

ANCIENT BEEHIVES FROM ISTHMIA

ABSTRACT

Ceramic beehives are known to have been utilized in ancient Greece. Excavations by the University of Chicago at Isthmia have produced many fragments with an interior combed surface characteristic of this special vessel. In addition to four almost complete beehives of horizontal type, four restored hives and a number of fragments of an upright style of hive from the Sanctuary of Poseidon and the Rachi settlement are published here. They provide the first substantial evidence for the existence of the upright hive in ancient Greece.

There is a black and white thyme, and it flowers very freely: it is in bloom about the summer solstice. It is from this flower that the bee gets the honey, and by it the beekeepers say that it is made known whether they have a good yield of honey or not; for if the thyme flowers abundantly, they have a good yield, but the bloom is injured or even destroyed if it is rained upon. . . . They say that it (thyme) cannot be grown or become established where a breeze from the sea does not reach (Theophr. *Caus. pl.* 6.2.2–4).

Several curiously shaped ceramic vessels were discovered in the course of excavations by the University of Chicago at the Sanctuary of Poseidon at the Isthmus (Fig. 1).¹ They fall into two types. Vessels of type 1 (Fig. 2) are long and slightly tapering in shape, described when first published as resembling an umbrella stand. The vessels are about two-thirds of a meter in length, and usually have a rounded bottom. Type 2 (Fig. 3) vessels are about half this size and have a flat base; in shape they are not unlike a basket (*kalathos*) for wool or olives, often with handles on either side and an upper diameter significantly greater than that of the base.²

A characteristic feature of both vessel types is the roughening of the interior surface from bottom to top with a comb or stick(s) before firing; the area covered varies from a quarter to a third of the circumference in

1. See Gebhard, Hemans, and Hayes 1998 for recent bibliography. A summary of this article ("Isthmia Hives and Others") was presented by J. Ellis Jones at the conference "Bee-Keeping in the Graeco-Roman World," held at Lady Margaret Hall, Oxford, on 7 November 2000.

2. For type 2 see Broneer 1958, p. 32, no. 42; Kardara 1961, pp. 264–265, fig. 6, pl. 81; Crane 1983, pp. 200–202.

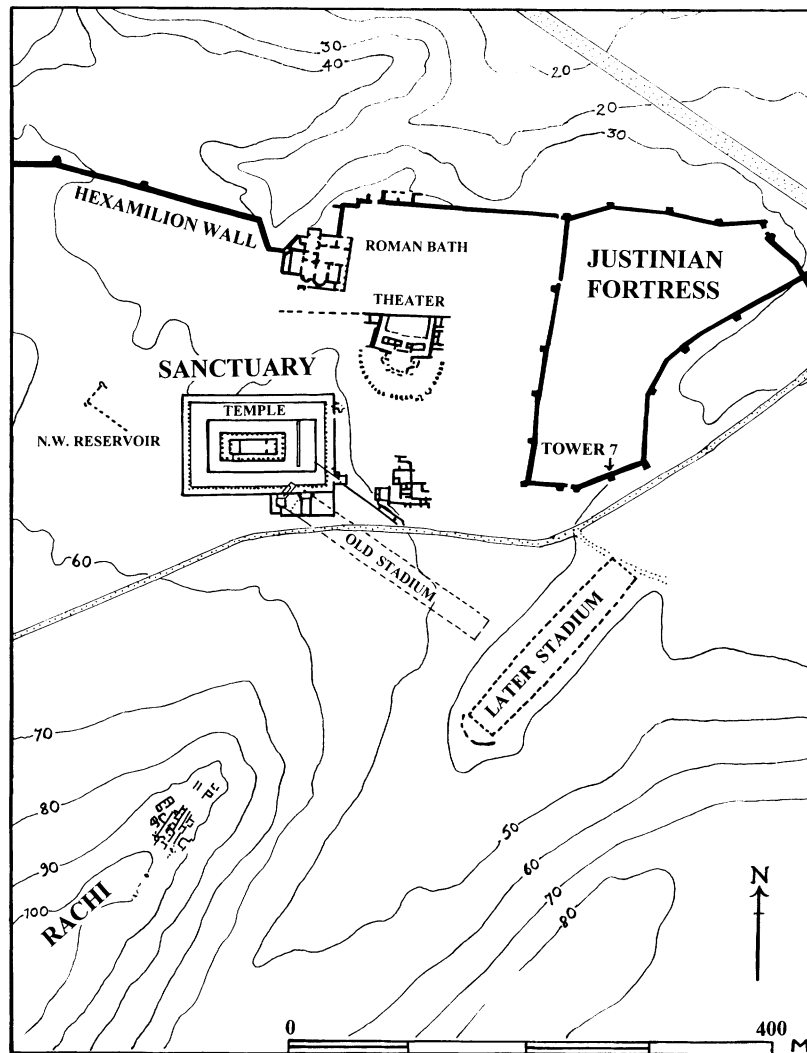


Figure 1. Plan of Isthmia, showing locations where beehive fragments have been found. J. Ellis Jones, after Anderson-Stojanović 1996, p. 58, fig. 1 (F. P. Hemans and W. B. Dinsmoor Jr.)

some cases, to two-thirds in others. It was primarily the treatment of the interior that suggested to D. I. Pallas that combed pots of type 1, found in a ruined tower of the Hexamilion fortress at the Isthmus, were beehives.³ Subsequent analysis of Attic examples of the “umbrella stand” type from the Vari farmhouse revealed the presence of beeswax, confirming the identification. Ethnographic parallels from the Cycladic islands and Crete had led earlier to the same conclusion.⁴

The type 1 hive was used in a horizontal position, with the combed portion at the top for the attachment of honeycombs that hung parallel to the mouth of the hive in a long series; a lid, with a small bee-entry hole (flight hole) in its lower edge, was placed over the opening and could be removed at need for harvesting the nearest combs (Fig. 2). Sometimes, detachable extension or expansion rings were placed at the front end, between hive and lid, to make the harvesting easier. Cylindrical beehives open at both ends were used in Spain during the 3rd and 2nd centuries B.C.⁵ The horizontal hive is the most commonly documented type in the archaeological record, and appears early in Egyptian tomb paintings.⁶ The

3. Broneer 1959, p. 337.

4. Jones, Graham, and Sackett 1973, pp. 397–414; Jones 1976; Ruttner 1979, pp. 221–225; Jones 1990, pp. 63–71; Crane 1983, pp. 35–76; Ifantides 1983, p. 79. Hives, extension rings, and lid fragments found at Knossos are published in Catling et al. 1981, p. 95, V 325, fig. 6; Sackett 1992, pp. 20, 27, 93, 176–177, 189, 203, 225, 241, 254, 480, ns. 83–85, pls. 96, 100, 134, 221. Four complete beehive extension rings have been found at Eleutherna (Vogt 2000, p. 95, figs. 47–48).

5. Bonet Rosado and Mata Parreño 1997, pp. 35–36. Dimensions vary from 0.24 to 0.29 for diameter and 0.53 to 0.58 for length. Interior scoring is horizontal, covering the entire surface.

6. Crane 1983, pp. 35–39.

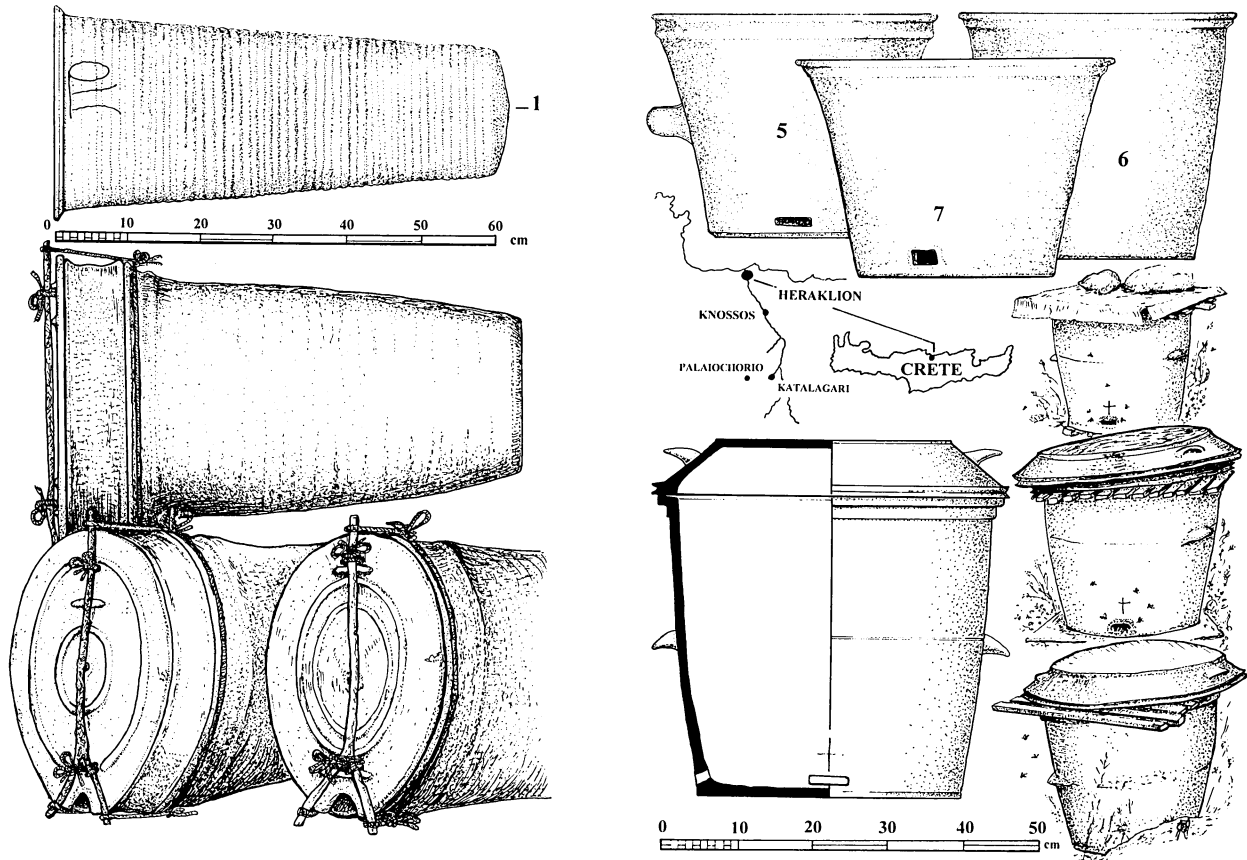


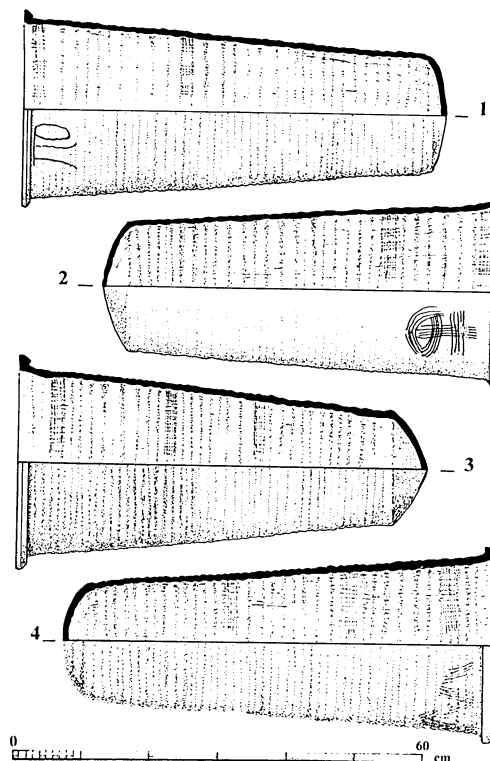
Figure 2 (*left*). Ancient horizontal hives: Late Roman example (1) from Isthmia; and Hellenistic hives from Trachones, Attica, shown with and without extension ring. J. Ellis Jones, after Jones, Graham, and Sackett 1973, p. 447, fig. 19

Figure 3 (*right*). Three upright hives from Isthmia (5, 6, 7) compared to a modern hive at Palaiochorio, Crete, and sketches of three Palaiochorio hives in use. J. Ellis Jones

7. Jones, Graham, and Sackett 1973, pp. 399–401, ns. 24–27; Jones 1990, p. 69, n. 9; Crane 1983, pp. 196–203. An unusual hive from Knossos with a domed end and possible entry holes is discussed in Hayes 1983, pp. 108–109, 132, no. 177, 134, fig. 15.

shape is still used in countries around the Mediterranean and also in many other areas of the world. Such hives can be used singly, but are more commonly found stacked in clusters, large or small, often in the shade of a shed or roof.

Excavations at Isthmia at the Sanctuary of Poseidon and at the Hellenistic settlement on the ridge known as the Rachi, south of the sanctuary, have produced additional examples of coarse ware with internal combing, several identifiable as the shorter type 2 vessel (Fig. 3) or parts of such a vessel. The aim of this article is to show that the type 2 vase from Isthmia was a beehive set upright on its flat bottom with honeycombs hanging down from above into the body of the vessel. An upright hive of this sort could have been used either as a movable-nest hive with the whole mass of honeycombs adhering to some form of removable lid fitting over the open top, or as a top-bar hive, a refinement in which combs hang from individual wooden bars set fairly close together across the open mouth, allowing separate removal of individual combs in harvesting the honey. A lid of some kind was used to hold down and shade the bars. Wicker and ceramic bar hives can still be seen in Crete at Palaiochorio, near Katalagari, south of Knossos (Fig. 3). A characteristic of these upright hives is that the bees are provided with a small entry hole low on the wall of the hive itself.⁷ Such hives are set out in the open or in the shade of an overhanging rock, well spaced or in loose groups.



