Spindle Whorls and Other Textile Tools

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In the following chapter, altogether 122 tools used in textile production at Tel Kinrot are presented; they mainly date to the Early Iron Age I, few are of an earlier date. For spindle whorls, specific data is given only on a representative selection, but the entire find group (N=117) is included in the drawings and tables below. Few particular items related to textile production are studied more in-depth, such as a spindle, four spatulae, and a bone needle (for metal needles, see chapter *Metal Finds: Weapons, Tools, Jewelry and Figurative Artifacts* by Noé D. Michael; items which perhaps were used as loom weights are listed in the respective chapters in Kinneret II,1).

1. Spindle Whorls

Various different types of spindle whorls[1] were found within the Iron Age Strata at Tel Kinrot. They can be divided into five distinct types, primarily based on their shape.[2]

Table 1 Typology of spindle whorls

Type	Description	Quantity	Material	Periods
SX01	Reworked pottery shards/ disk-shaped whorls	71	pottery shards	pre-IA (7), IA I (45), IA II (1), Ottoman (1), Surface (14), unstratified (3)
SX02	Globular whorls	20	clay	pre-IA (1), IA I (7), Ottoman (1), Surface (10), unstratified (1)
SX03	Discoid whorls	13	stone, bone, clay	pre-IA (1), IA I (6), Surface (5), unstratified (1)
SX04	Convex-conical whorls	12	stone, bone, ivory	pre-IA (3), IA I (5), pre-Ottoman (1), Surface (3)
SX05	Cylindrical whorls	1	stone	IA I (1)

[1] In previous research, the objects under discussion have occasionally been interpreted differently. Their identification as whorls, however, relies on several independent studies (e.g., Mårtensson, Andersson, Nosch et al. 2006; Vakirtzi 2012; Daviau 2014), and is further supported by the analysis of the material presented here.

[2] But partly also on the material used to produce them (when it comes to re-worked pottery shards). To date, there is no widely accepted system of categorization for spindle whorls. The typology provided here is based on the typology of spindle whorls developed by Margarita Gleba (2008), with two modifications: the division of her original discoid type into two separate types: reworked pottery shards/disk-shaped whorls (type SX01) and discoid whorls (type SX03), and the renaming of Gleba's conical type to convex-conical (type SX04).

1.1. Reworked pottery shards/disk-shaped spindle whorls (SX01)

Spindle whorls made from reworked pottery shards (Photograph 1) form by far the largest group of these tools retrieved from Tel Kinrot. In total, 71 such objects have been recorded, of which 47 are nearly completely preserved and 55 are fully drilled-through. Additionally, there are also discs, which were left unfinished. Six of them show marks from attempts to drill holes on them on both sides and ten show marks of drilling on one side.

Photograph 1: No. 67; Reg. No. 10530/1

The smallest whorls measure ca. 18.6 mm in diameter, while the largest can have a diameter up to 63 mm. The thickness of the reworked shards varies between 4.2–9.9 mm, and the diameter of the drilled hole ranges from 2 to 7.1 mm. The weight of the whorl varies between 3–34 gr., and there is no correlation between the size and the weight. This is due to the fact that the recycled shards were made from different clays and fired at different temperatures, thus having varying densities. The extent of warping and thickness depend on the ceramic artifact from which the shard originally broke off. There are also examples where the hole is off center and/or the shape of the whorl is asymmetrical.[3]

The whorls of type SX01 are cross-culturally widespread and attested from the Neolithic period onwards, peaking during the Iron Age (Shamir 1996: 150; Mazar, Panitz-Cohen and Shamir 2001: 260; Shamir 2007: 267). In the Southern Levant type SX01 whorls from Late Bronze Age to Iron Age I–II contexts are sometimes also referred to as net weights, loom weights, stoppers or buttons. They are reported from many settlement layers, e.g., Beth-Shemesh, Levels 6–3 (Bunimovitz and Lederman 2016: Fig. 16.7), Dan, Stratum VIII and Late Bronze age contexts (Ben-Dov 2011: Fig. 198:10–11), Dor, Phases 9 and 8 (?) (Ben Basat 2018: Fig. 26.2:25–26), Hazor, Stratum Vc (Cimadevilla 2012: Fig. 12.13), Tell Jawa, Strata VIII–VII (Daviau 2002: 184–188, Figs. 2.144:1–17; in total 108 items were recorded), Ḫirbet el-Mudēyine from Iron Age contexts (Boertien 2013: 219-220, Table 8.11–12; 3 items mentioned), Lachish, Levels P-4–P-3 and Strata VIIb (?), VIIa, VII–III (Sass 2004a: Fig. 23.13:4–11; Sass 2004b: Fig. 28.10:7–10), Megiddo, Strata XII, VIA, V, VB, VA–IVB, fill of Stratum IV, III and I (Lamon and Shipton 1939: Pl. 93:6, 23, 61, 68, Pl. 94: 21, 45–46, 60, Pl. 95:18–19; Sass 2000: Fig. 12.19:6–14), Tel Kinrot, Strata V–IV, II, IC, IB and I (Fritz 1990: Pl. 105:1–7, 11–12, Pl. 106:7, 20), Tel Qiri, Stratum VII (Ben-Tor 1987: Fig. 56:8–9), Timnah (Tel Batash), Stratum II (Mazar et al. 2001: 259–260, Pl. 78:12), Kadesh Barnea (Tell el-Qudeirat), Strata 4b, 3c and 2 (+1) (Shamir 2007: Fig. 16.21:1–4, 10), and Yoqneʿam, Strata VII and post-VII (Ben-Ami 2005: Fig. III.23:11–12), among others.

1.2. Globular spindle whorls (SX02)

Items classified as globular whorls (Photograph 2), with twenty recorded pieces of the type, are all made of clay of differing quality, with firing levels ranging from low to medium. Some of them look quite finely made, with a smooth piercing and even surface, so that the shape of the artifact can almost be compared to a bead (e.g. No. 88; Reg. No. 10474/5). Meanwhile, others have a slightly bi-conical shape and were altered or damaged by the process of piercing before firing, thus they can have a dented surface and the piercing can be left quite scraggly (e.g. No. 89; Reg. No. 10886/1).

[3] My own experiments showed that this does not appear to negatively influence the spinning process, despite one's intuition that asymmetry would cause imbalance – especially when one uses it as a high- or middle-whorl spindle (see 'technical discussion' below).

All the whorls are fully pierced, except for No. 73; Reg. No. 7569/1. Ten of them are complete and three nearly complete, while five are only half, and two less than half preserved. The smallest whorl measures 21.6 mm and the largest ca. 39 mm in diameter. The height ranges between 10.3–29.1 mm and the width of the piercing from 4.1–10.9 mm, while the weight varies between 4–27 gr.

Photograph 2: No. 85; Reg. No. 10287/1

Type SX02 whorls are known from different sites in the Southern Levant from Late Bronze Age, Iron Age I and Iron Age II contexts, (sometimes they are also interpreted as beads or small loom weights), e.g., from Beth-Shean, Level VI (Panitz-Cohen and Yahalom-Mack 2009: Fig. 15.1:14–15), Hazor, Stratum VI, V, Va and Late Bronze age contexts (Cimadevilla 2012: Figs. 12.1:1–4, 12.2:1), Tell Keisan, Niveau 9a, 9b, and few unstratified and surface finds (Nodet 1980: Pl. 97:9–13), Tel Masos, unstratified (chalcolithic) (Fritz and Kempinski 1983: Pl. 171:6), Megiddo, Stratum XVII, XI, VIIA?, VIIB, IV and unstratified contexts (Lamon and Shipton 1939: Pl. 94:59; Bidmead 2013: Fig. 23.4:2(292)–5(295), 7(297)–8(298), 10(300)–17(307); Blockman and Sass 2013: Table 2.6.4:292–295, 297–298, 300, Table 2.6.5:301–307), Tel Qiri, Stratum IX (Ben-Tor 1987: Fig. 57:2), and Yoqneʿam, Stratum XVIII and XVIIa (Ben-Ami 2005: Fig. III.23:1–2), among others.

Photograph 3: No. 89; Reg. No. 10886/1

For No. 89; Reg. No. 10886/1 (Photograph 3), which is a quite irregular globular whorl (from an Iron Age I context, mixed with earlier material), a parallel from Tel Masos, Stratum II (Fritz and Kempinski 1983: Pl. 171:1, burnt clay (crystal [sic!])) should be mentioned.

1.3. Discoid spindle whorls (SX03)

Twelve of the whorls found are classified as discoid. Six are made of limestone, two of basalt, one of granite, two of clay, and one of bone. One (No. 103; Reg. No.10445/1) is fully preserved, one (Photograph 4) nearly complete, and three are halves, while seven are smaller fragments (less than 50%). One of them is unfinished (No. 98; Reg. No. 9295/50); it shows a nearly successful attempt to drill a hole through it on one side.

Photograph 4: No. 104; Reg. No. 12164/1

The smallest discoid whorl measures 15.5 mm and the largest 59.5 mm in diameter. The height ranges between 9.0–20.7 mm, and the diameter of the piercing from 6.1 to 17.5 mm. The weight varies from 16 to 136 gr. A further division into form based sub-categories such as ‘torus-

shaped' (e.g., No. 100; Reg. No. 11519/1) and 'cylindrical-shaped' (e.g., No. 103; Reg. No.10445/1) is not provided here, as it seems not to have relevance for the technical analysis (below).

Type SX03 is known from Late Bronze Age, Iron Age I and Iron Age II contexts from different sites in the Southern Levant (sometimes interpreted also as loom weights or weights in general), e.g., from Tell Abu al-Kharaz, Phase IX (Fischer 2013: Fig. 346:11–12), Timnah (Tel Batash), Strata III–II (Mazar et al. 2001: Pls. 21:33, 39:4–5), Beth-Shean, Level VI and unstratified contexts (Panitz-Cohen and Yahalom-Mack 2009: Fig. 15.1:10–11, 13), Beth-Shemesh, Level 6–2 (Bunimovitz and Lederman 2016: 16.5:3396.01, 3396.01, 3127.02, 3351.01), Tell el-Farʿah (N), Strata VIIb and VIIe (Chambon 1984: Pl. 75:22–35.41–43), Tell Jawa, Strata VIII–VII (Daviau 2002: Figs. 2.144:16, 2.146:1, 2.147:1, 2.148:1–2), Lachish, Level IVa–b and IV–I (Sass 2004b: Fig. 28.9:3–16), Megiddo, Strata XIX, XVI, XII, X–IX, VIIA?, VIA, VB, VA–IVB, II–I and unstratified contexts (Lamon and Shipton 1939: Pl. 93:8, 24, 37–38; Sass 2000: Fig. 12.17:6–8.10–12; Sass and Cinamon 2006: Table 2.10.1: 485, Table 2.10.3: 501–505, Fig. 18.20:485, 501–505; Blockman and Sass 2013: Table 2.6:246–250, Table 2.6.2:257; Bidmead 2013: Fig. 23.1:1(246)–5(250), 12(257)), Tel Qiri, Strata VIII–VI (Ben-Tor 1987: Fig. 56:2–5.7–9), Yoqneʿam, Strata XIV and post-XIV (Ben-Ami 2005: Fig. III.23:10.13), and Tel Kinrot, Strata V–IV, II–I and IA (Fritz 1990: Pl. 106:2.4.8.18–19).

