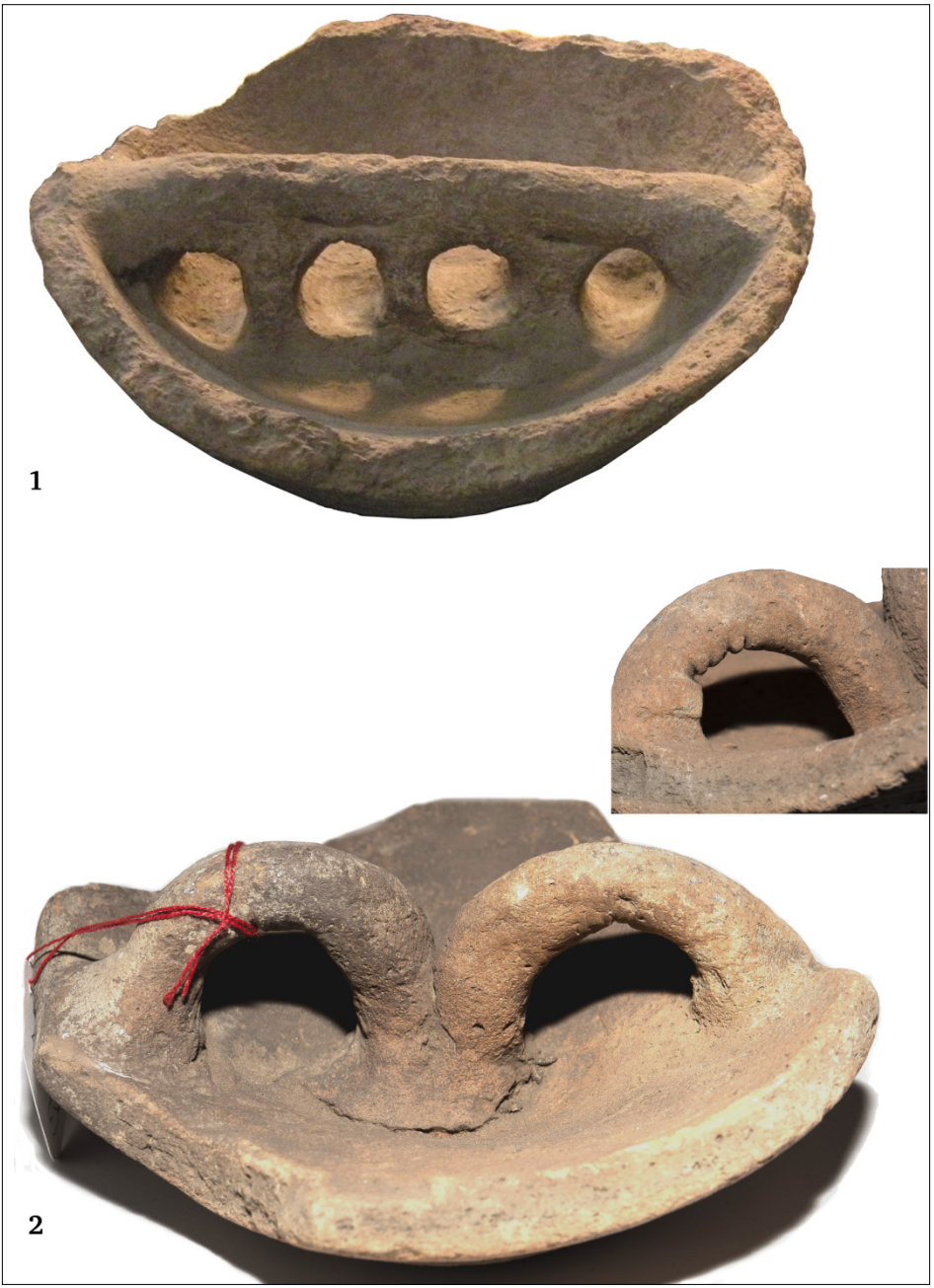



Plate 11.