TYPE 1 BEEHIVES

Four horizontal beehives of type 1 from tower 7 of the Hexamilion fortress have been restored (Fig. 4).⁸ The fabric of these vessels is reddish yellow (7.5YR 6/6), gritty, and fired rather hard; surfaces vary from red to reddish brown (2.5YR 5/4–6/4) with some patches of burning. Heights vary from 0.58 to 0.64 m and the body tapers from a diameter of 0.25–0.27 m at the mouth (D. rim 0.29–0.30 m) to ca. 0.17–0.19 m at the exterior of the base, which is rounded or domed to a greater or lesser degree (see Table 1 below). Rims tend to have a simple projecting profile and to be flat on top. The exterior of the lid (Fig. 5) and body shows traces of wheel ridging while the interior was incised vertically with a comblike instrument; the incisions cover between a quarter and a third of the vessel's circumference. Perpendicular to these marks and just below the rim is a band of horizontal combing, and frequently several other similar bands are found at intervals below. All four examples display marks or inscriptions added before firing just below the rim on the exterior (Fig. 4).⁹ It seems likely that these marks, which were incised in still-soft clay, denote the potter himself, or an owner who had ordered a number of hives in advance; if they had been scratched on after firing, they would be more likely to represent the owner's own identification mark.

8. No. 3 is illustrated in Broneer 1959, p. 337, no. 17 (IP 2139), fig. 11, pl. 72c. See also *Isthmia* V, p. 114, n. 5(c), where another rim fragment

(IPR 68–40, pl. 40d from tower 2, in a 5th-century A.C. context) is described.

9. Lüdorf (1998–1999, p. 51, n. 71) discusses inscriptions as owner's marks.

Figure 4. Horizontal hives 1–4.
J. Ellis Jones



Figure 5. Beehive lid 34, upper surface

TYPE 2 BEEHIVES

The first example of a type 2 vessel was found in the 1955 season of excavation at the Rachi settlement (Fig. 3:5; see below, Figs. 8–9). In an article about the settlement, C. Kardara suggested that this container was a beehive.¹⁰ It too has interior roughening, and just below the rim a series of letters, ΟΡΕΣΤΑΔΑ, perhaps the owner's name, has been incised after firing. The vessel is ca. 0.30 m in height and has a small rectangular opening at the bottom of the side where there is no combing on the interior. Three similar vessels (6, 7, 8) have been restored from recovered fragments, and other rim and base fragments with comparable features are also presented here.

The fabric of the type 2 vessels is in almost all cases that used for the typical Corinthian coarse ware or plain ware of the Greek and Early Roman periods. Vessel 18, however, is made of cooking fabric.¹¹ The fabric normally fires to a range of colors between reddish yellow (5YR 7/6, 7.5YR 7/6) and pink (7.5YR 7/4) or very pale brown (10YR 8/3).¹² All of these vessels appear to be wheelmade. Two types of rims may be distinguished: the more complex projecting rim with flat upper surface and prominent ridge beneath (5, 6, 9, 10, 11, 13, 15, 16, 18) and a plain projecting rim without the ridge (7, 8, 12, 14, 17, 19, 20, 21).¹³ A small flight hole, either rectangular or round, at the bottom of the wall or in the floor close to it, would allow the bees to go in and out of the hive. Round holes vary from 0.026 to 0.030 m in diameter, rectangular slits from 0.025 to 0.045 by 0.005 to 0.015 m. The upright beehive may have interior combing from bottom to top, and a few examples (e.g., 20) display a band of horizontal combing near the rim. In the Isthmia sample, the preserved fragments suggest that combing was omitted on the part of the interior wall on either side of the flight holes. The placement of the combing in this arrangement is analogous to that seen in the horizontal hive. It is possible that it was meant to encourage the bees to attach their combs to those parts of the wall with the roughened surface and not to the area near the opening. Details of combing vary from regular, closely spaced, deep incisions to a rather irregular, shallow treatment. There is some evidence to suggest that not all hives were roughened on the interior, although one cannot be certain unless most of the circumference is preserved. Hive 7, for example, has no combing on its surviving parts.¹⁴

10. Kardara 1961, pp. 264–265.

11. In addition to its use for containers placed on or in the fire, cooking fabric, because of its lightness, was used for pitchers and kraters, many of which have been found in the Rachi settlement.

12. Whitbread 1995, pp. 293–308, esp. pp. 301–302; *Corinth* VII.2, pp. 94–95; *Corinth* VII.3, p. 104. This Corinthian coarse ware, with greater or lesser amounts of grit and grog, was

used until the Hellenistic period for roof tiles, other terracotta architecture, perrirhanteria, type A' amphoras, basins, pitchers, and bathtubs. By the Late Roman period, light-bodied coarse wares were no longer used. Thin sections of the Isthmia combed sherds were made, and we await a report.

13. Lüdorf 1998–1999, figs. 32 and 33, are good examples of complex rim treatment; figs. 16 and 17 depict the simple form.

14. Other examples of beehives without characteristic openings in the floor or base, or diagnostic rims and lips, may have escaped our attention since the interior combing is the only feature that distinguishes body sherds of beehives from other coarse wares (such as *lekanai*, for example, noted by Lohmann [1993, p. 39]). Several of the pieces published by Lohmann are without internal combing and, indeed, he comments that it is not necessary.

Only one (5) of the three pots restored included handles among its surviving fragments. These handles could be confidently "replaced" in position; they are oval in section and set horizontally on either side of the vessel, opposite each other. The other restored pots did not have handle fragments or handle attachments securely associated with them. Several of the rim and wall pieces (9, 10, 13) do preserve a horizontal groove at the handle zone; on 18 the handle stub is placed directly upon such a groove. In fact, a small part of a similar groove can be seen on 5 about midway between the handles (see below, Fig. 9). This technique, used by Roman and modern potters, facilitates the placement of handles at the same level.¹⁵

Since the discovery of the so-called Orestada vase (5), there has been a certain amount of controversy regarding its identification as an example of an ancient upright hive. Arguments also have been made for and against the probable use of the top-bar hive in ancient Greece.¹⁶ The Orestada vase, in particular, was considered very small (estimated volume 17 liters) in comparison to modern hives of a similar type; it was too heavy, the interior combing was neither uniform nor did it cover the entire surface, and, in looking at the vase itself, it was difficult to determine how much of the flight hole was plaster and how much was an original feature.¹⁷ This opening (0.050 m in width and ca. 0.015 m in height), although partly restored, is an original feature of the vase: while the outside surface is broken, the interior retains the original form of the opening; the restoration is on the outside surface only.

A program of absorbed organic residue analysis of samples from combed/bee-hive sherds has been carried out under the direction of Richard P. Evershed of Bristol University to provide some scientific evidence for the use of the Isthmia pieces as beehives.¹⁸ Sherds from three areas (the fortress, Rachi settlement, and sanctuary and environs) were selected to be tested for the presence of beeswax. It was not possible, however, to submit inventoried, restored rim or base samples for this destructive analysis, and as a result all samples chosen were wall fragments. The presence of beeswax, found in sixteen of forty-one samples of combed sherds from Isthmia, supports the identification of many samples as beehives, but since types 1

15. We would like to thank one of the anonymous *Hesperia* reviewers for these observations. Roman examples of the use of grooves to align handles may be seen in *Corinth* XVIII.2, p. 63, no. 138, pl. 7; p. 81, no. 172, pl. 10; p. 123, no. 270, pl. 16; also *Agora* V, pl. 3, F84-85, and pl. 7, G190.

16. Crane 1983, pp. 200-202; Crane and Graham 1985, pp. 30-31.

17. Crane 1983, pp. 17, 201. When Kardara and Papadopoulou (1984, pp. 2-3) studied the vessel in the Isthmia Museum, they were not able to obtain accurate information.

18. See Evershed and Anderson-Stojanović 1995; Evershed et al., forthcoming. The chemical investigations

were performed on residues of beeswax absorbed within the fabric of the vessels. High-temperature gas chromatography (HT-GC) and HT-GC/mass spectrometry (HT-GC/MS) were used to screen lipid extracts for the presence of compounds characteristic of beeswax. Samples of beeswax taken from a 19th-century ceramic beehive were used as reference materials. Potsherds from ten pithoi recovered from the Rachi excavations served as controls. None of the pithoi contained beeswax residues. The presence of beeswax was deduced from the distributions of n-alkanes (C 23 to C 33), wax esters (C 40 to C 52), and long-chain alcohols (C 24 to C 34) released from the

wax esters during burial. As in a recent investigation of beeswax in Late Minoan lamps and conical cups from Crete (Evershed et al. 1997), ¹³C values were determined for the individual components of the lipid extracts by means of GC-combustion-isotope ratio MS. The values obtained for the n-alkanes (-24.5 to -26.9%) and n-alkanols (-25.0 to -25.7%) were comparable to the characteristic values obtained for the reference beeswax. Thus, on the basis of molecular structures, carbon number distributions, and ¹³C values, a significant proportion of beehive sherds were shown, unambiguously, to contain beeswax.

TABLE 1. DIMENSIONS OF TYPES 1 AND 2

<i>Sample</i>	<i>Height</i>	<i>Mouth Diam.</i>	<i>Rim Diam.</i>	<i>Base Diam.</i>
Type 1 (1–4)	0.58–0.64	0.25–0.27	0.29–0.30	0.17–0.19
Type 2 (5–8)	0.29–0.33	0.31–0.38	0.36–0.42	0.18–0.27
Rims (9–23)	—	0.31–0.40	0.35–0.43	—
Bases (24–32)	—	—	—	0.15–0.31

All measurements are in meters.

and 2 cannot be distinguished in the small fragments sampled, this analysis cannot be used to support the identification of type 2 hives.¹⁹

In summary, the upright hive at Isthmia is characterized by the following characteristics: 1) a flight hole for the bees in the lower wall or in the base of the vessel; 2) a height of 0.29–0.33 m; 3) a mouth diameter of 0.31–0.38; 4) a flat base; 5) commonly, a partially combed interior; and 6) less commonly, a pair of horizontal handles below the rim. Of the six attributes, a combination of several of them, or the flight hole on its own, would be a fairly good indication that the vessel was intended to be used as an *upright* hive. Thus, those flat base fragments with flight holes (25, 26, and 30) are likely to be from type 2 hives.²⁰ In order to distinguish the upright hive from the horizontal hive, one should ideally have a complete profile, or a *combination* of certain attributes that are not, unfortunately, ordinarily present in a single sherd.²¹

One fragmentary ceramic lid (34) has been included in this report because it is not unlike examples typically associated with horizontal beehives. It is flat in profile (Fig. 5), with curved ridges on the upper surface and a smooth underside.²² It has been suggested that such ridges provided reinforcement for the added pressure exerted by the cords that were used to attach the lid to the hive (Fig. 2).²³ A flight hole, which would be expected if used with a horizontal hive, is not preserved in this lid. But the curved ridges, arguably logical for the horizontal hive, are of no specific use in the vertical type, for which no cords were required.

CATALOGUE

The following catalogue is designed to illustrate the range of variation present in the beehives from Isthmia. It includes those vessels that could be restored from the fortress (1–4), the Sanctuary of Poseidon (6, 7), and the Rachi settlement, including the Orestada vessel (5) and one other (8), as well as inventoried rims and bases.²⁴ One wall fragment (33) is included to show an unusual combing pattern on the interior. The dimensions of the vessels are summarized above in Table 1. Since the focus of this article is the use of the vessels as containers for honeycombs, the diameter of the vessel mouth rather than of the rim is listed in the catalogue. All measurements are in meters. Despite the fact that type 1 hives were used in a horizontal position, it has been traditional to use the term height rather than length. We record here essential measurements only; more precise determinations would reflect the variation that frequently exists from one side

19. A full listing of the samples will appear in the publication of the study by Evershed et al. (forthcoming). Of the ten samples taken from the fortress, two were positive; five of twelve samples from the Rachi, and nine of nineteen from the sanctuary, were also positive. All positive samples from the fortress and sanctuary had been washed in an acid bath after excavation, while the five samples from the Rachi had not. There is no simple correlation apparent between the extent of beeswax degradation and whether or not acid washing took place.

20. A flat base with a hole in the center and no combing might have been a flowerpot. See Thompson 1963, p. 11, fig. 13, for an illustration of a flowerpot from the Hephaisteion garden.

21. Fabric is not, on its own, a reliable distinguishing factor.

22. Jones, Graham, and Sackett 1973, pp. 400, 446–447, pls. 77, 84; Jones 1976, pp. 82–84. It was not possible to test the lid fragments for the presence of beeswax. Similar lids are illustrated in Munn 1993, p. 77, figs. 30–31.

23. Jones, Graham, and Sackett 1973: see appendix I by M. I. Geroulanos, p. 446.

24. Any additional fragments that might be recovered from going through the lots from the Sanctuary of Poseidon would not significantly change the discussion above, although they would give us a better idea of the numbers of beehives in the area.

of the rim to another, or other irregularities of pots that have not been centered on the wheel. Corinthian clay is known to be too plastic to sustain the weight of large vessels. The Isthmia inventory number follows the catalogue number. For fragments inventoried after 1985, the lot number indicates context; for others, the field notebook reference is given.²⁵ More specific context information appears below in Table 2. Munsell readings are given only for those pieces that appear different from the typical Corinthian fabric.

NEARLY COMPLETE AND RESTORED VESSELS

TYPE I

- 1 IP 2216 Figs. 2, 4, 6
Horizontal beehive

Hexamilion fortress, tower 7, notebook DP, 1958, p. 85. Rest. H. 0.620–0.645; est. Diam. mouth 0.254; Diam. base 0.170, end only very slightly domed. Restored from many fragments with plaster infill. Hard-fired fabric, reddish yellow (7.5YR 6/6) fabric with interior fired red to reddish brown (2.5YR 5/4–6/4), discolored gray and black on exterior.