Three of the limestone whorls of this type (Nos. 102–104; Reg. Nos. 14204/1, 10445/1 and 12164/1), all from Iron Age I contexts, vary only slightly in size and weight. They are comparable with whorls published from Tell el-Farʿah (N), Stratum VIIb (Chambon 1984: Pl. 75:23, limestone), Lachish, Strata III and IVa (Sass 2004b: Table 28.20:5 = Fig. 28.9:5; Tables 28.20:8–9 = Figs 28.9:8–9, all limestone), Megiddo, Strata XII, VIA and II (Lamon and Shipton 1939: Pl. 93:24; Sass 2000: Fig. 12.17:8; Fig. 12.17:10; Bidmead 2013: Fig. 23.1:13(258), all limestone), and from Tel Qiri, Strata VIII–VI (Ben-Tor 1987: Fig. 56:2–4, all limestone).

Photograph 5: No. 99; Reg. No. 11062/28

Another noteworthy item is a bone whorl, fragment No. 99; Reg. No. 11062/28 (found in a mixed context [dump], Photograph 5). While only half of the whorl is preserved, and there are traces of burning on it, it is clear that the craftsperson took advantage of the natural cylindrical shape of the bone (presumably a vertebra) with its smoothed surface area. It was shortened into a ring-shape by carving and as a result, the artifact is spongy on one side. I have not found consistent parallels: a perforated bone disc from Timnah (Tel Batash), Stratum V (Yahalom-Mack 2006: Pl. 78:18 = Photo 125) has a highly polished surface and the exterior of the disc is ornately carved. The published drawing of a thinner whorl of bone or ivory from Megiddo, Stratum VIB, does not allow comparison (Blockman and Sass 2013: Table 2.6.3:275; Bidmead 2013: Fig. 23.2:13(275)). The modified fish vertebra from Megiddo (Sass and Cinamon 2006: Fig. 18.21:514, unstratified) also benefits from the natural shape of the bone, but it is artfully worked. In most cases, bone whorls are made of carved joint heads of suitable bones (see Poppa 1978: 61), e.g., of femurs, and belong to the convex-conical type (SX04). See e.g., an item from Beth-Shean, Level VI (Panitz-Cohen and Yahalom-Mack 2009: Fig. 15.1:1–3), and whorls found at Megiddo, Stratum VIA, III and unstratified items (Lamon and Shipton 1939: Pl. 93:67; Blockman and Sass 2013: Table 2.6.3:283, 285–286; Bidmead 2013: Fig. 23.3:2(283), 4(285)–5(286), 8(289)). In the European context, and especially for bone items with an unsmoothed flat side, the identification as whorls has been debated (see Becker 2005; Mauel 2008).

1.4. Convex-conical spindle whorls (SX04)

Type SX04 whorls have a smooth and even surface. They are flat on one face and convex-conical on the other. However some are only slightly convex and curved (e.g. No. 114; Reg. No. 10510/1), while others are more conical and quite sharply tapered around the edges (e.g. No. 115; Reg. No. 10446/1), or almost

hemispherical (e.g. No. 116; Reg. No. 10836/1). Since these objects cannot easily be subdivided into two (or more) clearly distinctive groups or types,[4] Gleba's terminology is modified, and the compound term 'convex-conical' is used.

Twelve pieces of this type have been found; three of them are blanks (Nos. 107, 108 and 112; Reg. Nos. 7548/40, 9171/40 and 9491/40). Most are fully preserved, only one (No. 110; Reg. No. 9383/40) is nearly complete (95%). Three are made of bone (Nos. 106, 109 and 112; Reg. Nos. 4273/40, 5647/40 and 9491/40), four of ivory (Nos. 107, 108, 110 and 114; Reg. Nos. 7548/40, 9171/40, 9383/40 and 10510/1); two of limestone (Nos. 115–116; Reg. Nos. 10446/1 and 10836/1), two of soapstone (Nos. 105 and 111; Reg. Nos. 4086/50 and 9413/50), and one of granite (No. 113; Reg. No. 9796/50). The smallest whorl measures 22 mm and the largest 32 mm in diameter, while the height lies between 7 and 14.3 mm. The diameter of the piercing ranges from 2.9 to 4.9 mm. They weigh between 3 and 14 gr. Convex-conical whorls of different materials were very common during the Iron Age I–II and earlier, and therefore well attested at numerous sites, e.g., Tell Abu al-Kharaz, Phase IX (Fischer 2013: Fig. 346:8–10), Tell Afis, Stratum 8 (Mazzoni 1998: Fig. 3:2–3), ʿAin Dara, Strata XVI, XIII, IX, VII, IV and trench 2 (IA II) (Stone and Zimansky 1999: Fig. 91:1–9), Ashdod, Strata XIII, XIIa and XIIb (Sedman 2002: 10.165–169.171–175.177–178; Dothan and Ben-Shlomo 2005: Figs. 3.8:13, 3.37:15, 3.39:9–11), Beer-Sheba, Stratum II (Singer-Avitz 2016: Fig. 28.2:11–18), Beth-Shean, Level VI (Panitz-Cohen and Yahalom-Mack 2009: Figs. 3.8:13, 3.37:15, 3.39:9–11), Dan, Strata VIIA1, VIIA2 and VIIB (Ben-Dov 2002: Tab. 2.12:259–291; Ben-Dov 2011: Fig. 198:1–7), Deir ʿAlla, Phase E (Franken 1992: Figs. 4–5:9–13 and 5–4:3), Tell el-Farʿah (N) I, Strata VIIb, VIIc and VIId (Chambon 1984: Pl. 75:1–14), Dor, Phases 7 and 6 (Ben Basat 2018: Fig. 26.2:17 and 22–24), Hazor Strata 1B, 3, 4, Xb–a, IXb, VIIIb, VIII–VII, VIIb, VIa and Vc (Yadin, Aharoni and Amiran 1960: Pl. 137:27; Yadin, Aharoni and Amiran 1961: Pls. 294:5; 299:5–6, 336 :13; Cimadevilla 2012: Fig. 12.2:3–12), Jebel al-Hawayah, Cave A4 (LB II and IA IA) (McGovern 1986: Fig. 76:2–3), Tell Keisan, Niveau 9a, 9c, 8, 7, 4/5, and 2a (Nodet 1980: Pl. 96:1–9, 16–26), Tel Kinrot, Strata IV, II, and IA (Fritz 1990: Pl. 106:1.6.11–17), Lachish, Level VII–VI, fill of IV, III–I, S-2 and P-2 (Sass 2004a: Fig. 23.12:8–13, 16–17; Sass 2004b: Fig. 28.10:1–6), Megiddo Stratum IX–VIIA?-B, VIA, VB, VA-IVB, IVA, post-Stratum IV and unstratified contexts (Sass 2000: Figs. 12.17:15–17 and 12.18:1–2; Sass and Cinamon 2006: Table 2.10.2: 495–500, Figs. 18.20:495–500, Table 2.10.4: 506–512, 515, 18.21:506–512, 515; Blockman and Sass 2013: Table 2.6.3:263–269, 271–274, 276–277; Bidmead 2013: Fig. 23.2:1(263)–7(269), 9(271)–12(274), 14(276)–15(277)), Tel Mevorakh, Stratum VII (Stern 1978: Fig. 16:19–21, Pl. 45:9–10), Tel Qiri, Strata IX–VII (Ben-Tor 1987: Fig. 57:15–18), and Yoqneʿam, Strata XIV, XII and XIIb (Ben-Ami 2005: Fig. III.23:5–7).

No. 113; Reg. No. 9796/50 (Photograph 6, MB IIB/LB I, mixed with some later material), is an exceptionally beautiful whorl, which undoubtedly would have made a cherished heirloom. The item is complete and made of granite – most unexpected material for the Bronze Age (but not in later, e.g., Roman times). The hardness of the material poses no problems with respect to spinning, but making these whorls is a different matter.[5]

Photograph 6: No. 113; Reg. No. 9796/50

No exact parallel has thus far been found. A certain visual similarity to a whorl from the Egyptian Garrison at Beth-Shean, Stratum VII (James and McGovern 1993: Fig. 109:1 = Pl. 50d, alabaster) can be detected, also in the description: "One of the alabaster whorls (Fig 109.9) is of interest, because it duplicates in stone a shell form" (*ibid.* 182).

[4] As it is possible in clearer cases, e.g., Masada (Reich 2007), Hazor (Cimadevilla 2012) and Ugarit (Elliott 1991).

[5] Many thanks to Dr. Gillian Vogelsang-Eastwood (Textile Research Centre, Leiden), Rosalind Janssen (UCL, London) and Dr. Deborah Cassuto (Bar-Ilan University, Ramat Gan) for their comments on this whorl, and to Dr. Kirsi Valkama (Helsinki University) and Ursina Bachmann (School of Applied Sciences, Bern) for the identification of the stone type.

Photograph 7: No. 114; Reg. No. 10510/1

No. 114; Reg. No. 10510/1 (Photograph 7), found from a mixed IA I/post IA context), is a complete whorl made of ivory. Similar whorls made of bone or ivory from other sites can be listed from Beth-Shean, Level VI (Panitz-Cohen and Yahalom-Mack 2009: Fig. 15.1:3), Dan, from a Late Bronze Age II tomb and Stratum VIIB (Ben-Dov 2002: Fig. 2.123:274; Ben-Dov 2011: Fig. 198:1, both ivory), Deir ʿAlla, Phase E (Franken 1992: Fig. 3–10:29, bone), Tell el-Farʿah (N), Stratum VIIc (Chambon 1984: Pl. 75:1, bone), Dor, Phases 6 (Ben Basat 2018: Fig. 26.2:22), unstratified context at Hazor (Cimadevilla 2012: Fig. 12.2:11, polished ivory), Megiddo, Strata VB and II (Lamon and Shipton 1939: Pl. 93:47; Sass 2000: Fig. 12.18:1, both bone). See further the parallels and discussion for whorl TJ 110 from Tell Jawa, Stratum VIII (Daviau 2002: 188–189).

