BEEKEEPING IN PREHISTORIC GREECE

Haralampos V. Harissis
Associate Professor of Surgery, University of Ioannina, Greece
harissis.h@gmail.com

Traces of beeswax on prehistoric potsherds have revealed that the harvesting of bee products by man has been practiced in Greece since the Middle Neolithic period[1] (*c.* 5500 BCE). However, it is difficult to ascertain whether beeswax was the product of wild or domesticated bees. The harvesting of wild honeycombs has existed since the time of hunter-gatherer groups: rock paintings from Spain, dating to the Mesolithic period, around 6000 BCE, depict such scenes[2].

It is known, mainly from pictorial evidence, that systematic apiculture (with beehives) was practiced in Egypt from at least *c.* 2400 BCE[3], and the forms of these ancient beekeeping paraphernalia have remained unchanged until modern times. Iconography, textual evidence and organic residue analysis leave no doubt that honey and its derivatives were used in Bronze Age Greece, the countryside of which possesses an advantage in beekeeping. Nevertheless, remnants of Greek prehistoric beekeeping paraphernalia are rare, and only a handful of archaeological findings - mainly smoking pots - were until recently identified as such, not permitting the ascertainment of the existence of systematic apiculture (with beehives) in prehistoric Greece. However, recent research has shed new light on old findings in prehistoric stratums. Here, I review all beekeeping paraphernalia from prehistoric Greece and I conclude that organized apiculture not only existed in prehistoric Greece, but it was as equally developed as it was in ancient Egypt[4].

I would like to thank G. Mavrofridis for his invaluable help.

1 Decavallas 2007. For traces of beeswax on potsherds of later periods, see Tzedakis and Martlew 1999 for Middle Minoan IA (c. 2160-2000 BCE), and Evershed et al. 1997 for Late I Minoan (c. 1600-1450 BCE).

2 Crane 2000.

3 Kueny 1950; Crane 2000, 163-4.

4 Harissis and Harissis 2009.

Beehives

Before the wide distribution of the modern beehive (discovered in 1866 but not propagated in Greece until 1930), in no place did there exist only one type of beehive[5]. A great variety of forms and materials were in use, at least up until the 1960s. The existence of numerous types of beehives can be explained by the diversity of the environmental conditions, the availability of raw materials and different beekeeping practices. The same was true in antiquity; Varro, Virgil, Columella, Pliny and Palladius mention the different materials used for beehives: biodegradable materials such as bark, Ferula plant stems, woven wicker, hollowed logs, boards of wood, cow dung, sun-dried mud and other non-biodegradable materials, such as clay, brick or stone[6]. The evidence for ancient beekeeping in Greece is based substantially on the remains of ceramic beehives; hives made of perishable materials have not been preserved.

Two types of ancient ceramic beehives have been identified, the horizontal and the vertical one. The horizontal beehive, a tubular container, was probably widespread in the Mediterranean area in antiquity[7]. The oldest horizontal beehive known today, dating to the 10th - 9th c. BCE, was discovered in Tel Rehov,

5 As was the case in Crete (Rammou and Bikos 2000, 428-430; Nixon 2000) and elsewhere in Greece (Liakos 1999; Graham 1975, 75; Anderson - Stojanovic and Jones 2002, 366, no 34).

6 See Crane 2000, 203, table 24.1A. Hesychius, the lexicographer, reports six different names for beehives, probably indicating different forms and materials.

7 Jones et al. 1973; Jones 1976; Jones 2000; Anderson-Stojanovic and Jones 2002; Bonet et al. 1997

Fig. 1 A traditional horizontal beehive from Greece (photo H. Harissis, Collection of A. Bikos in the Geoponic Institute, Athens)

Fig. 2 Detail of a copy of a wall painting of the tomb of Rekhmire (c. 1450 BCE) in Egypt, depicting horizontal beehives (copyist Nina de Garis Davies in 1926, scale 1:1, 43.5X33 cm, Metropolitan Museum accession number 30.4.88, from Davies 1944).

Israel[8]. Horizontal beehives, dating to the classical period, were found in many places in Greece, as in Attica, Isthmia, Crete, Euboea and on other Aegean islands[9]. Their dimensions varied, with a length of 40-60 cm and a mouth measuring 28-39 cm in diameter.