Flat rim, outwardly thickened. Tapering profile with rounded bottom. Wheel-ridged exterior, incised horizontal grooves just below rim on exterior. Interior: Overlapping bands of vertical combing on a third of interior circumference; perpendicular bands just below rim and about a third of the distance down interior wall. ΠΟ incised before firing, just below rim exterior.

Date: 6th century A.C.

- 2 IP 2217 Figs. 4, 6
Horizontal beehive

Same context as 1. Rest. H. 0.58; H. to start of dome 0.54; est. Diam. mouth 0.26; Diam. base 0.19. Large section of rim and wall missing; restored. Fabric as 1.

Similar in shape to 1 but rim more flared, exterior wall less ridged, and end more domed and pointed. Exterior wheel ridges smoothed. Deep, regular, vertical combing on interior; horizontal cross-bands just below rim and a quarter of the way

down interior wall. On exterior below rim is a mark made with a comb, in the shape of a rough T rising from an O.

Date: 6th century A.C.

- 3 IP 2139 Figs. 4, 7
Horizontal beehive

Same context as 1. Broneer 1959, pp. 320–321, 337, no. 17, fig. 11, pl. 72:c. Rest. H. 0.60 (with height to start of dome at 0.55, making the dome prominent and somewhat pointed); est. Diam. mouth 0.275; Diam. base 0.17. Restored with some plaster infills. Fabric as 1 and 2.

Thick rim, slightly downturned. Tapering profile with slightly concave wall. Strongly wheel-ridged exterior. Interior has deep vertical combing with three broad cross-bands at regular intervals on interior wall. Just below rim exterior are the letters ΠΟ, incised before firing.

Date: 6th century A.C.

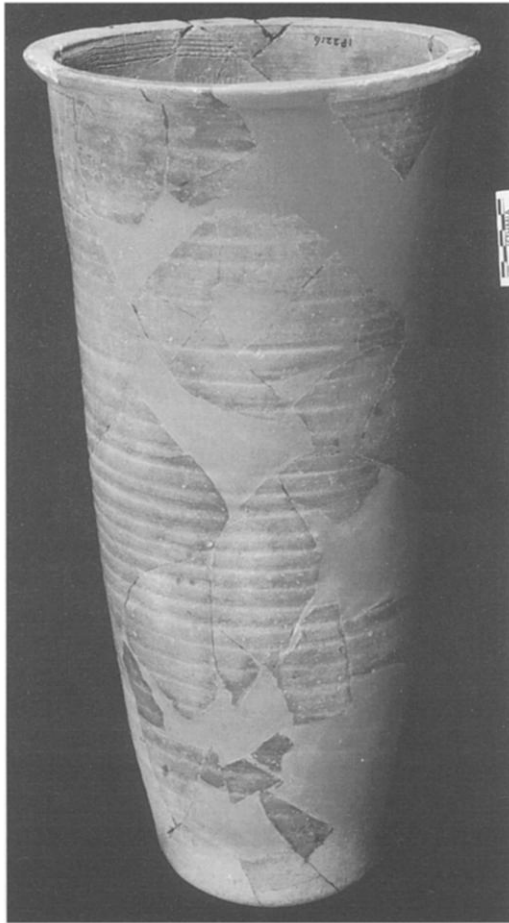
- 4 IP 2140 Figs. 4, 7
Horizontal beehive

Same context as 1. Rest. H. 0.63; H. to start of dome 0.60; est. Diam. mouth 0.255; Diam. base 0.170. Domed bottom similar to 2. Mended and restored with plaster infills. Fabric, exterior ridging, and interior combing as 3.

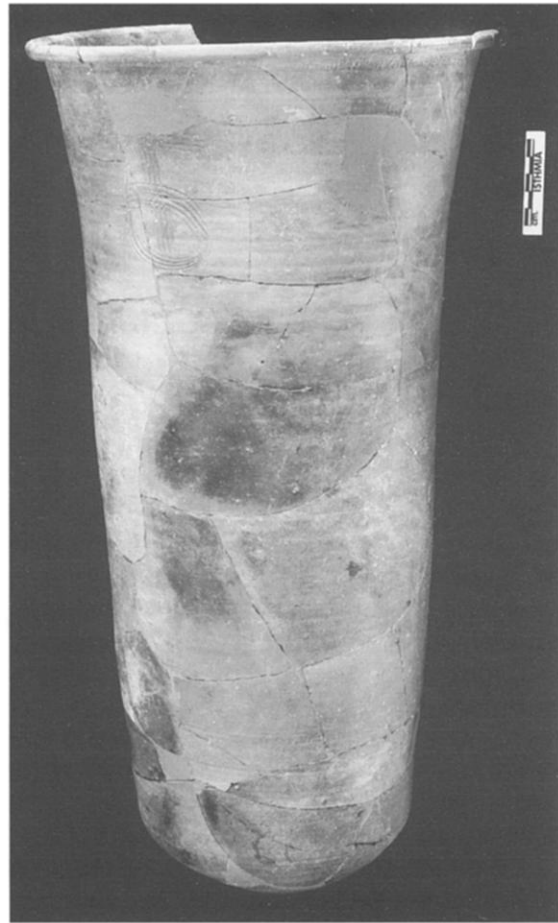
Similar in shape to 1. W or upside-down M incised with a comb, below rim on exterior.

Date: 6th century A.C.

25. These are stored in the Isthmia Museum along with all documentation from the University of Chicago Excavations at the site.



1



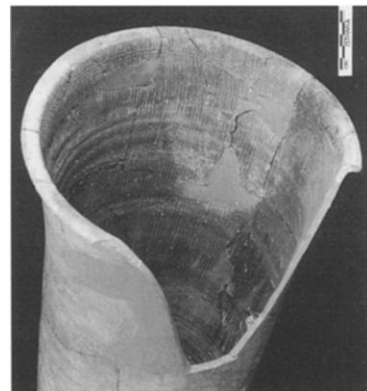
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1

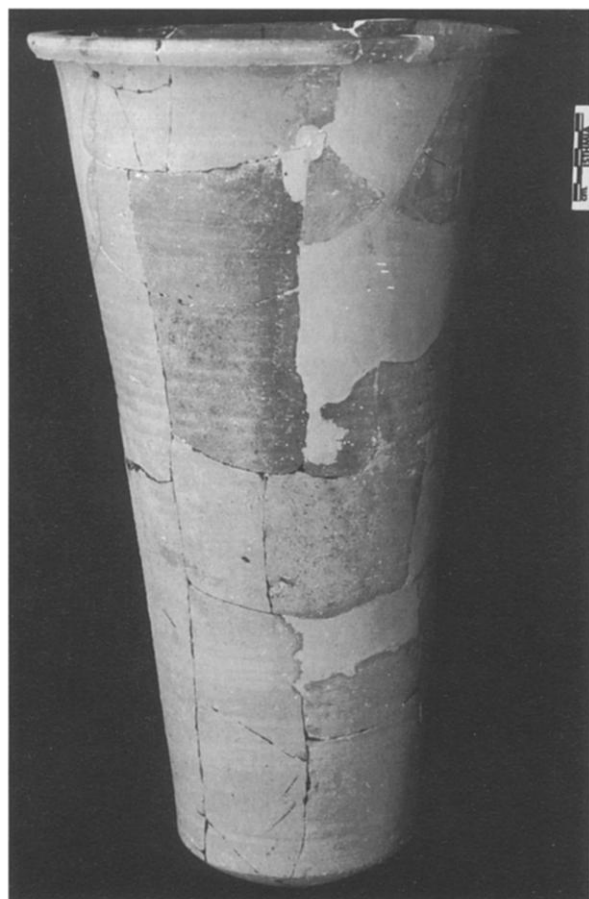


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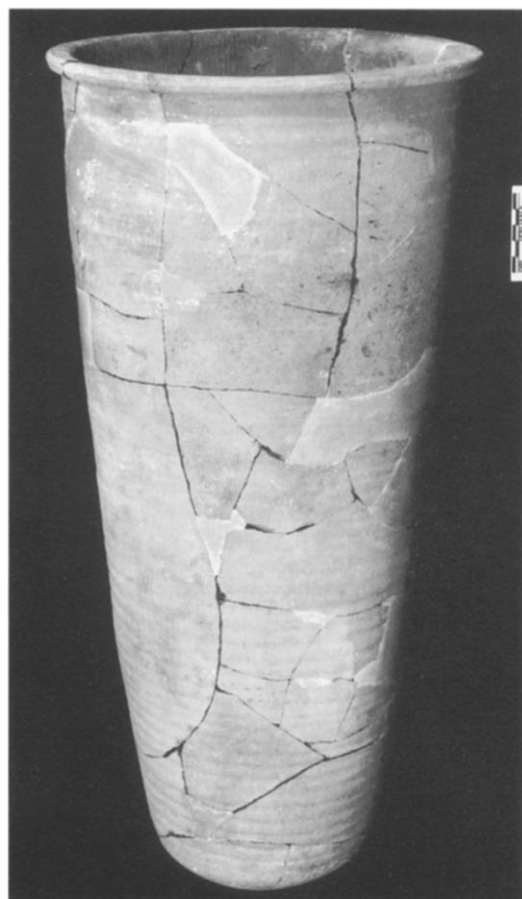


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Figure 6. Horizontal hives 1 and 2



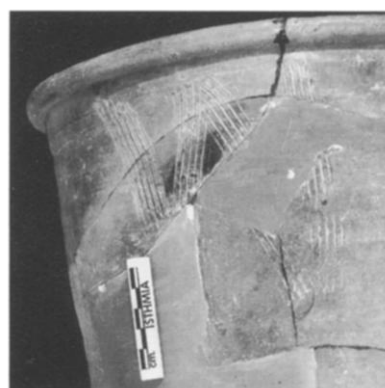
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4



3



4

Figure 7. Horizontal hives 3 and 4

TYPE 2

- 5 IP 586 Figs. 3, 8, 9
"Orestada vase," upright beehive

Rachi, tr. IV, notebook 8, pp. 62–63, house XV. Kardara 1961, fig. 6, pl. 81; Kardara and Papadopoulou 1984. H. 0.301; est. Diam. mouth 0.340; Diam. base 0.23. Flight hole just above slab of base measures not more than 0.050 wide, with the original bottom and right edges preserved; easier to see on the interior than on the exterior of the vessel. The original width could be a millimeter smaller since the left side is chipped. Restored as rectangular on the right, with the height of the hole ca. 0.010; plaster fills the upper part for two-thirds of the length on the right. On the upper left, the preserved shape might indicate that the opening was arched on the top, rising to a total height of ca. 0.015. Restored from numerous fragments, with plaster infill; small part of rim and one handle missing but wall preserves position for handle attachment. Typical Corinthian coarse ware fabric. Exterior surface worn.

Kalathos shape with wall flaring outward from flat base to outward thickened rim with prominent ridge or flange below. Originally two handles, oval in section, placed horizontally. Handle on left preserved; right handle restored. Shallow vertical combing covers nearly four-fifths of interior from lip to bottom of wall. Inscription just below rim: ΟΡΕΣΤΑΔΑ scratched on after firing (*SEG* XVII 134: 'Ορεστάδα).

Date: late 3rd century B.C.

- 6 IP 2215 Figs. 3, 8, 9
Upright beehive

Sanctuary, tr. D, West Stoa Reservoir, notebook JGH, baskets 17, 30, pp. 164, 214. Est. H. 0.33; est. Diam. mouth 0.335; Diam. base 0.26. Rectangular flight hole in floor near join of base with wall; partly restored but definitely 0.03×0.05 . Slightly less than half of the vessel was restored with fragments and plaster. Fabric varies from reddish brown to reddish yellow (7.5YR 6/4–6/6), rather fine

and without visible inclusions.

Slightly convex wall with little flare. Outward thickened rim with flange beneath. Exterior has random scrape lines created while the vessel was turning on the wheel. Roughly a third of interior has widely spaced vertical scoring made with a five-tooth comb.

Date: ca. 180–160 B.C.

- 7 IP 2512 Figs. 3, 8, 9
Upright beehive

Sanctuary, tr. GW2, notebook JGH, basket 3, p. 352. H. 0.29; rest. Diam. mouth 0.38; Diam. base 0.270 (slightly ovoid). Rectangular flight hole, 0.03 wide \times 0.02 high at bottom of wall, just above interior floor level. Restored from many fragments with much plaster infill; missing sections of rim and base. Pale Corinthian coarse fabric with few apparent inclusions (restoration does not allow for inspection of the cross-section).

Shape has flaring wall from foot to broad opening; rim similar to but less pronounced than 5 or 6. No combing on surviving parts of interior.

Date: Hellenistic.

- 8 IP 7753 Fig. 8
Upright beehive

Rachi, lot 89–116, house I, room A. Upper section: P.H. 0.22; est. Diam. mouth 0.315; est. Diam. base 0.180. Rectangular flight hole with rounded corners at bottom of wall, 0.02×0.025 . About two-thirds of upper part preserved, mended from many fragments; three joining fragments of a base probably come from the same hive. Upper and lower parts do not join. Corinthian plain ware fabric.

Flaring wall with convex curve toward bottom; plain, flat outturned rim. Flight hole is inclined so that, inside the pot, the floor rises higher than the outer lower edge. No combing preserved on interior of surviving fragments.

Date: late 3rd century B.C.