As for a complete whorl No. 115; Reg. No. 10446/1 (Photograph 8), made of limestone (found from a locus containing uniquely IA I material but unfortunately not connected to any architecture), a very similar stone (steatite?) piece with a square-sectioned iron pin (the remains of an iron rod?) attached to it has been found at Busēra (Sedman 2002: Pl. 10.235, topsoil). Further parallels can be cited from Hazor, Stratum VIII–VII (Cimadevilla 2012: Fig. 12.2:6, stone) and from Dan, Stratum VIIA2 (Ben-Dov 2011: Fig. 198:2 = Fig. 72:10, serpentine).

Photograph 8: No. 115; Reg.No. 10446/1

1.5. Cylindrical spindle whorl (SX05)

Cylindrical type SX05 has nearly vertical sides, only one has been discovered at Tel Kinrot to date: No. 117; Reg. No. 11075/1 (Photograph 9) was found in an Iron Age I context. The whorl is made of soapstone and nearly complete (90% preserved). On the outside of the whorl there are four circles carved parallel to each other. Three clearly comparable items should be mentioned, all with four parallel circles, one from Tel Masos, Stratum III (Fritz and Kempinski 1983: Pl. 171:3, limestone), one from Tell el-Ḥammām (Collins, Kobs and Luddeni 2015: No. 153 (P. 344), unspecified stone, Stratum not published) and one from Megiddo, Stratum VIA (Zarzecki-Peleg 2016: 313 with Fig. 100:2 and Photo 101:2, stone or highly fired clay). For a similar object with two pairs of two parallel circles see Tell Keisan, Level 9b (Puech 1980: Pl. 101:9, ivory), and Megiddo, Strata VIIB and VIA (Loud 1948: Pl. 172:28, bone; Zarzecki-Peleg 2016: 313 with Fig. 100:1 and Photo 101:1, ivory). For similar objects with three parallel circles see items from Megiddo, Stratum III (Lamon and Shipton 1939: Pl. 94:1, limestone), and Stratum VIIB (Loud 1948: Pl. 172:27, bone), Tell Abu al-Kharaz, Phase IX (Fischer 2013: Figs. 346:13; 349 and 457:13, stone [steatite?]), Timnah (Tel Batash), Stratum II (Mazar et al. 2001: Photo 189 = Pl. 51:11, limestone), and Tell el-Farʿah (N), Stratum VIIe (Chambon 1984: Pl. 75:37, schist).

Photograph 9: No. 117; Reg. No. 11075/1

From Iron Age I and Iron Age II contexts, further cylindrical whorls of different materials are known from numerous sites, e.g., Beth-Shean, lower Level V (Panitz-Cohen and Yahalom-Mack 2009: Fig. 15.1:12), Busēra, from Iron Age II context (Sedman 2002: Pls. 10.165–175, 10.177–178 and 10.180), Tell

el-Farʿah (N), Strata VIIa and VIIb (Chambon 1984: Pl. 75:36.39), Tel Masos, Stratum III and unstratified context (Fritz and Kempinski 1983: Pl. 105:3 = 171:3–4), Megiddo, Strata VIA, V(B) and III (Lamon and Shipton 1939: Pls. 93:64, 94:1, 95:30–31; Blockman and Sass 2013: Table 2.6.2:260; Bidmead 2013: Fig. 23.1:15(260); Zarzecki-Peleg 2016: 313 with Fig. 100:3 and Photo 101:3, ivory), Tel Qiri, Stratum VI (?) (Ben-Tor 1987: Fig. 57:19), Tawilan, from Iron Age II contexts (Bienkowski 1995: Fig. 9.29:1–3, 5–12, 15–16), and Timnah (Tel Batash), Stratum II (Mazar et al. 2001: Pl. 39:3, Photo 188), for a broader discussion of this type see Sedman 2002: 408–409.

2. Spindle

No new examples of intact spindles or fragments thereof were found in the latest excavations at Tel Kinrot, but there are two bone fragments of an item identified as *Stäbchen* (small stick) from an Iron Age II context, which were published by Fritz (1990: Pl. 112:12, Reg. No. 1945/40) already in *Kinneret I*. These fragments can be tentatively classified as belonging to a bone spindle with an approximate length of minimum 170 mm and a medial diameter of ca. 9 mm. The shorter piece measures 52 mm; it is tapered at one end and therefore has to be considered as the distal end. The longer piece measures 96 mm, at one end finishing straight (approximately the proximal end of the spindle) but not smoothed, and at the other end in an inclined crack. Between the two parts one or more fragments are missing. The artifact has a diameter fitting for whorls with a drilling of 8–9 mm in diameter, a common drilling width among the finds presented here (see below). But as neither a notch nor a whorl used on the spindle is preserved, this identification remains tentative.

3. Technical Discussion

Before entering the technical discussion on spinning and spindle whorls, the absence of complete spindles, i.e. composites of whorls and rods, has to be stated. This leads to a large scope of interpretation regarding the spinning techniques possibly applied: According to various remains from all over the Aegean Sea, Egypt and Mesopotamia (ancient pictures and few entirely conserved spindles as well as recent ethnographic pararells), whorls have been used in diverse facettes, e.g., for spinning by twisting a hooked stick, grasped spindle spinning, spinning by rotation of a spindle in the hand, spinning by a hand-supported spindle and spinning by suspended hand spindle, used for spinning in the narrower sense, but also for plying and twisting existent threads and prepared fibers (see Crowfoot 1931: 44–46; Barber 1991: 42–51; Grabundžija and Schoch 2020).

This variety gets further broadened by the three possible positions of the whorl on the rod: There is evidence for low-whorl spindles, middle-whorl spindles and high-whorl spindles.[6] In consequence, not only the position of the whorl on the rod, but also the right position for the whorl itself often remains unclear to us. Above all, whorls of type SX03 are affected by this uncertainty: On the majority of published photographs and drawings they are presented as belonging to a high-whorl spindle (i.e. flat side down, convex side up), when in fact some, if not most of them probably belonged to a low-whorl spindle and, therefore are presented upside down in modern publications. (Some of them may even have functioned in the manner of a whirligig.)

Finally, the discussion gets even more complex when taking into account new insights from experimental archaeology, which reports different results with one and the same whorl: For example, the quality of the thread depends, e.g., on whether wool fibers or flax fibers (see Olofsson, Andersson Strand and Nosch 2015; Ulanowska 2020), even on whether wild or cultivated flax (see Heidkamp 2018: 13–14), is used, in addition to the spinning angle of the respective spinner (see Möller-Wiering 2015). In order to avoid hasty

[6] At least for the Bronze Age it is generally assumed that in the Aegean people were using low-whorl spindles (in the Anatolian region, additionally, middle-whorl spindles have been found), while people from Egypt and the Near East used high-whorl spindles (see Barber 1991: 56–65). However, a more complex picture can be expected given traveling of people and spreading of different techniques via trade routes during the Bronze and Iron Age periods and already before (see for example Spinazzi-Lucchesi 2018:127–132).

interpretations of the data it is important to keep this theoretical variety in mind while studying the finds. Therefore, the results presented here begin by, first, giving pure mathematical calculations and statistical analyses, which allow comparison of basic characteristics, namely, the weight (W), the ratio between weight (W) and diameter (D) as well as the moment of inertia (MI). These are the parameters that influence the spinning consisting of two actions: drawing out and twisting the fibers (see Barber 1991: 41; Grabundžija and Schoch 2020).

The investigation was carried out on a selected sample consisting of 42 items: 22 belonging to the type of reworked pottery shards (SX01), 11 to the type of globular whorls (SX02), 4 to the type of ring-shaped whorls (SX03), 4 to the type of convex-conical whorls (SX04) and 1 belonging to the type of cylindrical whorls (SX05). Thus, the representation of the types SX01–SX04 is more or less consistent with their distribution in the find corpus, but type SX05 is obviously relatively overrepresented. The selection was determined also by the given data: When an artifact from group SX02 to SX05 is ≥ 50% preserved, its weight is calculated up to 100% (this is indicated in the table 3 and thereafter marked with an asterisk * for 'weight restored'). Artifacts from group SX01, which are not 100% preserved, and artifacts from group SX02–SX05, which are less than 50% preserved, are excluded from the calculations. To estimate their weights would be too speculative, especially in the case of artifacts belonging to group SX01, as they are often asymmetrical and drilled off center and the size of the object cannot be deduced from the position of the drilled hole.

3.1. Weight

The weight of the whorl is especially important when performing suspended spinning, because the whorl is used as a flywheel and provides a relatively continuous draft. It takes light, small whorls to spin fine, delicate threads, and heavier whorls for plying coarser, stronger fibers (for further details on wool quality and weight range of whorls, see Barber 1991: 51–52). The following table shows a grouping of the selected whorls according to weight, and the distribution over the different types (whereby in the column material, the somewhat fuzzy categories clay and shard are used to allow detection of type SX01 at first sight):