1

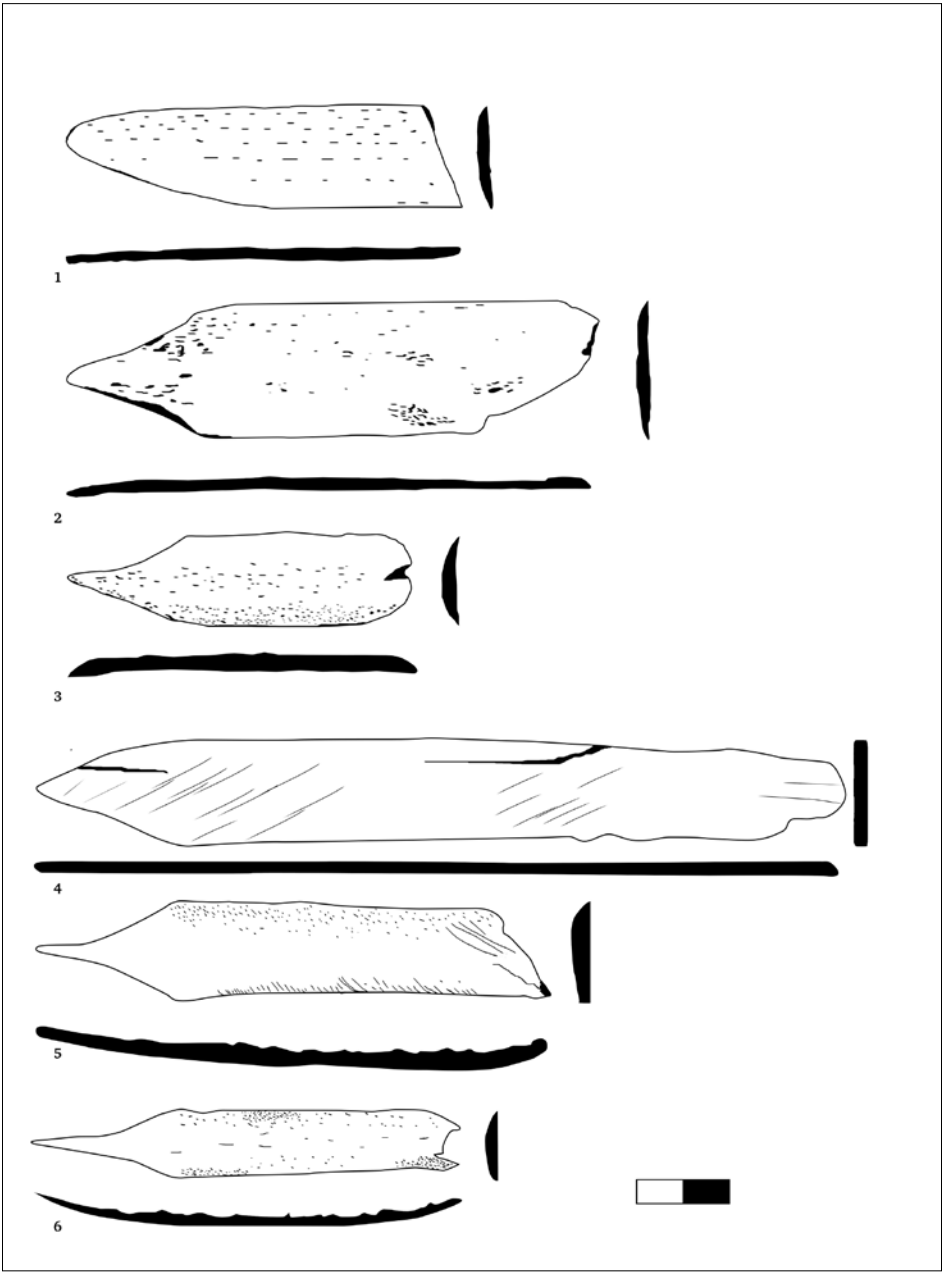
2

3


4

5

Plate 12.