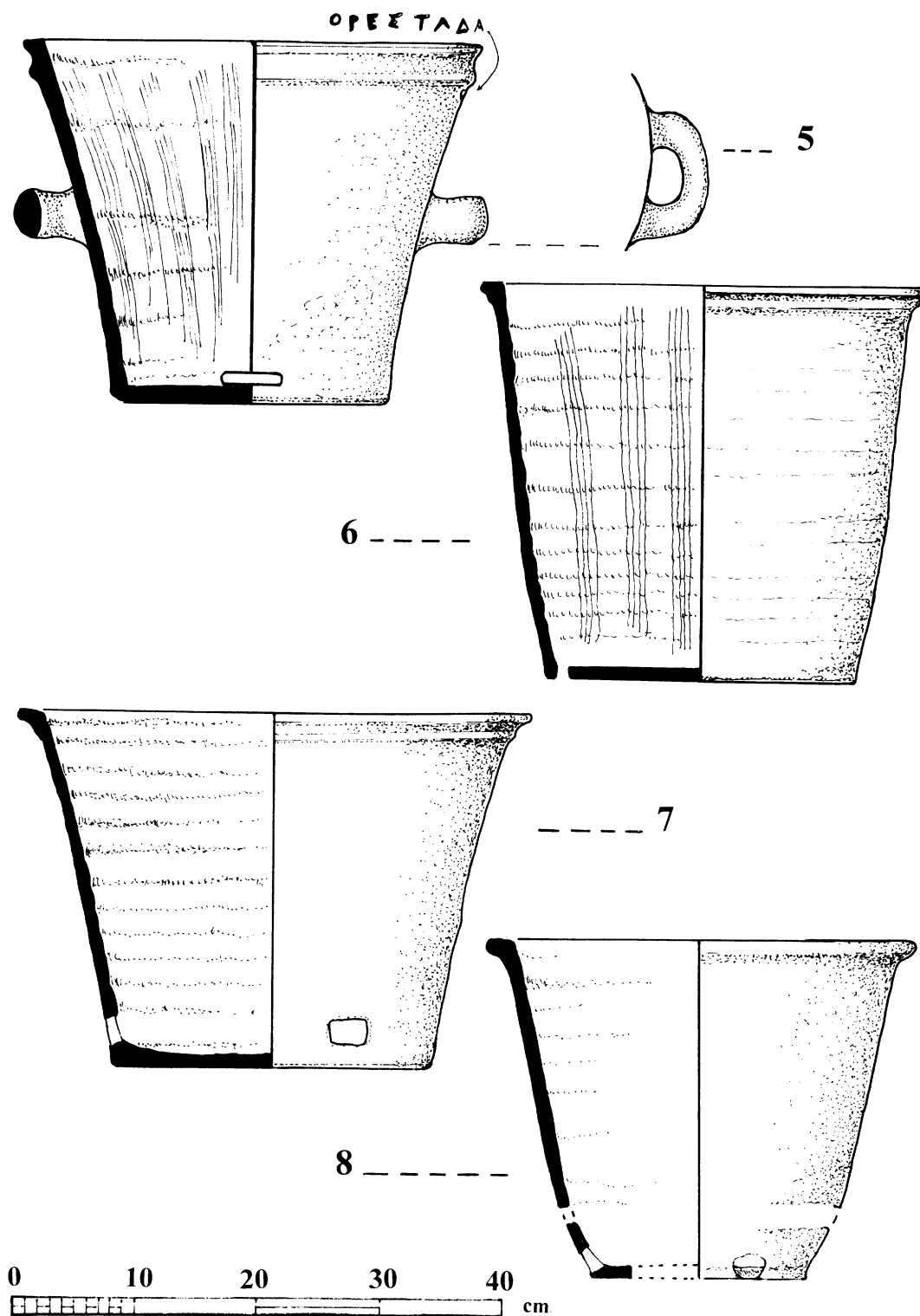
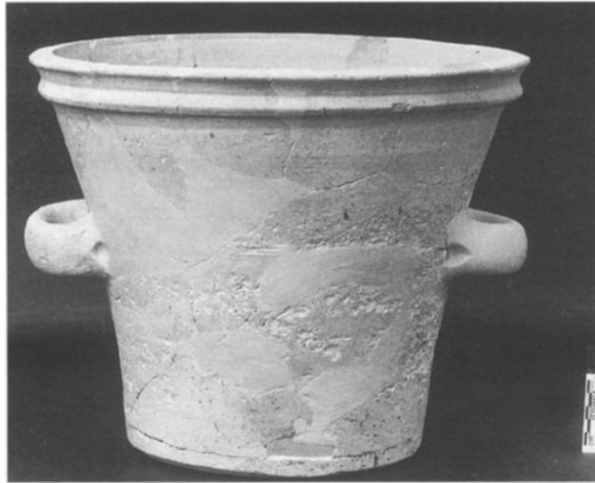


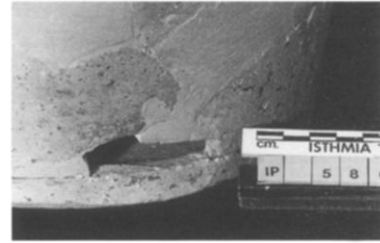
Figure 8. Four upright hives: 5 and 8 from the Rachi settlement, 6 and 7 from the sanctuary



5



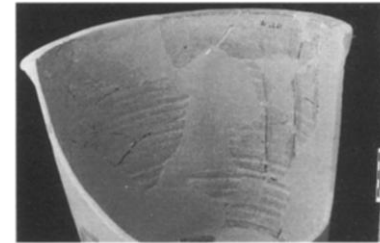
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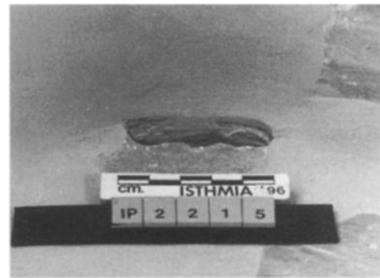
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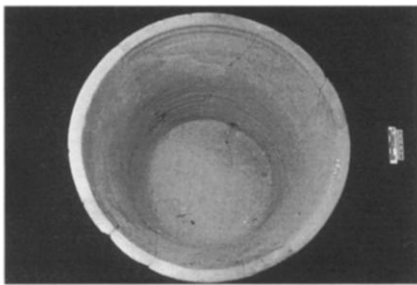
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6



6



7



7

Figure 9. Orestada vessel (5): exterior, interior, and detail of entry hole; hive 6: exterior, interior, and detail of entry hole; hive 7: interior, exterior

RIMS

- 9 IP 6712 Figs. 10, 11
Rim and upper wall

Rachi, lot 1052, house XVII. P.H. 0.17; Diam. mouth 0.365. One large fragment. Corinthian coarse ware.

Heavy rim with outwardly thickened lip and ridge below. Smooth exterior; single groove 0.115 down from rim, perhaps to align handles. If so, this was probably an upright hive. Cf. 10, 13, and 18. Combing on interior is very fine, closely spaced, slightly deeper at bottom with traces of finger ridging.

Date: 3rd century B.C.

- 10 IP 7388 Figs. 10, 11
Rim and wall

Rachi, house IV, notebook 8, p. 39. P.H. 0.21; est. Diam. mouth 0.332. Three joining fragments. Corinthian coarse ware.

Outwardly thickened rim with ridge below. Single groove (not aligned with wheel marks) on exterior wall, 0.137 down from rim, probably for handles. Cf. 9 above. Handles suggest an upright hive. Overlapping, vertical combing covers entire preserved interior surface, becoming deeper and more closely spaced at bottom. Probably from same vessel as 11.

Date: 3rd century B.C.

- 11 IP 7390 Rim Fig. 11

Rachi, house IV, notebook 8, p. 39. P.H. 0.108; est. Diam. mouth 0.32. Two joining fragments. Corinthian coarse ware.

Similar in shape to 10. Vertical combing on interior. Probably belongs with 10.

Date: 3rd century B.C.

- 12 IP 7759 Figs. 10, 11
Rim and wall

Rachi, lot 89-491, street 5, house XI. P.H. 0.145; est. Diam. mouth 0.375. Two joining fragments. Small worn area just below rim interior. Corinthian coarse ware.

Plain rim, slightly concave below. Interior displays deep, messy

combing, overlapping at top. Graffito scratched on wall appears to be either a backward N or an M.

Date: late 3rd century B.C.

- 13 IP 7780 Figs. 10, 11
Rim and wall

Rachi, lot 89-492, street 5, house XI. P.H. 0.13; est. Diam. mouth 0.34. Three joining pieces. Burned and discolored Corinthian coarse ware. Rather large grit visible at break.

Heavy, double-ridged rim. Groove just above break at bottom edge, for handles? Cf. 9, 10, and 18. Closely set vertical combing on interior, made with alternating deep and shallow strokes. Perhaps an upright hive.

Date: late 3rd century B.C.

- 14 IP 7841 Figs. 10, 11
Rim and wall

Rachi, lot 89-508, house VII. P.H. 0.15; est. Diam. mouth 0.33. Two joining fragments. Corinthian coarse ware with small amount of grit.

Projecting rim with shallow wheel ridging beneath. One narrow band of rather deep vertical combing on interior with traces of shallow combing to either side.

Date: late 3rd century B.C.

- 15 IP 7391 Rim Fig. 11

Rachi, house XVI, notebook 8, p. 66. P.H. 0.08; est. Diam. mouth 0.33. Two fragments, mended. Discolored gray surfaces; probably Corinthian fabric.

Outwardly thickened rim with prominent ridge beneath. Three broad bands of vertical combing on interior.

Date: 3rd century B.C.

- 16 IP 7758a Rim Fig. 11

Rachi, lot 89-114, house I, room B. P.H. 0.067; est. Diam. mouth 0.32. Two joining fragments. Corinthian coarse fabric.

Outwardly thickened, double-ridged rim above incurving wall. Shallow, vertical, interior scoring,