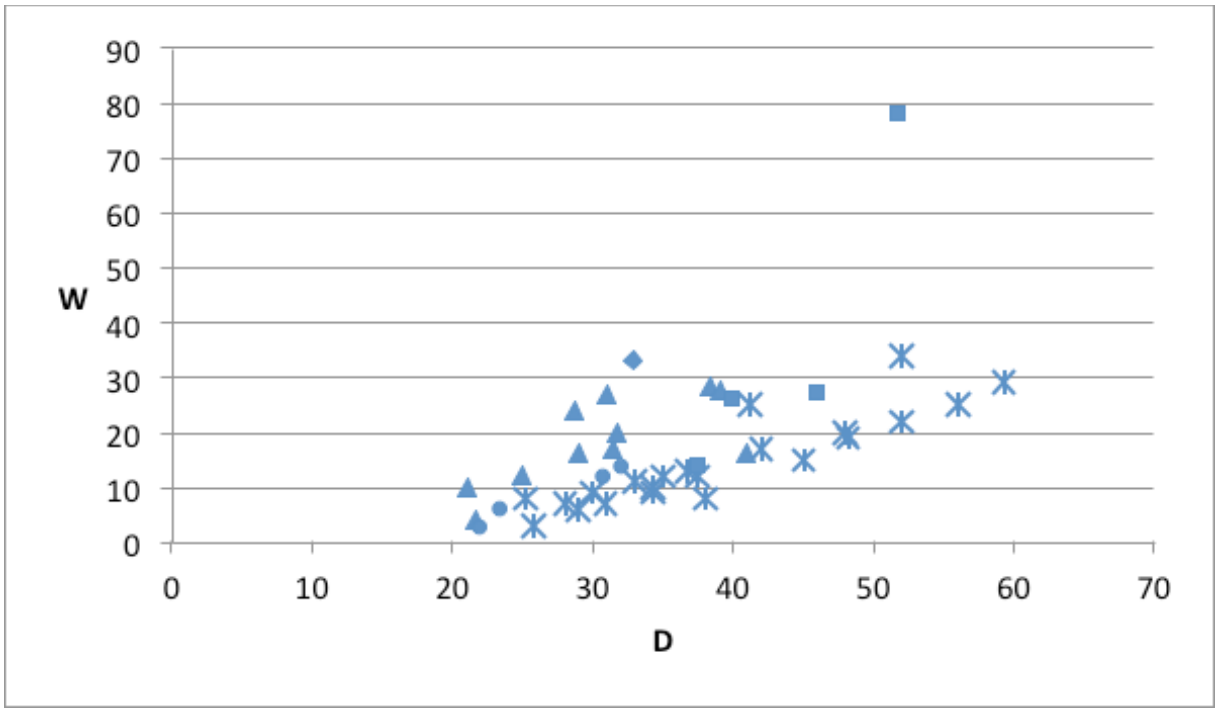
Table 2 Distribution of the weight according to whorl types

Mass (gr.)	Quantity	SX01	SX02	SX03	SX04	SX05	Material
3–4	3	1	1		1		clay, shard, ivory
5–6	2	1			1		shard, stone
7–8	4	4					shard,
9–10	4	3	1				clay, shard
11–12	5	3	1		1		clay, shard, stone
13–14	3	1		1	1		bone, shard, stone
15–16	3	1	2				clay, shard
17–18	2	1	1				clay, shard
19–20	3	2	1				clay, shard
21–22	1	1					shard
23–24	3	2	1				clay, shard
25–26	3	2		1			shard, stone
27–28	4		3	1			clay, stone
29–30	1	1					shard
31–32	0						
33–34	2	1				1	shard, stone
77–78	1			1			stone

The whorls from the selection show a quite regular distribution between 3–34 gr.; only one whorl is remarkably heavier. Regarding the types, it seems that type SX04 covers more the lower half, type SX03 more the upper half, and whorls of type SX01 cover the full range between 3–34 gr. These tendencies get even clearer when the ratio between weight and diameter is taken into account. The following diagram provides an overview of the distribution of the five types with weight (W) plotted against diameter (D).

3.2. Ratio between weight and diameter

The ratio between weight and diameter is a second parameter besides the weight that, i.a., affects the thickness of the thread spun (see Spinazzi-Lucchesi 2018:25–26). The following plot 1 provides an overview of the distribution of the five types with weight (W) plotted against diameter (D).



Plot 1: The x-axis portrays the diameter (D) in mm, the y-axis depicts the weight (W) in gr. Symbols: × reworked pottery shards (SX01); ▲ biconvex whorls (SX02); ■ ring-shaped whorls (SX03); ● hemispherical whorls (SX04); ♦ cylindrical whorls (SX05).

As the plot above shows, biconvex spindle whorls (▲) cover an area on the left side of the distribution pattern, which is also occupied by the hemispherical whorls (●) and the cylindrical whorls (♦). At the center of the graphic we can see ring-shaped whorls (■) extending further to the right. Reworked pottery shards (×), by contrast, cover the entire spectrum. An outlier is the ring-shaped stone whorl No 103; Reg. No. 10445/1. Apart from the latter, weight does not allow classifying them into distinct types by material (therefore from a purely technical standpoint, the grouping of whorls by material, occurring elsewhere, may be questioned).

3.3. Moment of inertia

The moment of inertia (henceforth MI), which is a measure of quantity, expresses the property of a rigid object that defines its resistance to change in angular acceleration. The moment of inertia of a whorl provides information about how easy or difficult it is to spin or twist it. If the MI is low, the whorl turns fast and the thread spun is very twisted; if the MI is high, the whorl turns slowly and, using the same fiber, will produce thread that is less twisted (Sauvage 2012: 199). The MI plays a role when any and all of the spinning

techniques are employed, including the use of a supported or suspended spindle, or when spinning with the spindle in hand. Generally the MI is calculated as follows: $MI=q*R^2$. For the various shapes of the whorls, different numerical values for q must be applied; used here: For SX01, SX03 and SX05 q=1/2; for SX02 and SX04 q=2/5.[7]

Table 3 Moment of inertia by type of whorl

No.	Reg. No.	Type	Material	D	H	d	Wt.	*	MI (g*cm²)
103	10445/1	SX03	Limestone	51,8	20	8,1	78		261,616
44	11875/2	SX01	Clay	59,3	7,9	-	29		127,473
46	11950/19	SX01	Clay	52	8,9	3,4	34		114,920
45	11906/10	SX01	Clay	56	7,3	3,1	25		98,000
67	10530/1	SX01	Clay	52	7,6	7,1	22		74,360
104	12164/1	SX03	Limestone	46	11,4	8,1	27	*	71,415
39	11234/1	SX01	Clay	48	8	4,1	20		57,600
43	11838/1	SX01	Clay	48,2	7,1	3,9	19		55,177
42	11535/9	SX01	Clay	41,2	7	4	25		53,045
102	14204/1	SX03	Limestone	40	15	8	26	*	52,000
117	11075/1	SX05	Soapstone	32,9	26,6	8,3	33	*	44,649
81	11835/1	SX02	Clay	39	28	9,8	27,5	*	41,828
80	11510/1	SX02	Clay	38,3	21,4	7,7	28,5	*	41,806
71	12111/3	SX01	Clay	45	6,4	4	15		37,969
64	10454/1	SX01	Clay	42	6,7	4,9	17		37,485
89	10886/1	SX02	Clay	31,5	16,9	7,8	16		15,876
85	10287/1	SX02	Clay	31	29,1	9,5	27		25,947
99	11062/28	SX03	Bone	37,5	17,5	11,1	14	*	24,609
49	12721/1	SX01	Clay	36,7	8,8	5	13		21,887
53	14258/1	SX01	Clay	37,5	6,4	4,3	12		21,094
82	12781/1	SX02	Clay	31,7	24,4	8,9	20	*	20,098
88	10474/5	SX02	Clay	28,7	27	7,9	24	*	19,769
51	12894/1	SX01	Clay	35	6,8	3,7	12		18,375
90	10257/1	SX02	Clay	31,4	18,4	8,2	17		16,761
69	10618/1	SX01	Clay	33	6	3,7	11		14,974
57	12620/1	SX01	Clay	34,3	6,4	3,7	10		14,706
28	12310/3	SX01	Clay	38	5,2	-	8		14,440
113	9796/50	SX04	Granite	32	12,8	4,9	14		14,336
86	10337/1	SX02	Clay	29	25	8,9	16	*	13,456
27	12300/10	SX01	Clay	34,3	5,9	-	9		13,236
115	10446/1	SX04	Limestone	30,8	14,3	4,3	12		11,384
38	11232/3	SX01	Clay	30	7,2	3,4	9		10,125
65	10483/1	SX01	Clay	30,9	6	3,1	7		8,355
83	10216/1	SX02	Clay	25	19,5	4,1	12	*	7,500

[7] Calculations differ slightly: For example, Sauvage analyzed the whorls from Ugarit corresponding to type SX02 with a value q=0.375 and the ones corresponding to type SX04 with q=0.5 (see Sauvage 2012: 199). Here, SX02 and SX04 are analyzed with q=2/5=0.4, considering the formula for hemispherical bodies more adequate for the respective types. In fact, the 0.025 difference between the qs is small enough to be disregarded; I thank Dr. Adrian Hutter (University of Basel) and Dr. Philippe Goldammer (University of Zurich) for their advice in mathematical and statistical matters.

63	10366/1	SX01	Clay	28	9,9	4,7	7		6,860
40	11056/19	SX01	Clay	25,2	6,7	2	8		6,350
41	11148/19	SX01	Clay	29	4,2	2,6	6		6,308
87	10361/4	SX02	Clay	21	21,5	6,3	10	*	4,410
116	10836/1	SX04	Limestone	23,4	11,7	4,1	6		3,285
52	14233/1	SX01	Clay	25,8	5,9	4,7	3		2,496
77	12267/1	SX02	Clay	21,6	10,3	5,7	4	*	1,866
114	10510/1	SX04	Ivory	22	7	2,9	3		1,452

Abbr.: D/ H in mm; d – diameter of drilling in mm; Wt. – weight in gr; * – restored weight; MI – moment of inertia.

Thus, two observations can be made. First: types SX02 and SX04 have mostly lower MIs, while the MIs of types SX03 and SX05 are higher, but type SX01 covers the whole range, followed by type SX02 with a wider range. Second: The materials used for the whorls do not allow grouping them into distinct groups by MI.

3.4. Further discussion

It appears clear that the presence of a relatively large mass of reworked pottery shards can be explained by the fact that it is a general model. If one chooses the right shard with the appropriate size, it will deliver the desired thread. Contrary to types SX02 and SX04, whose manufacturing require higher technical skill and more advanced equipment, pottery shards are available for everyone and are relatively easy to drill. According to my own experiments, at least when used for a high-whorl or middle-whorl spindle, neither asymmetrical shape nor off-center drilling caused problems with spinning. An additional advantage is that these whorls can be mass-produced and according to any need that may arise; a knob and a shard are enough to make them. Many threads could be spun and stored on different spindles without the necessity of unloading before continuing to spin. We can assume that more than one or two spindles were normally used to produce enough yarn for a piece of fabric. If only one or two spindles would have been available, the spinner would have had to unwind and rewind the thread in order to produce more yarn (see Boertien 2015: 271).

The second easiest way to mass-produce whorls is by manufacturing them as type SX02 whorls were made. They are also relatively frequent at Tel Kinrot and cover a broad range of the MI-spectrum.

In short: Whorls of type SX01 were a salvaged, re-cycled product, accessible to everybody and furthermore yielding excellent results. Next on the scale of efficiency are type SX02 whorls. All things considered, at least these two types do not offer any evident traces of cultural or technical insights; instead they appear to be tools covering a wide field of applications. They were made for everyday use without a direct implication of prestige or a marker of a cultural background. None of the whorls found at Tel Kinrot have obvious ornaments, in contrast to precious whorls attested in purses or among women's burial objects elsewhere. The only object with potential in this regard is No. 113; Reg. No. 9796/50 (type SX03).