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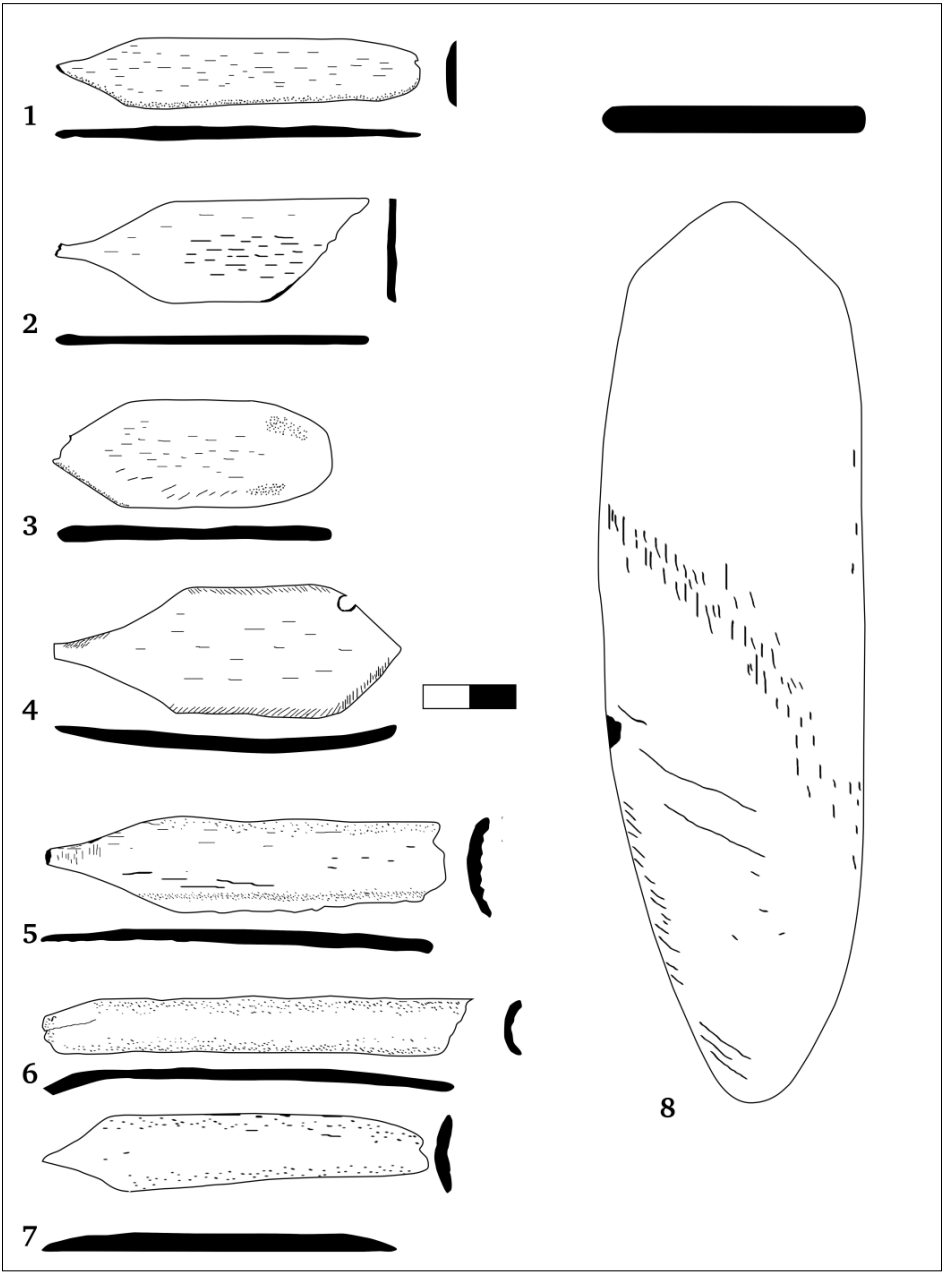


Plate 14.


Plate 15.

This book reviews certain of the most important archaeological finds of textile tools, in order to draw a picture of the spinning and weaving technologies adopted in the Levant and Egypt from the Neolithic to the Persian period. A brief description of the objects found at several sites is provided to highlight differences of materials and tool design in order to better understand developments in weaving technology across this region. Textile tools housed in the Museo Egizio di Torino are also examined here for the first time. These include spindles and spindle whorls, bone spatulae and needles, which for the most part originate from Schiaparelli's excavations at the Workers' village of Deir el-Medina. A general analysis is provided, which compares these objects to the tools known from other sites in Egypt, as well as a catalogue, which provides further description and exact measurements for each object of the collection.

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