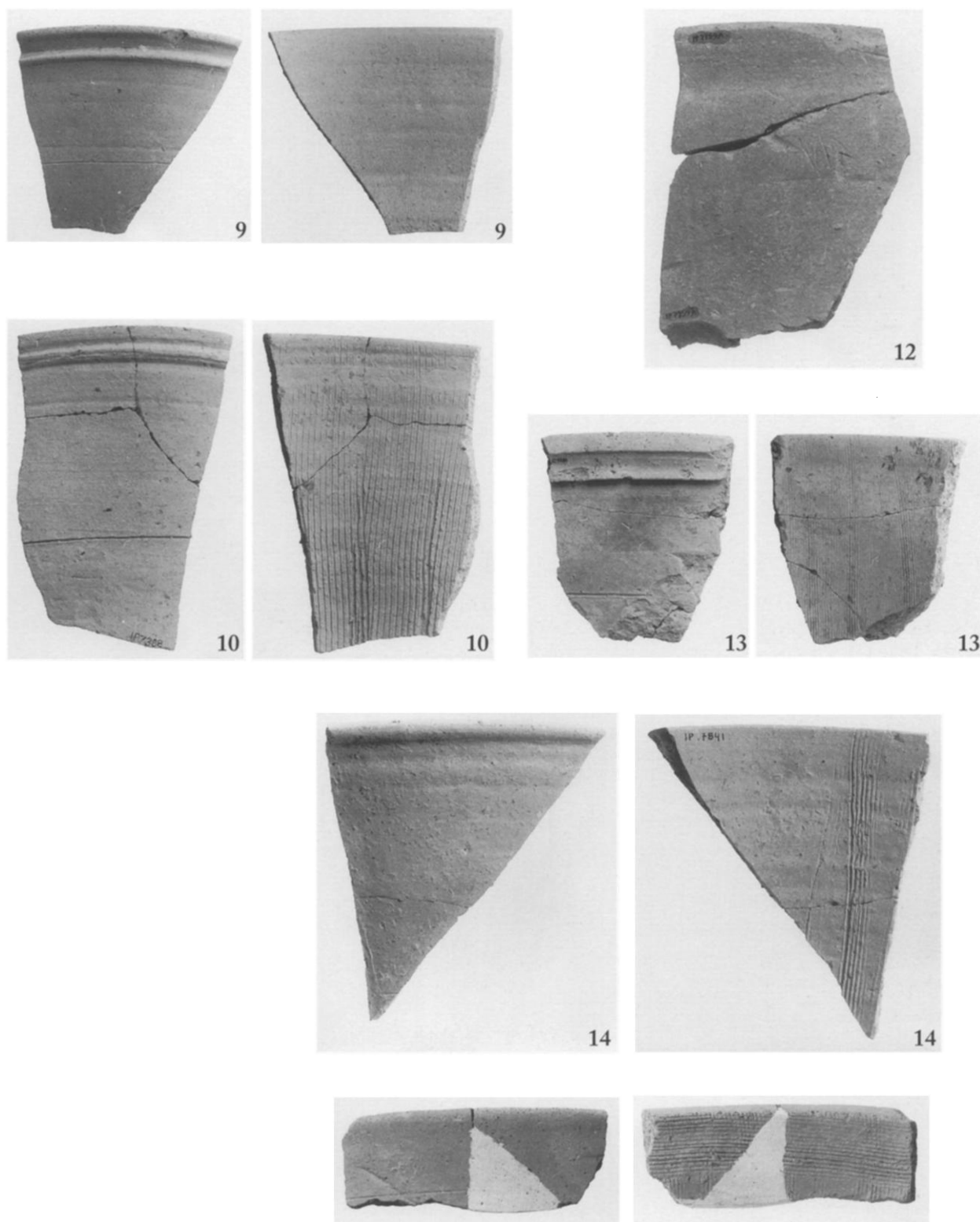


Figure 10. Hives 9, 10, 13, 14, 20:
exterior, interior; hive 12: exterior

20

20

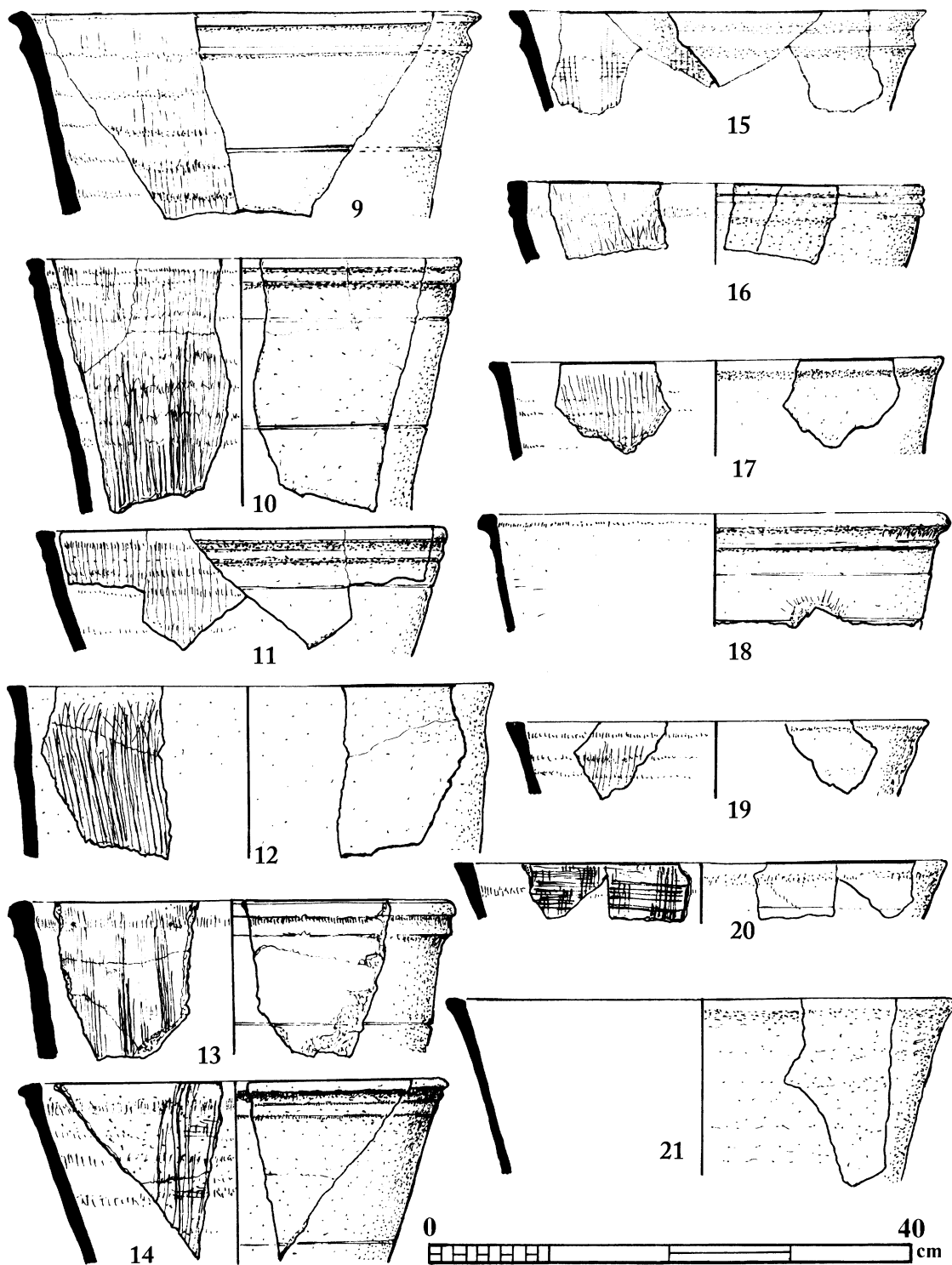


Figure 11. Rims 9-21. J. Ellis Jones

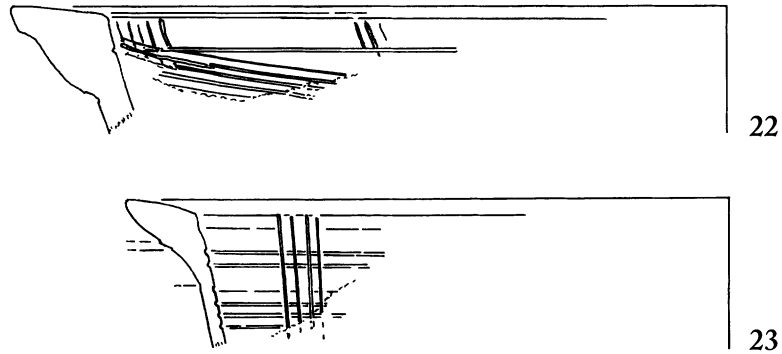


Figure 12. Hives 22 and 23.
J. W. Hayes

alternately deep and shallow with overlap.

Date: late 3rd century B.C.

17 IP 7392 Rim Fig. 11

Rachi, tr. T, notebook 2, p. 15. P.H. 0.075; est. Diam. mouth 0.35. One fragment. Corinthian coarse ware.

Plain rim. Regularly spaced vertical combing on interior.

Date: after 200 B.C.

18 IP 6509 Rim Fig. 11

Rachi, lot 1068, South Slope cistern, upper fill. P.H. 0.10; est. Diam. mouth 0.37. Seven joining fragments. Hard, thin, cooking fabric, gray to reddish brown on surface.

Rim rounded at exterior with ridge below. Trace of handle root on exterior, set along a faint groove at 0.09 below lip. On the evidence of the handle, this rim is likely to be from an upright hive.

Date: late 3rd century B.C. (Anderson-Stojanović 1997, p. 16).

19 IP 7760 Rim Fig. 11

Rachi, lot 89-507, house XIV. P.H. 0.062. One fragment. Smooth Corinthian plain ware.

Plain rim. Widely spaced combing on interior. Cf. 20 and 21 for similar profiles.

Date: late 3rd century B.C.

20 IP 1546 Rim Figs. 10, 11

Sanctuary, lot 1408, tr. H, cistern. P.H. 0.049; est. Diam. mouth 0.38. Two fragments, mended with

plaster. Corinthian plain ware.

Plain rim. Interior preserves vertical combing, overlapping with horizontal band just below rim interior. Cf. 19 and 21 from Rachi with similar rim profiles.

Date: Mixed Hellenistic and Roman context.

21 IP 7791 Rim Fig. 11

Rachi, lot 89-497, house X, room C. P.H. 0.158; est. Diam. mouth 0.37. Two joining sherds. Spalling on outer surface. Corinthian coarse ware.

Plain rim. Close-set vertical combing on interior. Cf. 19 and 20 for similar profiles.

Date: late 3rd century B.C.

22 IP 6416 Rim Fig. 12

Sanctuary, lot 161, tr. Vc, notebook 7, circular cistern, pp. 20-21. Layer in which rim was found: 0.70-1.20 m. P.H. 0.033; est. Diam. mouth 0.40. Single sherd. Soft local fabric, rather fine in texture.

Simple everted rim. Traces of vertical and horizontal scoring on interior.

Date: early 2nd century A.C.

23 IP 6938 Rim Fig. 12

Sanctuary, lot 720, tr. NTD, section III, notebook 10, pp. 167-170. P.H. 0.041; est. Diam. mouth 0.30. Single sherd. Corinthian plain ware.

Everted rim. Segment of vertical combing on interior.

Date: Late Hellenistic/Early Roman.

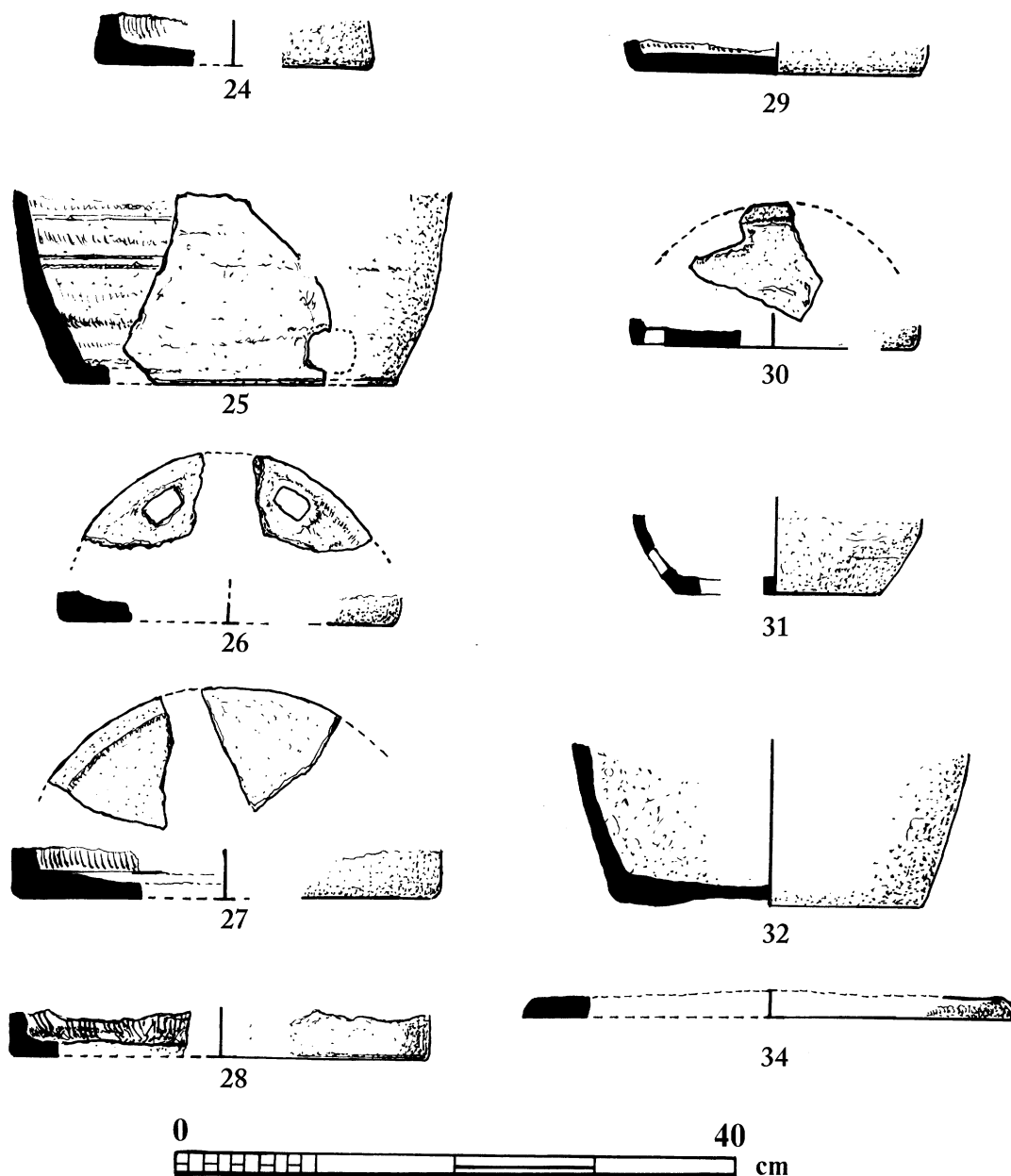


Figure 13. Base fragments 24–32 and lid 34. J. Ellis Jones and V. R. Anderson-Stojanović

BASES

24 IP 628 Fig. 13
Part of base and lower wall
Rachi, lot 1034, well, layer 13.
P.H. 0.035; est. Diam. ext. 0.20. One
fragment. Corinthian coarse ware.
Flat base with inturned wall.
Faint traces of interior combing.
Date: late 4th century B.C.
(Anderson-Stojanović 1993, p. 297).

25 IP 562 Figs. 13, 14
Base and wall with flight hole
Rachi, lot 138, N. Building,
rooms 3, 4. P.H. 0.130; est. Diam. int.
0.021; Diam. flight hole 0.030. One
fragment. Corinthian coarse ware.
Flat base with convex, flaring
wall. Exterior smoothed over but
worn in some areas; wheel ridges on

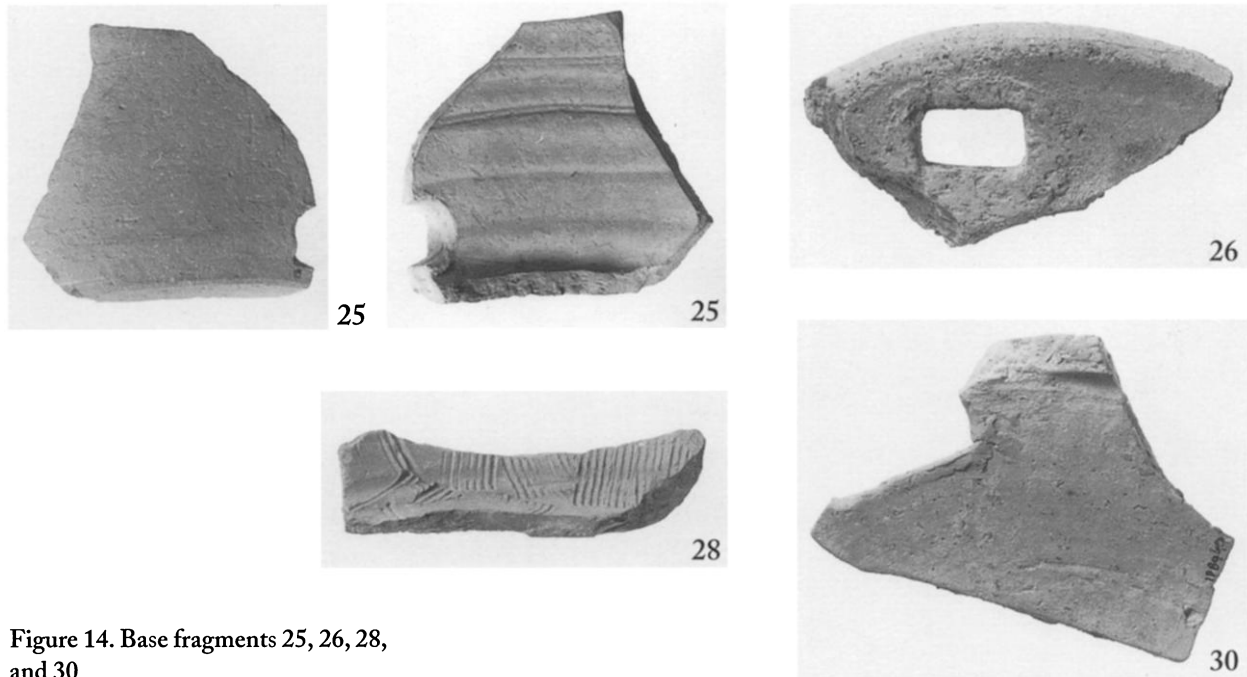


Figure 14. Base fragments 25, 26, 28, and 30

interior. Flight hole at bottom of wall. No combing preserved on interior.