Regarding the five different whorl types (SX01–SX05), it can for now only be assumed that craftswomen and -men benefited from having different items at their disposal, each of which somehow suitable for producing a different kind of thread with the specific quality needed, but details of the craft remain obscure to us.

3.5. Whorls, weights and loom weights

With its weight of 78 gr. the outlier No. 103; Reg. No. 10445/1 (Photograph 10) requires special treatment. It is more than double the weight of any complete whorl in the corpus and it is debatable, whether or not it really is a whorl. It is far too light, the shape is atypical and there is no context for considering a single stone weight or pendant as loom weight. This also accounts for the other stone objects listed as loom weights in Kinneret II,1, below: The find context alone does not allow clear identification (the only group suggesting a more probable identification as loom weights are the 128 ceramic balls found at the Iron Age II acropolis of Tel Kinrot, (see Rabe 1996: 100–121, Pl. 9). It is possible to define No. 103; Reg. No. 10445/1 as a light weight for some other purpose, while also considering its use as a potential whorl.[8]

Photograph 10: No. 103; Reg. No. 10445/1

On the one hand, No. 100; Reg. No. 11519/1 (Photograph 11), a ring-shaped whorl (SX03) of basalt (a surface find) is only 25% preserved, and it can be estimated to have weighed ca. 136 gr. when complete. It has a clearly defined shape of a whorl, so a significantly heavier whorl with a larger diameter and a higher MI than No. 103; Reg. No. 10445/1 is attested at the site, which was possibly used to spin much thicker threads. On the other hand there are whorls used not only for spinning but also for plying or throwing already spun yarns or otherwise prepared fibers (see Barber 1991: 48). This process demands more pragmatic whorls.

Photograph 11: No. 103; Reg. No. 10445/1

Neither of these two whorls nor the whole assemblage provide an insight as to which kinds of fibers have been converted. The animal remains show a considerable quantity of sheep and/or goat bones, so access to wool was given (Manhart and von den Driesch 2003: 3–27); also flax is attested in the broader region, at least in later times, so flax spinning is also a possibility (see Fortner and Rottloff 2003: 136). Finally, plucking of wild fibers, cultivated or domesticated providers (both floral and faunal) cannot be completely discounted.

4. Spatulae

Spatulae are thin, pointed tools made of bone, antler or ivory. Their function has long been debated (see Mazar et al. 2001: 264), but the most widely accepted explanation for the function of such objects is that they were used in the weaving process (see Cristiani 2006; Boertien 2015: 72–73, 218), to separate and strengthen the threads on the loom (see Bidmead 2013: 1097) or to make colored and/or intricate patterns on the woven fabric (see Boertien 2013: 218).

Four spatulae have been found at Tel Kinrot, three of them are completely preserved and pointed at one end (Nos. 118–120; Reg. No. 5133/40 = Figure 1; Reg. Nos. 8475/40 and 8478/40). One (No. 121; Reg. No. 8473/40) is broken into two parts (ca. 75% of the object is preserved) and it was possibly rounded at both ends. Most finely made is a spatula carved of a hippo's rib (*hippopotamus amphibious*) (No. 118; Reg. No.

[8] For further discussion see chapter *Stratigraphy of Area U and N* by Kirsi Valkama in the final publication.

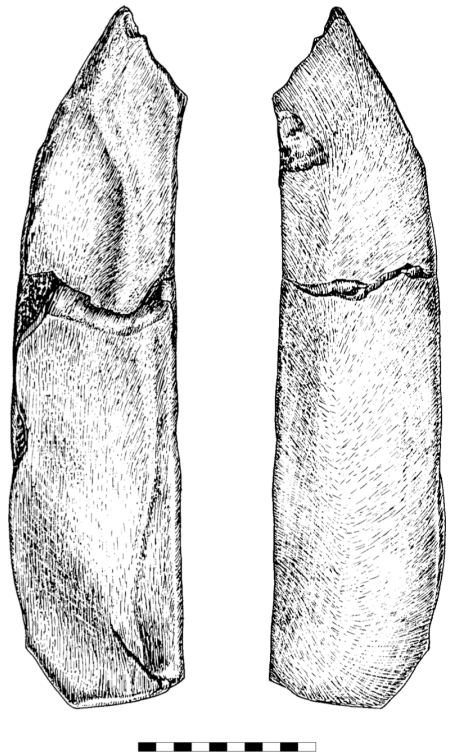


Figure 1: No. 118; Reg. No. 5133/40

5133/40), found in a Stratum V context. It is oblong and flat, varying according to the natural shape of the rib. Only one end is pointed and the edges of the other end are not smoothed. The tool is blank and shows no traces of use (see Manhart and von den Driesch 2003: 26–28; Thomsen 2012).

Spatulae of bone and ivory varying slightly in shape and size are known from different sites from Late Bronze, Iron Age I and Iron Age II contexts: at Busēra they were found in Late Iron Age II deposits (Sedman 2002: Pl. 10.14:a–b), at Tell el-Farʿah (N) in Stratum VIId-e (Chambon 1984: Pl. 73:13–14), at Hazor in Strata VIII–VI (Yadin et al. 1961: Pl. 188:25–27; Bechar 2012: Fig. 8.1:11–15), at Ḫirbet el-Mudēyine in Iron Age context (Boertien 2013: 218), at Lachish in Level IVb–a, IV–II (Sass 2004b: Fig. 28.12:1–12), at Lahav (Tell Halif) in Stratum VIB (Hardin 2010: Pl. 6:5), at Megiddo in Strata XVIII, XIV, V, VB–A, IVB, IV and II–I (Lamon and Shipton 1939: Pls. 95:39–42, 96:1–9; Sass 2000: Fig. 12.20:1–6; Blockman and Sass 2013: Table 2.19.3:387–388; Bidmead 2013: Fig. 23.8:1 (387)–2(388)), at Tawilan in Iron Age II contexts (Bienkowski 1995: Figs. 9.10:1–14, 9.11:1–16), at Timnah (Tel Batash) in Stratum II (Mazar et al. 2001: Pls. 40:8, 69:10), at Tel Qiri, in Strata IX/VIII and VII (Ben-Tor 1987: Fig. 57:12–13), at Kadesh-Barnea in Strata 3–1 (Gera 2007: Pl. 13.5:30–31.37–38.48–49.52) and at Tell Jawa in Stratum VIII (Daviau 2002: Fig. 2.154:1–3), among others.

5. Needle

Several bronze needles were found at Tel Kinrot (discussed in chapter *Metal Finds: Weapons, Tools, Jewelry and Figurative Artifacts* by Noé D. Michael in the final publication), but here, only one made of bone is treated:

No. 122; Reg. No. 12860/1 (Photograph 12) is a cuneiform needle, found *in situ* on a floor, from an Iron Age I context. It is 52 mm long and flat (Th 2.6 mm), tapering to a sharp point; on the wider end (W 8.9 mm) there is a drilled eye with a diameter of 3 mm. It weighs less than 1 gr. The surface is in parts shiny from use. The best parallel is a contemporary bone needle from Lachish, Stratum VIIb–VIIa (Sass 2004b: Fig. 23.14:6 = Table 23.23:7 = Photo 23.27:4). If it was used as a needle in sewing, the breadth suggests a use for coarse, coarsely weaved textiles or other loose materials where it would have been used either with a fine-spun thread or some other naturally thin fiber. Perhaps the tool should better be interpreted as a small point for delicate fabrics. Points were used in a similar manner as spatulae (see Bidmead 2013: 1097). The hole at the top could have allowed it to be secured to the loom.

Photograph 12: No. 122; Reg. No. 12860/1

6. Spatial Distribution of Textile Tools

The trade and production of textiles was a lucrative trade or business. At least for the Bronze Age periods a regulatory system for textile production can be assumed (see Goshen, Yasur-Landau and Cline 2013). For the Iron Age periods, there is also evidence for a well elaborated and coordinated *chaîne opératoire* regarding

textile production (see Cassuto 2018 and Mazar 2019). There are hypotheses that temples have been involved in the production of textiles. It is, therefore, to be expected that textile production was likely located in the vicinity of temples or other types of public buildings associated with the communities' elites (see Ackerman 2008). In the prosperous Iron Age I city of ancient Kinneret, the influential textile production centers, given that they indeed existed, ought to have been located in or close to the acropolis of the city. However, the area excavated by Volkmar Fritz and the Kinneret Regional Project focused mainly on domestic quarters in the lower city and thus reflects the everyday life of ordinary people, also echoed by textile tools.

Some observations can be made upon examining the spatial distribution of the whorls and spatulae at Tel Kinrot. All five types of whorls (SX01–SX05) are simultaneously attested in Stratum V in the domestic quarters of Field I. They appear in two adjacent parts of Complex 1. Further rich in textile tools is courtyard 4236 with room 4330 next to it – both being part of architectural structures also containing semi-industrial installation in Area U, West of Complex 1. Table 4 lists the two clusters of well-stratified textile tools indicating domestic production by individual households.

Table 4 Spatial distribution of textile tool clusters in Stratum V

Cluster	Locus	No.	Reg. No.	Type	Material	D	H	d	Wt.	*	MI
Cluster 1a: *Field I; Stratum V*, *Complex 1*											
	1753	56	7011/1	SX01	Clay	not 100% preserved					
	1753	57	12620/1	SX01	Clay	34,3	6,4	3,7	10		14,706
	1753	102	14204/1	SX03	Limestone	40	15	8	26	*	52,000
	1753	122	12860/1	Needle	Bone						
	1744	82	12781/1	SX02	Clay	31,7	24,4	8,9	20	*	20,098
	1758	49	12721/1	SX01	Clay	36,7	8,8	5	13		21,887
	6105	30	9244/1	SX01	Clay	blank with drilling attempt on both sides					
Cluster 1b: *Field I; Stratum V*, *Complex 1*											
	1772	32	9370/1	SX01	Clay	not 100% preserved					
	1772	33	9338/1	SX01	Clay	44,6	4,7	4,2	–		–
	1772	53	14258/1	SX01	Clay	37,5	6,4	4,3	12		21,094
	1772	110	9383/40	SX04	Ivory	46,2	6,1	5,5	–	*	–
	1763	38	11232/3	SX01	Clay	30	7,2	3,4	9		10,125
	1763	51	12894/1	SX01	Clay	35	6,8	3,7	12		18,375
	1763	55	6932/1	SX01	Clay	40,1	8,6	6,5	–		–
	1764	48	12661/2	SX01	Clay	blank with drilling attempt on one side					
	1764	50	12763/1	SX01	Clay	not 100% preserved					
	1764	52	14233/1	SX01	Clay	25,8	5,9	4,7	3		2,496
	6144	117	11075/1	SX05	Soapstone	32,9	26,6	8,3	33	*	44,649
Cluster 2: *Field I, Area U (Courtyard 4236 and neighbouring room 4330)*											
	4236	61	10293/1	SX01	Clay	not 100% preserved					
	4236	64	10454/1	SX01	Clay	42	6,7	4,9	17		37,485
	4236	65	10483/1	SX01	Clay	30,9	6	3,1	7		8,355
	4236	67	10530/1	SX01	Clay	52	7,6	7,1	22		74,360
	4236	87	10361/4	SX02	Clay	21	21,5	6,3	10	*	4,410
	4236	89	10886/1	SX02	Clay	31,5	16,9	7,8	16		15,876
	4330	68	10642/2	SX01	Clay	not 100% preserved					
	4330	69	10618/1	SX01	Clay	33	6	3,7	11		14,974
	4330	70	10820/2	SX01	Clay	not 100% preserved					

For the rest of the textile tool findings, contextualized analysis is not to the same extent possible. The available data of the entire find group (N=122) has been compiled in tables 5 and 6.

