THE USE OF PERFORATED CLAY BALLS ON THE WARP-WEIGHTED LOOM

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Perforated clay balls shaped like doughnuts have been found in almost every Iron Age excavation in this country. Made of a very friable, soft-baked clay, their weight varies between 200-400 grams, their height from 5-8 cm. and their diameter from 6-10 cm. (Pl. 16:1). Macalister, who called them weavers' weights, noted that they were often found in large hoards, sometimes as many as 50 together (*Gezer II:*73-74; Fig. 268d). His spherical type he described as "almost always merely sun baked, and generally falling to pieces after being unearthed, and if wet reduced to mud." Albright, who found "scores of basketfuls" of these doughnut-shaped objects at Tell Beit Mirsim, considered them proof that the inhabitants of the town specialized in the manufacture of textile goods (*TBM II:*Pl. 45:9-16; *TBM III:*56). Starkey (1936:188) and Tufnell (*Lachish III:* 108, 143) referred to these clay balls from Lachish as loom weights, as did Kenyon at Jericho (1957:58, 230) and Crowfoot at Samaria (*Samaria-Sebaste III:*399-402).

In his first report on the excavations at Tell Qasileh, Mazar (1950-1951: 76) also described these perforated clay objects as loom weights; he found a number of them (near a spindle bowl) in a typical four-roomed Israelite house of Stratum XI, 80 of them in Court K1 of Stratum IX and more in House H2 of Stratum VII. In his next report, however (*ibid.:*197), he suggested that they could be "clay heaters" for "keeping food warm". Later he came up with the idea that they might have been used as weights for fishing nets (1964:25, n. 60). Lapp (1969:47) favoured Mazar's heat-retention theory, but added that an enigmatic cult function might also be considered, such as "to absorb heat in connection with the burning of sacrifices". He argued against their use as loom weights (1964:28) because of their fragility and size, even though he noted that they were reported to have been found in functional relation to a loom (1967:25). Young, who unearthed more than 500 such objects in a single room at Gordion, also rejected their use as loom weights (1962:165) but did not propose any alternative function.

Quantities of these perforated clay balls were found in the excavations at Tel Beer-sheba and were studied by me. Among the many specimens, 51 came from the Stratum II storehouses near the city gate (11 in Locus 222 and 40 in Locus 282); 42 were found together with kitchen utensils in the courtyard of a Judean house (Locus 416) and several more in the courtyards of each of three dwellings adjoining the casemate wall (Loci 75, 76, 25).

In order to ascertain whether these unbaked clay "doughnuts" could indeed serve as loom weights, the Tel Beer-sheba Expedition decided to build a warp-weighted loom and use such clay balls as weights to keep the warp threads firmly stretched (Pl. 15).[1] We erected the loom with the help of the Beduin guard, Muhammed Abu-Rabia. The loom weights were made by Naomi Nadav, who took clay from the wadi bed near the tel, mixed it with straw, duplicating

1 In designing the loom we were aided by sketches and diagrams of Wilson (1933:6), Crowfoot (1936-1937:Fig. 1), Roth (1951:42; Fig. 36) and Wild (1970:172), and the description by Hoffman (1964:6): "The loom consists of a sturdy upright beam on each side, set up in a sloping position, the top being

as closely as possible the exact shape and weight of the ancient clay balls, and then dried them in the sun. For weaving the material we used raw sheep wool bought in the Beer Sheva market. Although both wool and flax were used in Iron Age textiles, we chose wool for our experiment because there is not enough water for growing flax in the Beer Sheva region, whereas the Negev has been known for its flocks of sheep and goasts since the days of Abraham.

The width of the woven material was 24 cm., with a density of about 5 threads per centimeter. About 5-8 threads were tied to each of 17 loom weights. The odd and even threads were separated by sticks (the shed and heddle rods of Hoffman's description in Fig. 2). The thread was spun by Muhammed's mother and other Beduin women of her family, who washed and combed the wool and arranged it in a sausage-like roll (called *lawayia*) from which they pulled and twisted the threads with the aid of a spindle. The material was woven by Amalia Tidhar, working from top to bottom in a standing position. The weaving itself was very easy and quick, taking less than an hour to produce a piece of material one metre long.

No damage occurred to the loom weights even when the loom had to be moved from place to place. When the weaving was finished, the weights were put in a box. We presume that in ancient times they were likewise stored away when not in use, as indicated by a large krater found filled with loom weights (Locus 362) at Tel Beer-sheba (Pl. 16:2). Although this locus is in the Hellenistic stratum, at Tel Ta'anach, at eight-handled krater of the 10th century B.C.E. was found full of these balls (Lapp 1964:28; Fig. 13).

The earliest evidence for the warp-weighted loom seems to come from the second settlement at Troy (ca. 2500 B.C.E.), where Blegen found two postholes that he interpreted as indicating the existence of uprights to support one end of a loom. Near them "lay several almost orderly rows of clay loom weights, there they had fallen and been partially baked when fire destroyed the house" (Blegen 1950:350; Fig. 461). The warp-weighted loom was also known in Middle Minoan Crete, as may be assumed by the ideogram in Linear A script that apparently depicts it (Evans 1935:678; Fig. 661/7).

In Israel there is evidence of such looms at several sites. In the Iron Age level at Tell Beit Mirsim, Albright inferred that a vertical loom stood firmly secured to four stout standing stones, not far from the find-spot of some 97 doughnut-shaped loom weights (*TBM III*:56). At Lachish a "weaver's establishment" was described by Starkey as follows (1936:188): "On the floor, aligned against a raised cobbled platform were groups of mud loom weights indicating the position of the weaving machinery. . . . An upright member of one of these machines was still in position reduced to charcoal". (See also *Lachish III*. 107; Fig. 9; Pl. 20:5). At Nir David in the Beth-shean Valley a settlement was excavated in which several rows of loom weights (in this case of gypsum plaster but of approximately the same weight as the clay

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supported against a wall. These uprights have a bracket at the top in which the beam rests. The warp sewn to this beam is kept taut by means of weights attached to the bottom, a group of warp threads being tied to each weight. A cross bar, the shed rod, is fixed to the uprights; this divides the warp into two halves, the natural shed. The front threads lie in front of this rod; the back threads hang straight down behind. Another rod, the heddle rod, which can be moved backwards and forwards, is connected to the back threads by a number of loops — the heddles. When the weaver pulls the heddle rod forward, all the back threads move with it, and a new shed, the countershed, results."

balls) were found, lying just as they had fallen from the loom when the house was destroyed by fire (Levy and Edelstein 1972:333-335; Pls. XXIV:1; XXVIII:11).

There are many references to this kind of loom in Greek literature (Crowfoot 1936-1937) and several vase paintings depicting it (Hoffman 1964:297 ff.), the earliest of which dates to the 6th century B.C.E. (Davidson Weinberg and Weinberg 1956).

The evidence from excavations, the illustrations and references from the Hellenistic world and our own weaving experiment seem to indicate that the warp-weighted loom was known and used extensively in the Iron Age and that the function of the ubiquitous perforated clay balls was to keep the warp threads properly taut during the weaving process.

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