Date: 3rd century B.C.

26 IP 7372 Figs. 13, 14
Base with rectangular flight hole

Rachi, lot 546, house XVII, p. 198. P.H. 0.020; est. Diam. ext. 0.240. W. flight hole 0.025; H. flight hole 0.015. One small fragment with outer wall preserved. Gritty fabric, reddish yellow at core (5YR 6/6) with pink surfaces (7.5YR 7/4).

Flat base with rectangular opening 0.017 from inner edge of wall.

Date: 3rd century B.C.

27 IP 7389 Fig. 13
Part of base and lower wall

Rachi, lot 312, N. Building, rooms 3, 4. P.H. 0.035; est. Diam. ext. 0.31. One fragment. Corinthian plain ware.

Flat base. Closely spaced, rather deeply cut combing on interior.

Date: 3rd century B.C.

28 IP 7776 Figs. 13, 14
Base and lower wall

Rachi, cleaning unit, north side,

notebook 58, basket 63, p. 125. P.H. 0.040; est. Diam. ext. 0.30. One fragment. Corinthian plain ware.

Flat base. Combing on floor at various angles.

Date: after 200 B.C.

29 IP 8430 Fig. 13
Base and lower wall

Rachi, lot 89-492, street 5, house XI. P.H. 0.019; est. Diam. ext. 0.21. Slightly more than half preserved. Corinthian coarse ware.

Flat base. On interior floor a row of tiny circular impressions appear to be the imprint from the comb used to make the characteristic inner surface.

Date: late 3rd century B.C.

30 IP 8449 Figs. 13, 14
Base and lower wall with rectangular flight hole

Rachi, lot 89-122, house II, room B. P.H. 0.016; est. Diam. ext. 0.205; W. flight hole 0.036; H. flight hole 0.011. One piece, preserving bottom edge and floor. Corinthian coarse ware.

Flat base and flaring wall. Smoothed interior surface. Rectangu-

lar opening with smoothed edges in floor, immediately inside wall, 0.008 from edge of pot.

Date: late 3rd century B.C.

31 P 8128 Fig. 13
Base and lower wall

Rachi, lot 89-519, house IX. P.H. 0.056; Diam. base 0.145; Diam. holes 0.016-0.020. One fragment. Most of flat base with two holes, one in wall, the other in floor; both punched through from above. Possi-

bly a flowerpot rather than a beehive? Corinthian plain ware.

Flat base with curved sides.

Date: late 3rd century B.C.

32 IP 8111 Fig. 13
Base and lower wall

Rachi, lot 89-519, house IX. P.H. 0.122; Diam. ext. 0.22. One fragment. Corinthian coarse ware. Coarse, pitted and burned surface. Concave base with flaring wall. Date: late 3rd century B.C.

OTHER BEEHIVE FRAGMENTS

33 IP 8678 Wall Fig. 15

Rachi, lot 89-507, house XIV. P.H. 0.074. One fragment of wall. Corinthian coarse ware.

Straight profile. Combing is in two parts: deep horizontal combing in lower half, three groups of diagonal shallow grooves above.

Date: late 3rd century B.C.

34 IP 8129 Lid Figs. 5, 13

Rachi, lot 89-518, house IX. Est. Diam. 0.330; Th. 0.020. One fragment, restored with plaster infills, ca. two-thirds preserved. Corinthian coarse ware, burned.

Underside plain, upper surface with semicircular ridges as at Trachones. Cf. Jones 1976, p. 83.

Date: late 3rd century B.C.

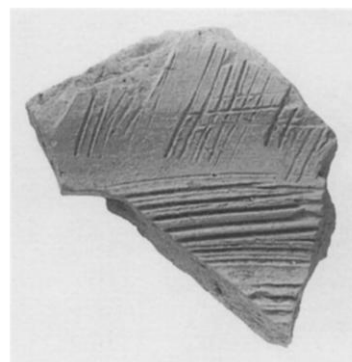


Figure 15. Wall fragment 33, interior

DISTRIBUTION AND DATE OF THE BEEHIVES

It is not our intention to present an in-depth review of recent work on beehives or beekeeping, but rather to set forth the evidence for beehives, especially the upright hive, as it exists from Isthmia, and to encourage others to use this information to advance the study of ancient beekeeping.

The distribution and date of the beehive fragments found at Isthmia are described in Table 2. The four securely identifiable examples of horizontal beehives (1-4) of type 1 from the Hexamilion fortress were found in association with Late Roman pottery in the interior fill of tower 7.²⁶ We can only speculate as to whether they were in use at the fortress. A rim from tower 2 in a 6th-century A.C. context has an estimated diameter of 0.34 and could have belonged to either a type 1 or type 2 hive (Table 1).²⁷ Other body sherds occurred in contexts of Roman and Byzantine date. On the other hand, current evidence indicates that the type 2 beehives were used at Isthmia in Hellenistic times and into the Early Roman period. Given this wide range of dates, the sample from Isthmia does not include a sufficient number of securely identified horizontal and upright hives to determine which variations in profile, fabric, and surface treatments (variables typically identifiable on fragments) might be characteristic of a particular type or origin.

The majority of beehive fragments from the Rachi settlement were found in destruction debris within the houses or on the streets of the settlement (Table 2). With the destruction dated to ca. 200 B.C., we have secure

26. *Isthmia* V, p. 127: "This material, however, does not appear to have been stratified, and Middle Byzantine material, an early Roman lamp, and Late Roman pottery were all encountered in the lowest level of the tower. The examples of nearly complete sixth-century vessels appear to have been scattered throughout the fill, from top to bottom, and so it is unlikely that the amphoras and beehives were used in the tower. Rather, they must have been dumped into the tower at some later date, perhaps even in the fourteenth or fifteenth century."

27. *Isthmia* V, p. 114, n. 5.

TABLE 2. DISTRIBUTION OF BEEHIVE FRAGMENTS AT ISTHMIA

<i>Area</i>	<i>Feature</i>	<i>Context</i>	<i>Location</i>	<i>Date</i>	<i>Cat. No.</i>	<i>Type 1</i>	<i>Type 2</i>	<i>Rim</i>	<i>Base</i>	<i>Wall</i>	<i>Total</i>
Fortress	tower 2	fill	within walls	5th A.C.				1			1
Fortress	tower 7	fill	interior	Roman-Byz	1-4	4**					4
Fortress	tower 14			Roman						2*	2
Fortress	NE gate			Roman-Byz						5*	5
Fortress	NW			Hell-Rom						1*	1
Fortress	S gate			13th A.C.						2*	2
Rachi	N bldg	destr		3rd B.C.	25, 27				2**		2
Rachi	H I, II	surface		post 200 B.C.						6 (5*)	6
Rachi	H I A	destr	basement	3rd B.C.	8		1**				1
Rachi	H I B	destr	basem, ctyd	3rd B.C.	16			1**		4 (1*)	5
Rachi	H II B	destr	basement	3rd B.C.	30				1**	2	3
Rachi	H IV	destr	press	3rd B.C.	10, 11			2**			2
Rachi	H VII	destr	basement	3rd B.C.	14			1**		1	2
Rachi	H VIII	wash		post 200 B.C.						2 (1*)	2
Rachi	H IX	destr	basement	3rd B.C.	31, 32, 34	1 lid(?)**			2**	1	4
Rachi	H X C	destr	basement	3rd B.C.	21			1**		2	3
Rachi	H XI	destr	press, wkrm	3rd B.C.						3 (2*)	3
Rachi	H XII	destr		3rd B.C.						1	1
Rachi	H XIV	destr	storage	3rd B.C.	19, 33			1**		3 (1**)	4
Rachi	H XV	destr	ctyd	3rd B.C.	5		1**				1
Rachi	H XVI	destr		3rd B.C.	15			1**			1
Rachi	H XVII	destr	ctyd	3rd B.C.	9, 26			1**	1**	1*	3
Rachi	street 1	surface		post 200 B.C.						1*	1
Rachi	street 5	destr		3rd B.C.	12, 13, 29			2**	1**	3 (1*)	6
Rachi	SS cist	destr	upper fill	late 3rd B.C.	18			1**			1
Rachi	well	dump	layer 13	late 4th B.C.	24				1**		1
Rachi	N side	wash		post 200 B.C.	28				1**		1
Rachi	tr T			post 200 B.C.	17			1**			1
Sanctuary	W stoa	fill	reservoir	2nd B.C.	6		1**				1
Sanctuary	tr GW2			Hell	7		1**				1
Sanctuary	tr H	fill	cistern	Hell-Rom	20			1**			1
Sanctuary	circ cist	fill		early 2nd A.C.	22			1**			1
Sanctuary	NTD			Hell-Rom	23			1**			1
Sanctuary	NTD	surface								1*	1
Sanctuary	SEA									1*	1
Sanctuary	ET									2*	2
Sanctuary	ET 7	fill	road	early 2nd A.C.						1*	1
Sanctuary	ET	fill	road E	Hell-1st A.C.						1*	1
Sanctuary	NE	fill	caves	2nd, 3rd A.C.						2*	2
Sanctuary	NE	surface								2*	2
Sanctuary	ST									1*	1
Theater	N/NE	surface								1*	1
Stadium	STE-5	fill	water chan	Roman						2*	2
Stadium	STW-1	fill	w chan tun	Roman						1*	1
Stadium	STE-3E	surface	start line	Byz						1*	1
Stadium	STW-2S	surface		Byz						1*	1
Stadium	STE-1	surface		Roman						1*	1
Stadium	SS-1, 1A	dump	N tunnel	Roman						1*	1
TOTAL						5	4	16	9	59	93

*Sample for analysis. **Included in catalogue. Abbreviations: destr = destruction debris; wash = earth washed down from deposits above; basem = basement; ctyd = courtyard; wkrm = workroom; chan = channel; tun = tunnel.

dates for those pieces.²⁸ These include two restored examples (5, 8) of upright hives and the fragments of others (9–16, 18, 19, 21, 25, 27, 29–34) possibly or probably of that type. We cannot be sure if they were in storage, or in use in courtyards and on roofs within the settlement during a late phase, when the inhabitants may have been largely confined to the hill for security (Fig. 1).²⁹ Other pieces come from contexts associated with deposits close to the surface, or from sediments washed down from above. Some may belong to a period when habitation at the site had mostly ended, and when abandoned dwellings were reused as convenient shelters by local beekeepers. Many beehive fragments have recently been documented from the Athenian Agora, which suggests that bees did not require an isolated location for their hives.³⁰

Beehive fragments from the Sanctuary of Poseidon are primarily from secondary contexts (Table 2). Two restored examples (6, 7) of the upright hive as well as some rim fragments (20, 22, 23) are from the temenos area, while several wall sherds were found in the northeast caves and the theater. According to John Hayes, these examples belong either to the Hellenistic or Early Roman period.³¹ Were they once in use there or did they arrive as votives? Other wall sherds found in the vicinity of the Hellenistic stadium (Fig. 1, “later stadium”), southeast of the sanctuary, were selected for chemical analysis. Beehives may originally have been placed in the fields near the stadium or on the northeast side of the Rachi, which rises above the stadium.

It is possible that the upright type of beehive was in use elsewhere in the region but has simply not been identified because of the fragmentary state of the remains. Similarly, the horizontal hive may also have existed in the Corinthia during Classical and Hellenistic times. No beehives have been published from Ancient Corinth, and we are aware of only a few others from the Corinthia.³² Both type 1 and type 2 hives may have been made of wicker and other perishable materials, which have not survived in the archaeological record.³³ There is no reason why several different types of hives in a variety of materials might not have been in use simultaneously, as recently observed on Crete, Cyprus, and Siphnos.³⁴

28. See Anderson-Stojanović 1996, pp. 93–94, on the demise of the settlement, perhaps as a result of military activity in 198 B.C. A detailed discussion of the contexts in which the combed sherds were found will appear in the forthcoming volume on the Rachi settlement in the *Isthmia* series.

29. Bonet Rosado and Mata Parreño (1997, p. 42) discuss beehives in settlement contexts, in particular mentioning beehives on rooftops. See also generally the information posted in 2000 on the Sphakia Survey Web site: L. Nixon, J. Moody, S. Price, and O. Rackham, “Sphakia Survey: The Internet Edition,” <http://sphakia.classics.ox.ac.uk>. Abstracts of “Bee-Keeping in the Graeco-Roman World,” a conference organized by Simon Price

and Lucia Nixon at Lady Margaret Hall, Oxford, on 7 November 2000, may also be found on this Web site. The Akrotiri central corridor of Crete is discussed in Raab 2001, pp. 134 (Hellenistic), 137 (Early Roman), and 160 (general discussion).

30. Rotroff 2002. I am grateful to Susan Rotroff, who generously provided us with a copy of her paper.

31. To be published in a forthcoming volume in the *Isthmia* series by Hayes on the Hellenistic and Roman pottery from the Sanctuary of Poseidon.

32. Several body sherds are described in Gregory 1985 (p. 428, nos. 37–39, pl. 111), dated Late Roman to Early Byzantine. See the comments in Jones, Graham, and

Sackett 1973, p. 397; Jones 1976, p. 83; and Salmon 1984, p. 24.

33. Crane 1983, pp. 51–54. Davis (1996, p. 461) suggests that wicker hives were typical of apiculture in the Peloponnese, although this cannot, of course, be proved.