Table 5 Spindle whorls

No.	Type	Material	Reg. No.	Locus	Elevation	Square	A.	Str.	Pres.	Figure
1	SX01	Reused shard	4123/2	1237	-22.34	AI24	E	IV	40%	1
2	SX01	Reused shard	5087/9	2044	-21.20	AK35	G	IV	55%	2
3	SX01	Reused shard	5096/12	2047	-21.60	AK35	G	V	100%	3
4	SX01	Reused shard*	5091/1	2051	-21.10	AK35	G	post-IV	100%	4
5	SX01	Reused shard	5157/9	2073	-22.01	AK35	G	VI	100%	5
6	SX01	Reused shard	5357/1	2141	-21.49	AK34	G	V	100%	6
7	SX01	Reused shard	5377/1	2147	-21.19	AK36	G	IV	100%	7
8	SX01	Reused shard*	6248/1	3062	-56.75	BT22	H	pre-VI	100%	8
9	SX01	Reused shard	7018/5	4011	-65.15	CF11	J	unstrat.	50%	9
10	SX01	Reused shard	7284/1	4120	-59.43	CA11	J	V	50%	10
11	SX01	Reused shard	8459/1	5086	-52.19	BO2	K	V	90%	11
12	SX01	Reused shard*	7590/1	5167	-54.73	BT4	K	V(?)	100%	12
13	SX01	Reused shard	8882/1	5269	-53.57	BQ5	K	V	80%	13
14	SX01	Reused shard	8885/2	5278	-54.72	BT3	K	IV	100%	14
15	SX01	Reused shard	7743/1	5291	-51.41	BPØ1	K	V	100%	15
16	SX01	Reused shard	7771/1	5296	-51.60	BPØ1	K	V	100%	16
17	SX01	Reused shard	7805/1	5301	-51.29	BPØ1	K	Surface	100%	17
18	SX01	Reused shard*	9004/1	6002	-58.54	CC2	M	Surface	80%	18
19	SX01	Reused shard	9046/1	6017	-61.13	CE2	M	pre-VI	100%	19
20	SX01	Reused shard	6516/1	3550	-58.68	BT13	N	pre-VI	100%	20
21	SX01	Reused shard	6578/1	3568	-58.13	BU11	N	Surface	100%	21
22	SX01	Reused shard	6565/1	3578	-57.25	BT11	N	V	50%	22
23	SX01	Reused shard	6582/1	3578	-57.43	BT11	N	V	100%	23
24	SX01	Reused shard*	6596/1	3589	-58.20	BT12	N	V	80%	24
25	SX01	Reused shard	6640/1	3612	-56.34	BS12	N	Surface	40%	25
26	SX01	Reused shard	6645/1	3614	-56.34	BS12	N	Surface	100%	26
27	SX01	Reused shard*	12300/10	3922	-58.12	BT13	N	V	100%	27
28	SX01	Reused shard*	12310/3	3931	-56.64[3×]	BS11/12	N	Surface	100%	28
29	SX01	Reused shard*	5596/1	2226	-26.54	AR36	Q	Ottoman	100%	29
30	SX01	Reused shard*	9244/1	6105	-59.54	CA13	R	V	100%	30
31	SX01	Reused shard	9315/1	6124	-60.57	CC13	R	Surface	50%	31
32	SX01	Reused shard*	9370/1	6127	-60.65	CC13	R	V	95%	32
33	SX01	Reused shard	9338/1	6134	-60.53	CC13	R	V	100%	33
34	SX01	Reused shard	9340/2	6135	-61.88	CB13	R	VI	55%	34
35	SX01	Reused shard	9406/1	6151	-59.47	CB12	R	Surface	100%	35
36	SX01	Reused shard	9564/1	6178	-62.37	CD12	R	V	50%	36
37	SX01	Reused shard*	9500/1	6181	-63.70	CE13	R	pre-VI	100%	37
38	SX01	Reused shard	11232/3	6402	-59.80	CB14	R	V	100%	38
39	SX01	Reused shard*	11234/1	6409	-62.29	CD14	R	Surface	100%	39

40	SX01	Reused shard	11056/19	9899	-64.32[5×]	CE14/ CF14	R	pre-VI	100%	40
41	SX01	Reused shard*	11148/19	9916	-64.71[2×]	CF14	R	pre-VI	100%	41
42	SX01	Reused shard*	11535/9	6469	-62.37[5×]	CE10	R_1	Surface	100%	42
43	SX01	Reused shard	11838/1	6602	–	CA11	R_2	unstrat.	100%	43
44	SX01	Reused shard*	11875/2	6630	-58.68	BU12	R_2	V	100%	44
45	SX01	Reused shard	11906/10	6646	-59.62[2×]	CA/CB11	R_2	V	100%	45
46	SX01	Reused shard	11950/19	6660	-59.06[5×]	BU12/ CA11/12	R_2	V	100%	46
47	SX01	Reused shard	11429/3	6759	-66.37	CF13	R_3	pre-VI	50%	47
48	SX01	Reused shard*	12661/2	1710	-59.57[4×]	CB13/14/ CC13	S	V	80%	48
49	SX01	Reused shard	12721/1	1719	-58.45	BU14	S	V	100%	49
50	SX01	Reused shard	12763/1	1721	-59.90[3×]	CB13/14	S	V	40%	50
51	SX01	Reused shard	12894/1	1728	-59.99	CB14	S	V	100%	51
52	SX01	Reused shard	14233/1	1746	-60.22	CB13	S	V	100%	52
53	SX01	Reused shard	14258/1	1770	-60.23	CB14	S	V	100%	53
54	SX01	Reused shard	14288/1	1786	-58.32	CA15	S	IV and V	50%	54
55	SX01	Reused shard	6932/1	3715	-60.10	CC14	S	V	100%	55
56	SX01	Reused shard	7011/1	3725	-59.52	CA14	S	V	40%	56
57	SX01	Reused shard	12620/1	3790	-59.00	CA14	S	IV and V	100%	57
58	SX01	Reused shard	10147/3	9014	-35.32	AU8	T	unstrat.	50%	58
59	SX01	Reused shard	10211/1	4202	-58.27[5×]	CA10	U	Surface	50%	59
60	SX01	Reused shard	10285/4	4216	-58.83[4×]	CA10	U	IV	55%	60
61	SX01	Reused shard	10293/1	4230	-57.32[5×]	BU9	U	V	95%	61
62	SX01	Reused shard	10354/1	4252	-56.83[2×]	BT10	U	Surface	40%	62
63	SX01	Reused shard	10366/1	4255	-56.87	BU8	U	Surface	100%	63
64	SX01	Reused shard	10454/1	4276	-57.58	BU10	U	V	100%	64
65	SX01	Reused shard	10483/1	4277	-57.63	BU9	U	V	100%	65
66	SX01	Reused shard	10503/1	4281	-57.66	BU10	U	Surface	95%	66
67	SX01	Reused shard	10530/1	4282	-56.79	BT9	U	V	100%	67
68	SX01	Reused shard	10642/2	4312	-58.08[4×]	BU11	U	V	50%	68
69	SX01	Reused shard	10618/1	W4212	-57.63	BU8	U	V	100%	69
70	SX01	Reused shard	10820/2	W4212	-57.63[4×]	BU10	U	V	50%	70
71	SX01	Reused shard	12111/3	5439	-49.56[5×]	BM3	W	IV	100%	71
72	SX02	Clay	5166/2	2050	-21.75	AK34	G	V	100%	72
73	SX02	Clay*	7569/1	5153	-53.98	BS3	K	Surface	100%	73
74	SX02	Clay	7602/1	5254.1	-50.13	BO1	K	Surface	100%	74
75	SX02	Clay	7775/1	5293	-50.64	BOØ1	K	Surface	100%	75
76	SX02	Clay	6632/1	3602	-58.74	BU11	N	V	100%	76
77	SX02	Clay	12267/1	3911	-57.92	BT13	N	Surface	50%	77
78	SX02	Clay	5556/1	2214	-26.16	AQ36	Q	Ottoman	100%	78
79	SX02	Clay	5644/1	2241	-26.90	AR36	Q	pre-VI	100%	79
80	SX02	Clay	11510/1	6463	-62.18	CD10	R_1	unstrat.	95%	80
81	SX02	Clay	11835/1	6619	-58.70	CA11	R_2	Surface	95%	81
82	SX02	Clay	12781/1	1722 [1734]	-59.38	CB14	S	V	50%	82