34. Jones, Graham, and Sackett 1973, pl. 78d, shows terracotta and wicker hives in use at the same time and in the same location on Crete. See Graham 1975, p. 75, for cylindrical terracotta hives along with wooden box hives in use simultaneously on Cyprus (as photographed by Jones in 1972). As recently as 1987, Jones saw horizontal pot hives and wooden hives in use on a field terrace near the tower of Aspro-pyrgos on the south coast of Siphnos.

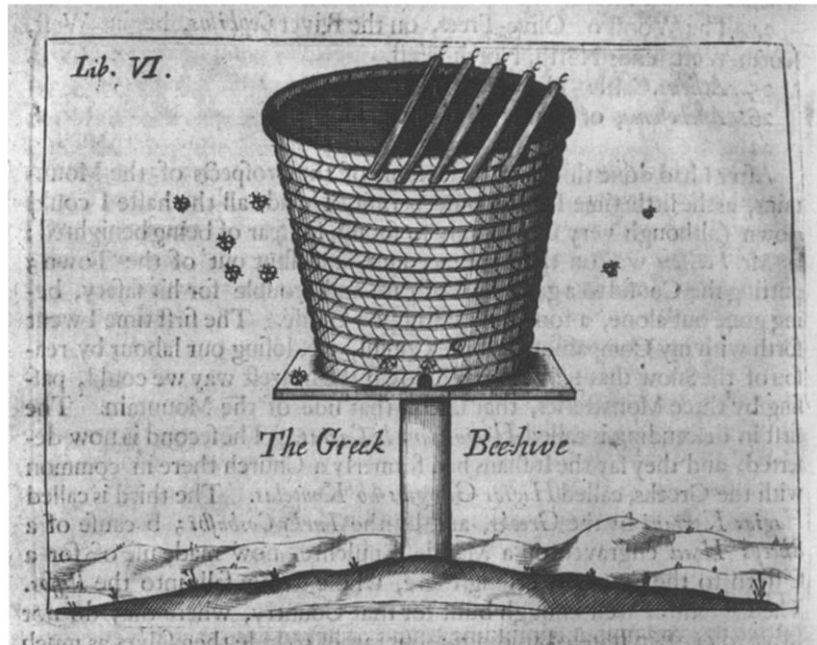


Figure 16. Greek beehive.

From Wheler 1682, p. 11. Courtesy Founders' Library, University of Wales, Lampeter.

BEEHIVES FROM ELSEWHERE IN GREECE

Upright bar hives of wickerwork are documented in 17th-century Attica by Sir George Wheler in *A Journey into Greece* (Fig. 16).³⁵ Attica, where type 1 was in use in the Classical and Hellenistic periods, is well known as a source of numerous examples of ancient beehives.³⁶ Even today, Mt. Hymettos is famous for its honey. Examples from the excavations in the Athenian Agora and Eretria, although taller than the Isthmian type 2 hives, have a similar rim diameter as well as flat bases.³⁷ A number of the rims found during Lohmann's survey of Attica have diameters large enough for upright hives, but bases with interior combing and entry holes have not been published.³⁸ A hive from the Kerameikos excavations is quite similar to the Isthmian type 2, with a height of 0.355 m and exterior rim diameter of 0.380 m.³⁹ Lüdorf, in her classification of the three major types of beehives in Attica, classifies both the Agora and Kerameikos hives as type A1, the *kalathos* shape.⁴⁰ Type A1 varies in height from 0.35 to 0.55 m, in rim diameter from 0.32 to 0.40 m, and in base diameter from 0.17 to 0.27 m. Finally, from excavations on Chios in the 1950s come several rim fragments whose dimensions may qualify them as examples of type 2.⁴¹

Although the larger diameter is a feature of the type 2 hive, the flat base is also characteristic of many hives of type 1. Furthermore, none of

35. Wheler 1682, pp. 412–413. See below, p. 369, for the full text.

36. See the comprehensive study of Lüdorf (1998–1999) and the earlier study of Lohmann (1993).

37. *Agora* XII, p. 366, no. 1853, pl. 88; and Lüdorf 1998–1999, p. 84, B1, pl. 11, are the same vessel: H. 0.437, Diam. rim 0.390; *Eretria* VIII,

p. 112, no. 76, H. 0.418, Diam. rim 0.363. For several beehives from the western tombs of Oropos, see Pologorge 1998, pp. 62–63, 127–128.

38. Lohmann 1993, p. 355, A53–18, with est. H. 0.46–0.48, Diam. rim 0.363.

39. Lüdorf 1998–1999, p. 84, B3, pl. 13, dated 340–300 B.C.

40. Lüdorf 1998–1999, pp. 56–57.

41. E.g., Anderson 1954, p. 137, no. 28, p. 173, fig. 5, Diam. rim 0.47; p. 142, no. 79, p. 173, fig. 5, Diam. rim 0.40. Both have horizontal combing on the interior walls and both rims correspond to the complex profile of type 2.

the beehives mentioned just above has a flight hole in the lower wall or floor of the vessel, suggesting that the hive stood upright. A recently published fragmentary, flat beehive base from the late-5th-century Agora does have a flight hole in the center of the floor; although only 0.148 m of the height is preserved, the diameter of 0.29 m at the top of the fragment must have been greater at the original rim.⁴² The presence of the flight hole, combing on the interior, and a rim diameter of probably at least 0.35 m suggests that this is the first known example of an upright hive in Attica. Just as modern beehives vary in size, ancient Greek beehives too will have varied, as is clear from Lüdorf's typology of four types (A1, A2, B1, B2).⁴³

Few beehives have been reported from surveys in Greece. Almost no beehive fragments have turned up in the Pylos region or in the Nemea valley, while in the southern Argolid and on Methana, only a handful of fragments have been identified.⁴⁴ Some areas of Greece, however, have produced more fragments of ceramic beehives than the Peloponnese: Kea, southern Euboia, Boiotia, and western Crete, in particular.⁴⁵ About eighteen beehive fragments spanning the ancient to medieval periods are cited in Raab's work (2001) on the Akrotiri peninsula in Crete. An unusual ring base fragment with internal combing and a small hole (D. ca. 0.025 m) in the floor near the vessel wall was found in the Kathiani district and may have been part of a type 2 hive.⁴⁶ Columella (*Rust.* 9.14.19), citing Celsus, also mentions Euboia, Akhaia, the Cyclades, Skyros, and Sicily as regions where bees are moved in order to be near favorable plants such as thyme, marjoram, and savory.

No ancient Greek or Roman visual representations of beehives exist as far as we know. Ancient literature has extensive references to beekeeping, the most substantial of which are in Aristotle (*Hist. an.* 5.21.553a–554b; 9.40.623b–627b; *Gen. an.* 3.10.759a–761a), Varro (*Rust.* 3.16), and Columella (*Rust.* 9.2–16). Varro and Columella give practical accounts from the point of view of the beekeeper, but the question of whether a movable-bar hive existed in ancient Greece or Rome cannot be satisfactorily or conclusively answered from any of the sources.⁴⁷ The description of

42. Rotroff 2001.

43. Lüdorf 1998–1999, pp. 55–76, 84–85. Crane (1983, p. 17, table 2) provides a table of modern hive variations.

44. Davis (1996, p. 461) considers the evidence provided by recent surveys for apiculture in ancient Greece. Wright et al. (1990) mention no beehives in the Nemea survey; see also Davis 1996, p. 461, for the Pylos area. One site in the southern Argolid produced fragments of ceramic beehives, and Jameson, Runnels, and van Andel (1994, pp. 289–290) suggest that hives of wood or straw must also have been used. One beehive fragment from the Roman period is noted from the

Methana survey (Mee and Forbes 1997, p. 122).

45. Two rims from Kea pictured in Sutton 1991 (pp. 260–263, no. 11.6, fig. 5.9 and no. 57.4, fig. 5.10) have a markedly slanted profile but, with rim diameters of under 0.20, are too small to be from upright hives. Davis (1996, p. 461) also mentions Boiotia and southern Euboia as sources of hives, but Bintliff and Snodgrass (1985) report no beehives, nor are many noted in unpublished reports on the Southern Euboia Exploration Project. D. R. Keller (pers. comm., Oct. 2002) excavated a nearly complete example of a hive in a Classical cistern (with later reuse) on the Paximadhi peninsula in

southern Euboia, but he comments that fragments found during survey of the area are generally rare. Beekeeping in western Crete is the subject of Francis 1999, and is also discussed on the Sphakia Survey Web site (see above, n. 29).

46. Raab 2001, p. 97, no. 85, p. 204, fig. 41.

47. Klek and Armbruster (1919–1921) compiled surveys of the ancient literature on the topic. See also Fraser 1951, pp. 14–17; Pritchett 1956, pp. 260–261; Jones, Graham, and Sackett 1973, pp. 403–412, n. 46; Crane 1983, pp. 200–202; Graham 1975, pp. 74–75; Lüdorf 1998–1999, pp. 47–51.

the top-bar hive by Wheler is the earliest account of the appearance and use of hives that he compares to modern wastebaskets and that resemble type 2 beehives in shape (Fig. 16). As this work is not available in many university libraries, the passage is quoted here in full:

The Hives they keep their Bees in, are made of Willows, or Osiers, fashioned like our common Dust-Baskets, wide at the Top, and narrow at the Bottom; and plaister'd with Clay, or Loam, within and without. They are set the wide end upwards, as you see here. (A, B,). The Tops being covered with broad flat Sticks, (as at C.C.C.) are also plaister'd with Clay at the Top; and to secure them from the Weather, they cover them with a Tuft of Straw, as we do. Along each of these Sticks, the Bees fasten their Combs; so that a Comb may be taken out whole, without the least bruising, and with the greatest ease imaginable. To increase them in Spring-time, that is, in *March* or *April*, until the beginning of *May*, they divide them; first separating the Sticks, on which the Combs and Bees are fastened, from one another with a Knife: so taking out the first Combs and Bees together, on each side, they put them into another Basket in the same Order as they were taken out, until they have equally divided them. After this, when they are both again accommodated with Sticks and Plaister, they set the new Basket in the Place of the old one, and the old one in some new Place. And all this they do in the middle of the day, at such time as the greatest part of the Bees are abroad; who at their coming home, without much difficulty, by this means divide themselves equally. This device hinders them from swarming, and flying away. In *August* they take out their Honey; which they do in the day-time also, while they are abroad; the Bees being thereby, they say, disturbed least. At which time they take out the Combs laden with Honey, as before; that is, beginning at each out-side, and so taking away, until they have left only such a [p. 413] quantity of Combs in the middle, as they judge will be sufficient to maintain the Bees in Winter; sweeping those Bees, that are on the Combs they take out, into the Basket again, and again covering it with new Combs and Plaister. All that I doubt concerning the Practice of this here in *England*, is, that perhaps they gather a less quantity of Honey; and that, should they take the like quantity of Honey from the Bees here in *England*, they would not leave enough to preserve them in Winter. But this hinders not much: For by being less covetous, and not taking so much Honey from the poor Bees, the great encrease and multiplying of them would soon equalize, and far exceed the little Profit we make by destroying of them. This is done without Smoak; wherefore the *Antients* call this Honey *Ακάπνιστον*, *Unsmoken Honey*: and I believe the Smoak of *Sulphur*, which we use, takes away very much of the Fragrancy of the Wax; and sure I am, the Honey can receive neither good Taste, nor good Smell from it.⁴⁸

48. From A. Brothers' text of Wheler (1682), pp. 412–413. We acknowledge our thanks to Tony Brothers of the Department of Classics, University of Wales, Lampeter, and to the Founders' Library of the University of Wales, where a copy of this rare work exists.

DISCUSSION

Regardless of the type or orientation of the hive, bees always attach their combs to the top of the hive (Columella, *Rust.* 9.15.7–8). The shape of the combs is determined by the angle of the beehive wall, and the honeycombs hang either facing the opening or parallel with its axis.⁴⁹ The former arrangement would be ideal for harvesting combs from type 1 hives, but bees are annoyingly inconsistent, according to Columella (see above). The beekeeper might try to control the orientation of the combs by placing wax on the combed surface of the interior to encourage attachment of the combs in particular places. In a movable-nest hive, all the combs are attached to the underside of the lid and removed as one mass when the lid is lifted. They then must be cut off the lid. In a top-bar hive (Figs. 3, 17), the combs are stuck underneath individual bars set across the mouth of the hive, between the hive and the lid. Only with the latter arrangement would the beekeeper be able to control the orientation of the comb by the arrangement of the bars or sticks but, since all combs would be equally easy to access, the orientation would not matter.

If the upright hives from Isthmia were used as movable-nest hives with lids, or as top-bar hives, it would appear that the combing on the inside served no purpose; as we noted earlier, hives 7 and 8 have no combing preserved on what remains of the interior. Perhaps the tradition of scoring the interior was simply a holdover from the technique used with the horizontal hive. If the combs *were* stuck at their edges to the sides of the pot, then the beekeeper would have had the extra work of cutting the comb from the side of the pot with a knife.⁵⁰ Some modern studies have suggested that sloping side walls discourage the attachment of combs.⁵¹ In one experiment, however, it was found that combs were indeed attached to hive walls in some cases, particularly if the angle of slope was less than 50°. ⁵² Further work on identifying upright hives in the existing ancient beehive corpus will be necessary to solve the relationship between beehive shape or orientation and comb attachment to upright hive walls.

An essential element of type 2 beehives is the flight hole located in the lower wall or base of the hive. It is typical for bees to check carefully a new nest site for the right amount of space, a south-facing view, sufficient distance from the ground, and an entrance no more than ca. 0.04 m in diameter with proximity to the floor.⁵³ By not attaching combs to the floor, the bees leave a space in the lowest part of the hive for circulation and the removal of debris. One may well say that the opening in the wall seems sensible, but a hole in the bottom of the floor somewhat impractical because it would require placement on an open stand or framework to allow the bees access. To simplify matters, piles of stones, bricks, or wood might also serve the same purpose. Columella (*Rust.* 9.7.5–6) emphasizes the need for the opening to be as small as possible to keep out the cold, as well as beetles, cockroaches, lizards, and butterflies, and that it is useful to have more than one opening. Perhaps an opening in the floor is less obvious to predators, and protected from the wind.