83	SX02	Clay	10216/1	4203	-58.46[5×]	CA10	U	Surface	50%	83
84	SX02	Clay	10233/3	4219	-57.08[4×]	BU9	U	Surface	50%	84
85	SX02	Clay	10287/1	4228	-57.36[2×]	BU9	U	Surface	100%	85
86	SX02	Clay	10337/1	4246	-55.90	BU7	U	Surface	95%	86
87	SX02	Clay	10361/4	4256	-57.53[4×]	BU9	U	V	50%	87
88	SX02	Clay	10474/5	4273	-56.92[3×]	BT10/BU 10/9	U	V and Surface	50%	88
89	SX02	Clay	10886/1	4340	-57.65	BU8	U	V	100%	89
90	SX02	Clay	10257/1	4219 [4210]	-57.28[2×]	BU9	U	Surface	100%	90
91	SX02	Clay	12172/1	5456	-49.93[3×]	BN2	W	V	40%	91
92	SX03	Limestone	8576/50	5121	-53.40	BU2	K	V	50%	92
93	SX03	Clay	7575/50	5153	-53.96	BS3	K	Surface	50%	93
94	SX03	Basalt	9151/50	6041	-57.30	CA2	M	pre-VI	50%	94
95	SX03	Limestone	6558/50	3574	-57.15	BT11	N	V	40%	95
96	SX03	Limestone	6656/50	3614	-56.34	BS12	N	Surface	40%	96
97	SX03	Granite	12222/2	3908	-57.15[2×]	BS12/ BT12	N	Surface	40%	97
98	SX03	Limestone*	9295/50	6121.1	-60.59	CB13	R	VI	40%	98
99	SX03	Bone	11062/28	9902	-61.67[3×]	CD14/15/ CE15	R	unstrat.	50%	99
100	SX03	Basalt	11519/1	6460	-62.12[5×]	CE10	R_1	Surface	25%	100
101	SX03	Clay	11529/5	6469	-62.27[5×]	CE10	R_1	Surface	40%	101
102	SX03	Limestone	14204/1	1729	-59.60	CA12	S	V	50%	102
103	SX03	Limestone	10445/1	4269	-56.47	BT9	U	V and Surface	100%	103
104	SX03	Limestone	12164/1	5451	-48.63	BL3	W	IV	90%	104
105	SX04	Soapstone	4086/50	1227	-22.50	AK23	E	IV	100%	105
106	SX04	Bone	4273/40	3127	-57.18	CA21	H	pre-VI	100%	106
107	SX04	Ivory*	7548/40	5134	-56.86	BU2	K	V	100%	107
108	SX04	Ivory*	9171/40	6033	-60.90	CD2	M	pre-VI	100%	108
109	SX04	Bone	5647/40	2234	-27.67	AR37	Q	pre-Ottoman	100%	109
110	SX04	Ivory	9383/40	6134	-60.55	CC13	R	V	95%	110
111	SX04	Soapstone	9413/50	6152	-60.93	CD13	R	Surface	100%	111
112	SX04	Bone*	9491/40	6181	-63.10	CE13	R	pre-VI	100%	112
113	SX04	Granite	9796/50	6292	-61.19	CC13	R	VI	100%	113
114	SX04	Ivory	10510/1	4255	-57.16	BU8	U	Surface	100%	114
115	SX04	Limestone	10446/1	4269	-56.69	BT9	U	V and Surface	100%	115
116	SX04	Limestone	10836/1	4334	-55.17[4×]	BS10/11	U	Surface	100%	116
117	SX05	Soapstone	11075/1	9904	-60.84[3×]	CC12/13	R	V	90%	117

Adendum: Blanks/Pieces which are not fully drilled through are marked with *

Table 6 Spatulae, Needle

No.	Object	Material	Reg. No.	Locus	Sq.	Elev.	A.	Str.	L	W/D	Th	Pres.	Fig.
118	Spatula	Bone	5133/40	2050	AK34	-21.60	G	V	156	41	8–19.5	100%	118
119	Spatula	Bone	8475/40	5095	BR2	-53.61	K	V	85	31	5	100%	119
120	Spatula	Bone	8478/40	5095	BR2	-53.59	K	V	46.6	16.6	7.7	100%	120
121	Spatula	Bone	8473/40	5094	BP2	-53.13	K	V	41	24.4	6	75%	121
122	Needle	Bone	12860/1	1729	CA14	-59.53	S	V	52	8.9	2.6	100%	122

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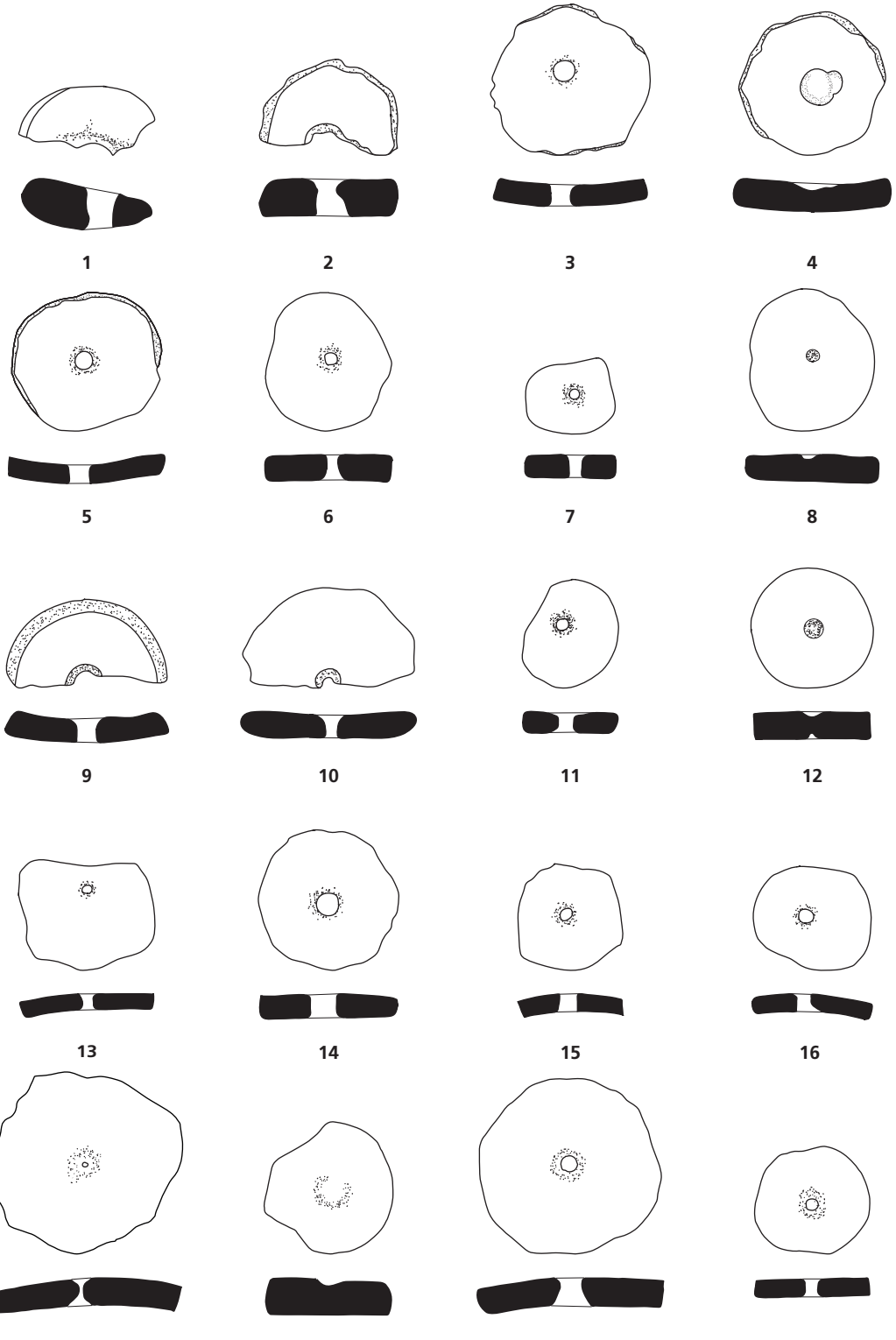
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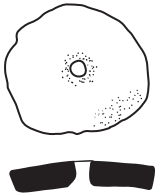

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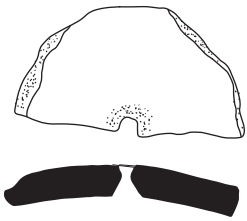

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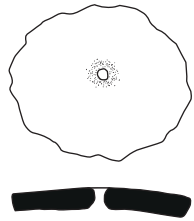

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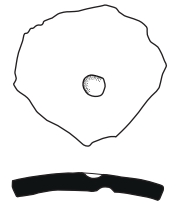

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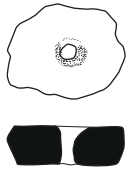

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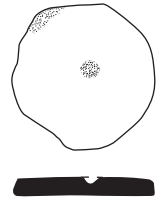

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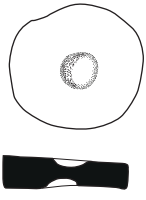

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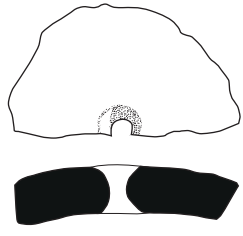

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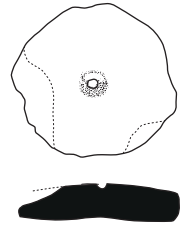

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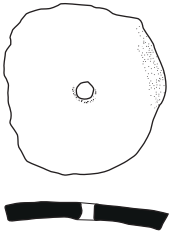

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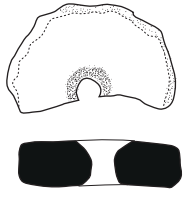

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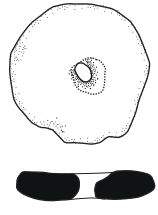

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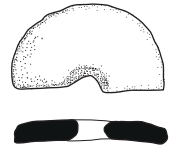

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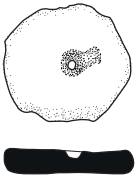

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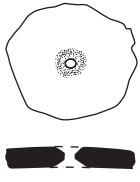

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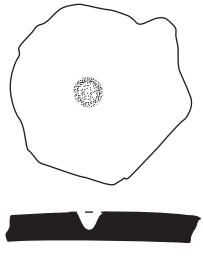

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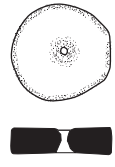

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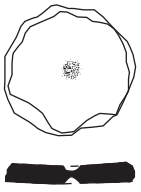

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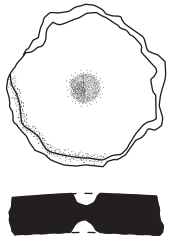

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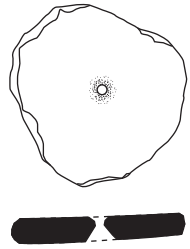

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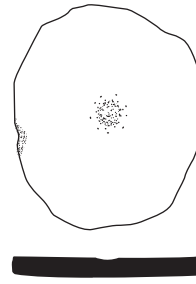

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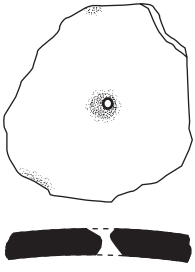

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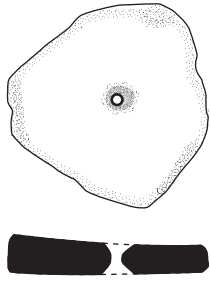

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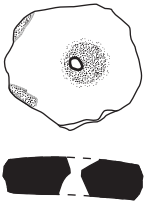

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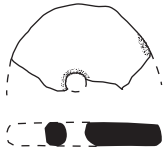

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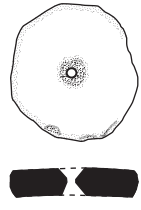

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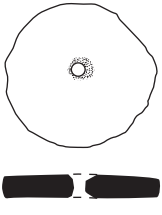

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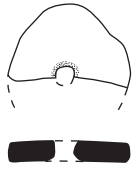

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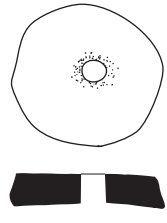

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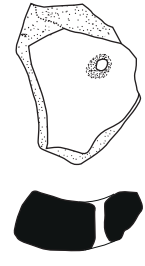

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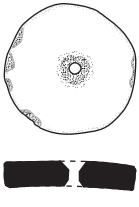

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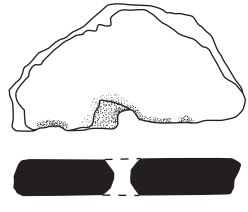

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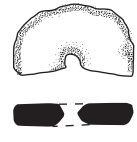

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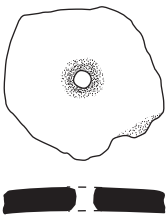

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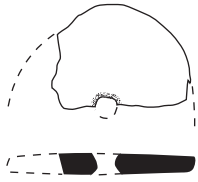

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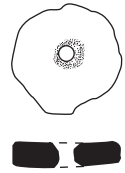

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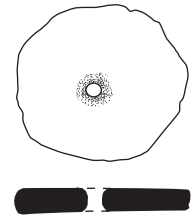

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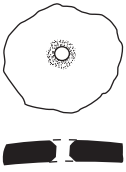

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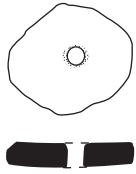

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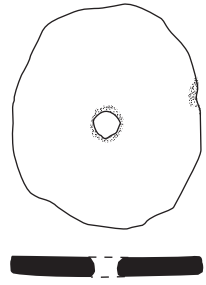

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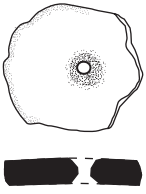

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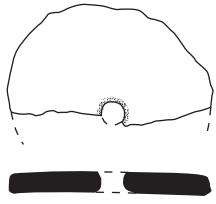

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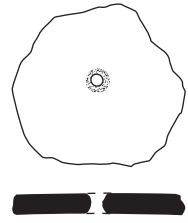

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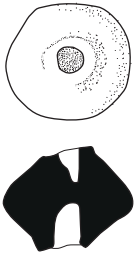

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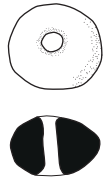

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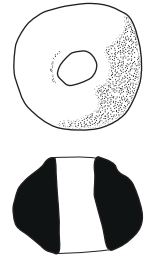

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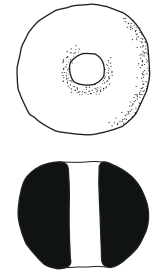

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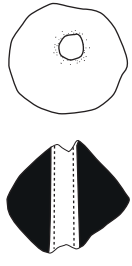

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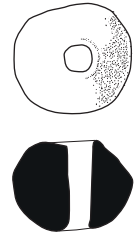

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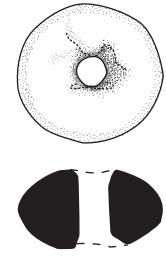

80

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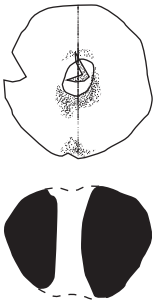

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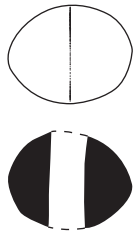
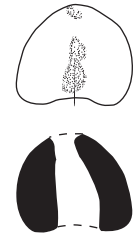


82*

83*



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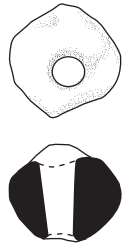

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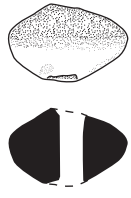
89



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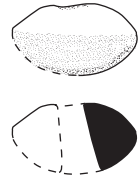

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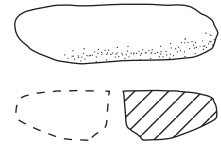

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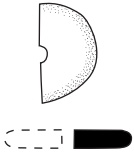

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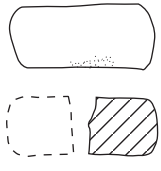

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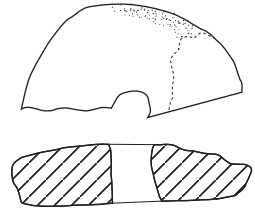

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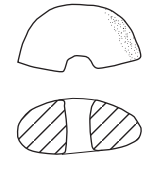
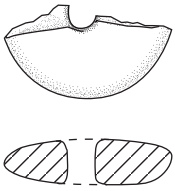


96

* exterior view drawn sidewise

0 5 cm



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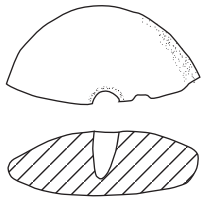

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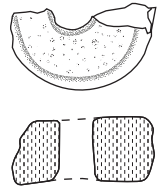

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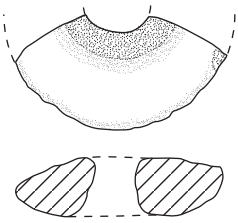

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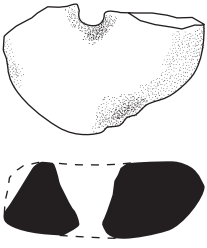

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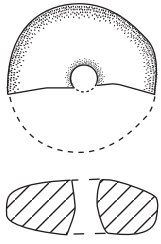

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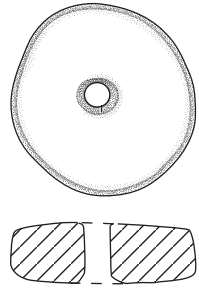

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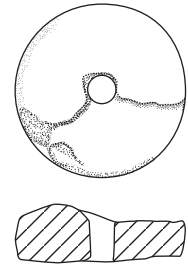

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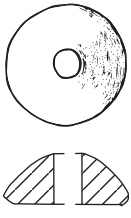

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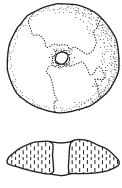

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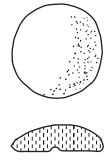

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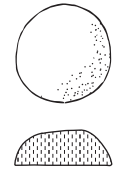

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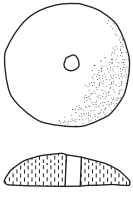

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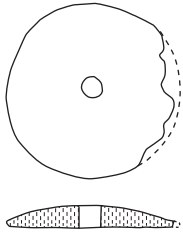

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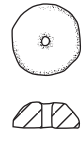

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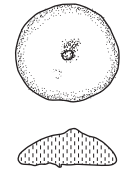

112

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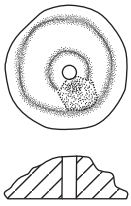
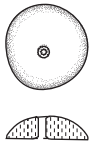
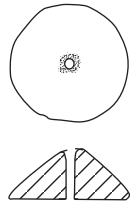


113



114



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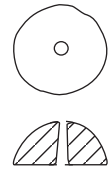

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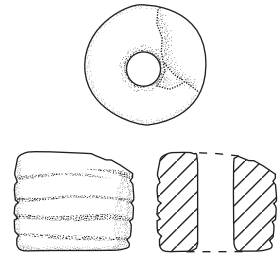

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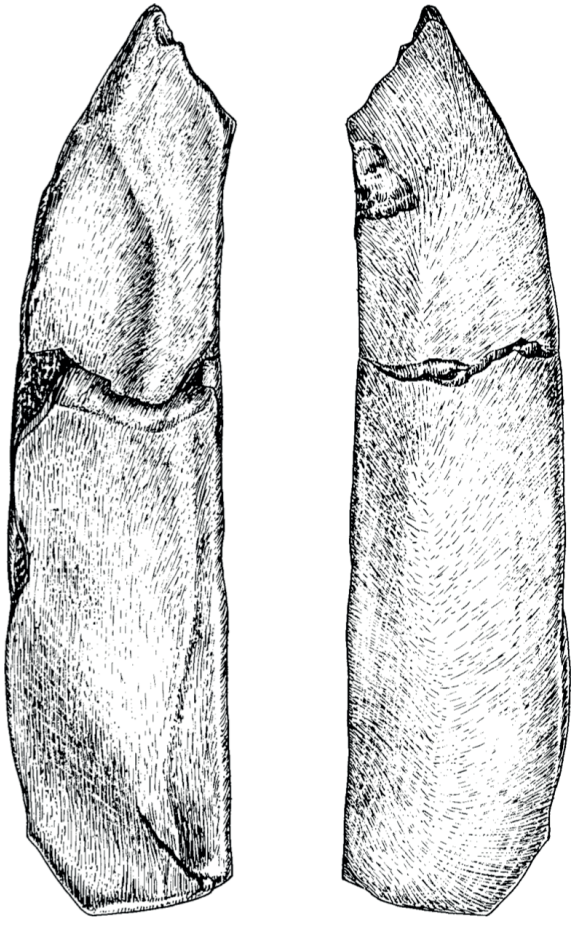

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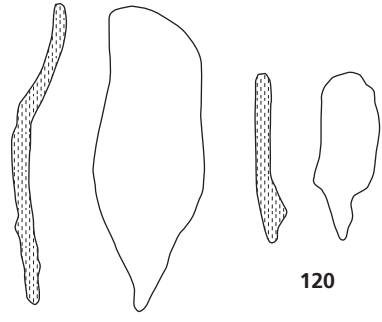
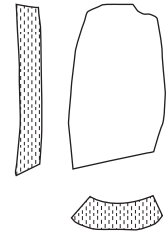


119

120



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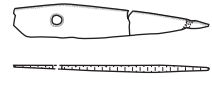

122

0 5 cm