The top-bar beehive made beekeeping and the acquisition of honey much easier, as the combs could be lifted out of the hive for inspection or

49. Ifantides (1983, pp. 79, 84, fig. 4) illustrates the combs parallel to the axis of the opening. See also Jones, Graham, and Sackett 1973, p. 447, pl. 85; Jones 1976, pp. 84–86.

50. Jones, Graham, and Sackett (1973, p. 448, n. 246) note that, in Cyprus, long knives were used to cut out combs from the rear end of the long-pipe horizontal hive. Rather less effort would be required—only at the edges of the dangling comb—if the comb were stuck on a bar. Columella (*Rust.* 9.15.7) says that “the combs adhere very little to the sides.” On the other hand, Seeley (1995, p. 34) writes: “They then build their beeswax combs downward, attaching them to the cavity’s roof and walls and leaving small passageways along the edges.”

51. E.g., Ifantides 1983, p. 80.

52. Free and Williams 1981, p. 240.

53. Seeley 1995, p. 34, where 25 liters is mentioned as the minimum amount of space required; see also <http://www.nbb.cornell.edu/neurobio/seeley/seeley.html> for information on the behavior of bees.

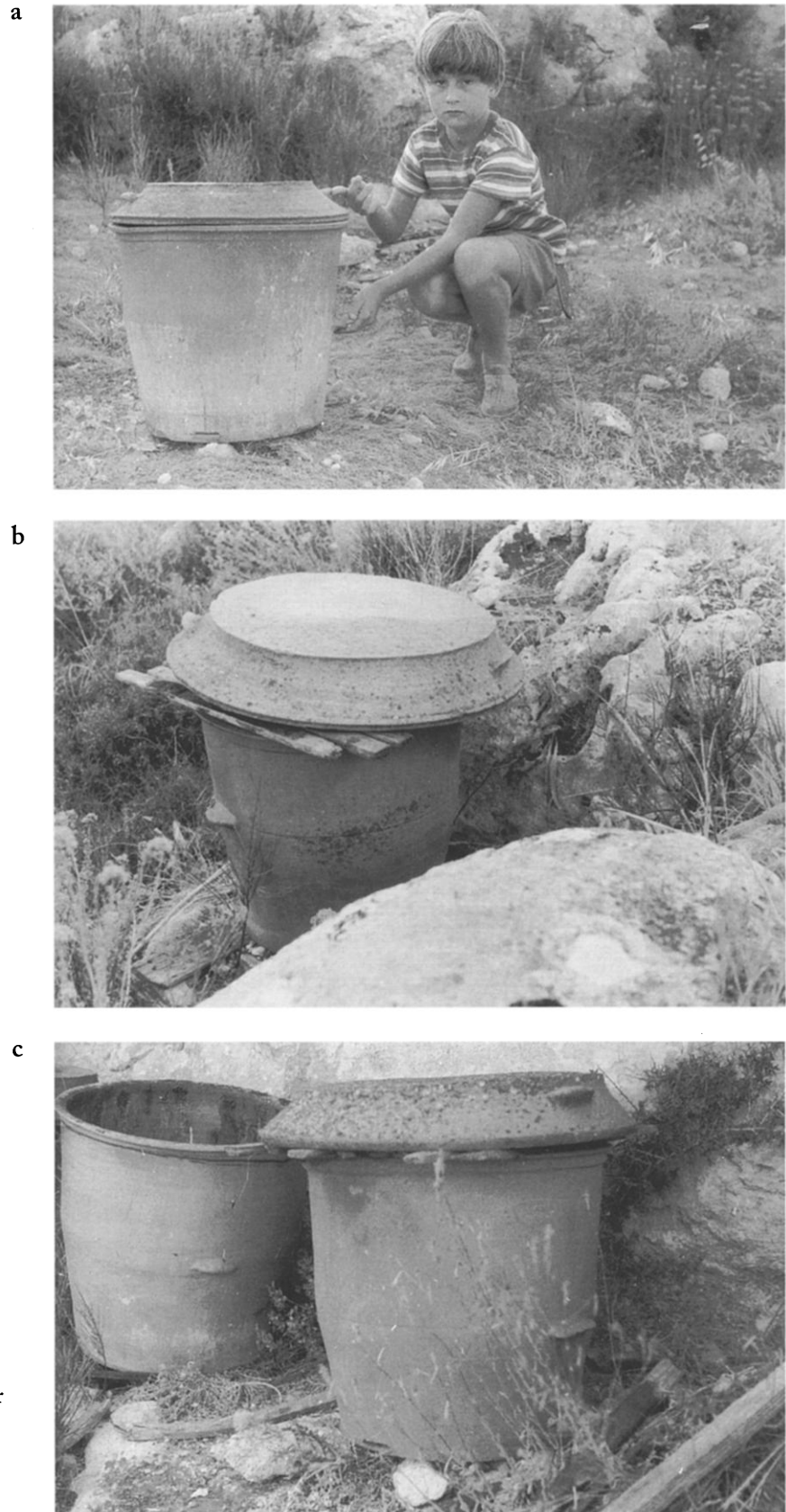


Figure 17. a) Empty upright top-bar hive at Palaiochorio, Crete, 1973; b) same hive in use; c) same hive in use, and one empty hive, ready for use. J. Ellis Jones

for harvesting rather than cut away from the top of the hive, which would have been necessary in type 1 hives.⁵⁴ Although this arrangement made it easier to harvest the honeycombs, the number of combs in the upright hive must have been smaller than in the horizontal hive, inasmuch as examples 0.58–0.64 m in height would allow as many as fifteen combs, given the natural distance of 0.038 m from the middle of one comb to another.⁵⁵ Those at the smaller end would be smaller than those at the larger, front end. The upright hive, however, with a mouth of ca. 0.31 to 0.38 m, would have held no more than seven to ten combs, those at the center being the largest and those at the edges very small (see Figs. 16, 17:b–c).

Ifantides reconstructs the possible steps in the development of the movable-nest or top-bar hive: 1) the typical horizontal hive with cover is placed in an upright position; 2) as a result of this orientation, bees attach the combs to the lid; 3) the (wooden?) lid is removed in sections to free a smaller number of honeycombs at once; and 4) the hive is made shorter and sticks or bars are placed across the mouth for the attachment of the combs, making it possible to remove each comb individually.⁵⁶ The upright beehives at Isthmia may illustrate a late stage of step 3 or step 4.

These ancient hives were presumably produced by potters for the general market, and not by beekeepers themselves. The beekeeper could make adjustments to his purchased hives as needed. For example, an excessively large hole could have been made smaller through the use of clay or mud filling (Columella, *Rust.* 9.14.13–15). Individuals certainly must have purchased or acquired used hives and lids whenever possible and made do with what they had. We should not expect any particular degree of standardization.

A variety of beehive pots of upright type were seen by Ellis Jones in a potter's yard located on the coast west of Heraklion, Crete. Moreover, the examples of upright hives still in use at Palaiochorio, mentioned earlier, illustrate combs hanging down from a rack or mesh of sticks or sticks, wire, and twigs (Figs. 3, 17). The hives themselves are slightly larger than the restored upright hives from Isthmia (5–8), with curving sides and small bee-flight holes just above the flat bases. The Cretan ceramic hives generally also have projecting lugs or handles on the upper part of the vessel, one on each side, to allow hives to be lifted and moved. There are examples of lids with downturned edges and lug handles, some of which, at least, were made to fit individual hives closely (as was tested with empty hives). Generally, however, the lids are used simply as umbrellas over the bars or rack, to shade the hives from sun or rain, and no particular care is taken to use a close-fitting lid. These modern Palaiochorio hives have no internal combing, and in that respect they resemble the horizontal hives in use in the Cycladic islands, and vessels 7 and 8 from Isthmia.

54. Crane 1983, pp. 196–212, esp. p. 196, fig. 221, p. 198, fig. 225, and p. 210, table 8.

55. Jones, Graham, and Sackett

1973, p. 411; Crane 1983, p. 210.

56. Ifantides 1983, pp. 81–85. We have briefly summarized the sequence here.

CONCLUSION

As many have already noted, beekeeping was an important economic activity in the ancient world.⁵⁷ Honey was the only available sweetening agent, a component in medicines and in fixing scents, and also served as a suitable offering to the gods. An equally valuable commodity of apiculture was beeswax, useful for writing, sealing items, lighting, and for lining vessels.

From the Isthmus of Corinth we have presented four almost complete examples of ancient beehives of the upright variety, together with fragments of others, including three bases with flight holes (25, 26, 30) and a rim with one handle preserved (18). Three other rims with a requisite mouth diameter and grooves for placing handles (9, 10, 13) are also good candidates for upright hives. Of the two restored hives with combing on the walls of the interior, neither preserves this treatment on the inner surfaces close to the flight hole, nor on the floor. Thus, the absence of interior combing on fragments is not a criterion for rejecting them as beehives. The other base fragments (27, 28) display a combination of combing and a flat base, the estimated exterior diameters of which (0.31 and 0.30 m, respectively) are very large for horizontal hives (cf. Table 1). We do not know, however, whether the Isthmian upright hives were of the movable-nest or top-bar variety.

Regardless of the specific type of beehive represented, these new examples of upright hives document a clear advance in the practice of ancient apiculture by providing greater efficiency in the extraction of combs, portability, and ease of use in small spaces. What is particularly significant about the beehives from the Rachi settlement is their securely dated context in a village setting, where economic activities included the production of olive oil and textiles on a scale beyond domestic subsistence.⁵⁸ This evidence, together with the ethnographic parallels that we have adduced, provides a compelling argument for the use of the upright hive in the Corinthia by the 3rd century B.C.

The Isthmus of Corinth was a busy port and a natural crossroads, an international gathering place and market. Beekeeping would have provided a significant source of honey and wax not only to sell, but also to use or dedicate at the Sanctuary of Poseidon, the site of the Isthmian Games. In addition to the uses of honey and wax that were mentioned above, there were two purposes for which artists and artisans employed beeswax that have a special connection with votives at the Sanctuary of Poseidon. First, painters needed wax for encaustic painting on votive panels, tablets, and walls. One of the events in the Isthmian Games in the Roman period was indeed devoted to a painting competition (Plin. *HN* 21.83–84; 35.49, 149).⁵⁹ Second, beeswax was essential for the manufacture of bronze objects by means of the lost-wax process. Debris from the casting of small bronzes has been found at many of the major Greek sanctuaries, including Nemea, Olympia, and the Isthmus.⁶⁰ Ancient Corinth and the Isthmus are mentioned a number of times in myth and other testimonia in connection with

57. Crane 1983, pp. 238–240; Forbes 1966, pp. 35, 90–96; Fraser 1951, pp. 109–121.

58. Anderson-Stojanović 1996, pp. 90–93; 1998.

59. *Anacreontea* (D. A. Campbell, trans., Cambridge, Mass., 1988), frs. 3 and 16, pp. 164, 165, 182–185, provides the earliest references to encaustic painting.

60. The evidence for the casting of small bronzes at the Isthmus is presented in Rostoker and Gebhard 1980, pp. 350–354, 361; and Rostoker, McNallan, and Gebhard 1983.

the Greek words meaning hive (see LSJ, s.v. κυπέλη) and honey (see LSJ, s.v. μέλι).⁶¹

The Isthmus of Corinth may have had a long tradition of apiculture, in keeping with the association of Corinth with advances in craftsmanship.⁶² When in use, these beehives were probably placed in available spots in the settlement, or scattered just as they are today on the slopes of the Rachi, which were then, as now, covered with fragrant purple flowering thyme in late spring and early summer.

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61. The Corinthian tyrant Kypselos was saved from death when his mother hid him in a chest (κυπέλη) (Nic. Dam., *FGrHist* 90, F 57; Polyæn. 5.31). The relationship of this term to the name of the Corinthian tyrant Kypselos and to the Thracian town of Kypsela has already been remarked upon by Kardara (1961, p. 265), who compares the Orestada vase (5) with images of containers on the coins of Kypsela; the handles depicted on the coins, however, are placed vertically rather than horizontally as on 5. It is possible that the orientation of the handles was changed for the sake of the clarity of the design; Ure 1922,

pp. 198–214. Herodotos (5.92) tells us that the name of the wife of Kypselos's son Periander was Melissa, or honey/bee maiden. See *RE* XXIX, 1931, cols. 524–528, s.v. Melissa (Van der Kolf); Larson 1995, pp. 352–353. Priestesses of Demeter and Kore were also called μελίσσαι (Apollod., *FGrHist* 244, F 89; Kallimachos, *Hymn* 2.110), and honey was considered an appropriate offering for these two goddesses, who had a shrine on the slopes of Acrocorinth (*Corinth* XVIII.3), as well as on the summit of the Rachi (Anderson-Stojanović, forthcoming). We know from Servius (*Aen.* 1.430) that Melissa was the name of the

priestess of Demeter who took part in the Thesmophoria at the Isthmus. There was also a town in the Corinthia named Melissos, home of a famous Corinthian family (*RE* XXIX, 1931, cols. 529–530, s.v. Melissos [W. Nestle]; Wiseman 1978, p. 10). Finally, the name Melikertes, the boy hero in whose honor the Isthmian Games were established, means “honey-cutter,” and honey, as a symbol of immortality, was often associated with heroes (*RE* XXIX, 1931, cols. 514–520, s.v. Melikertes [A. Lesky]; Gebhard 1992, pp. 73–74).

62. Wiseman 1978, p. 13.

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