This type of beehive, ceramic or other, was widespread in traditional apiculture in Morocco, Egypt, Israel, Jordan, Syria, Lebanon, Iraq, Iran and the Arabian Peninsula[10], as well as in Greece, Crete, the Aegean islands and Cyprus[11] (**Fig. 1**). The post-antique (traditional) Greek horizontal ceramic beehive was longer than the ancient one, with a length of 64-100 cm. However, its mouth measured 29-40 cm in diameter, just as the ancient one, tapering to a diameter of 19-23 cm at the back and usually had both ends open. Each end was sealed, either with a wooden lid and mud, or with a ceramic disc or stone plate and mud[12]. One or more small holes allowed the bees to fly in and out from the front end, while the back end permitted harvesting of the beehive. Horizontal beehives were laid on their sides[13] and stabilized by walls, rocks, or trees, and could be stacked, as is illustrated on an Egyptian wall painting in the tomb of Rekhmire (1475-1448 BCE) (**Fig. 2**). Bees attached their honeycombs to the interior roof of the hive, from which the combs hung down into the hive's interior. Sometimes, little wooden bars were positioned across the walls of the beehive to encourage the bees to build their combs parallel to the open end of the hive, which facilitates honeycomb harvesting. This practice is already mentioned in the 12th c. *Book of Agriculture* by Ibn al-Awwam[14]. During harvesting, the back lid was removed and the bees were driven by smoke from the back end to the front of the hive. Hives with only one opening at the front, such as those employed in recent times on some Aegean islands, required a more difficult harvesting procedure. A traditional practice, also known in antiquity, was to elongate horizontal hives by adding a bottomless cylindrical terra-cotta stem ("extension ring"), which was fastened between the lid and the end of the hive, which had projecting rims[15]. With this technique, the beekeeper could easily separate the extension ring from the main hive and harvest part of its crop without disturbing the inner parts; this entailed using less smoke, which was known to harm the taste of honey[16]. Additionally, the

8 Mazar and Panitz-Cohen 2007.

9 Crane and Graham 1985, 150, table 1; Lüdorf 1998–1999, 72-75; Crane 2000, 199-200, table 23.2A.

10 Crane 2000, 167-8; 175, table 21.4A181-2, fig. 21.6a.

11 Jones et al. 1973, plate 85a; 85c; 85d; Crane 2000, 193-5, fig. 22.3a; fig. 22.3b. In Cyprus a testimony of 1801 for this type of beehive comes from travellers (Rizopoulou-Igoumenidou 2000, 393).

12 Crane 2000, 192; 387-8. Similar horizontal beehives with lids closing their ends were used till recently in Egypt (Kueny 1950, 88).

13 Crane 2000, 201–2; Lüdorf 1998–1999, 163–9, figs. 43–9; Rotroff 2006, 129.

14 Ibn al-Awwam 2000, 1022.

15 Crane 2000, 210. Such a practice was widespread in various parts of the Mediterranean as in the Aegean, Malta, Morocco, Turkey, and Lebanon but also in Iran, Iraq, Pakistan and India (Crane 2000, 387-8).

16 Strabo's (9.399) and Lucianus' (*Navigium* 23.4)

Fig. 3 Gold signet rings depicting apicultural scenes. 1st row: ring CMSII3, 114 from Kalyvia, Crete (Herakleion Museum no HMEm 45). A horizontal beehive is depicted on the right and a swarm capture from a tree on the left; 2nd row: ring CMSI, 219 from Vapheio (Athens Archaeological National Museum no 1801). A horizontal beehive is depicted on the right and a big honey bee on the left; 3rd row: ring CMSI, 126 from Mycenae (Athens Archaeological National Museum no 3179). Stone beehives are depicted on the right and on the left and a swarm capture from a tree on the left.

extra space provided in the hive prevented swarming.

Archaeological data indicate that the form of the post-antique horizontal beehives in Greece has remained unaltered since at least the classical period[17]. As with post-antique hives, some ancient examples have one solid end that is either flat[18] or curved[19]. The bees' flight hole is sometimes preserved in the solid bottoms of some ancient hives, but these holes were probably more commonly built into the lids of the hives. A consistent feature of ancient Greek beehives is their interior scoring, which is thought, by modern scholars, to have supplied the bees with a roughened surface onto which they could attached their honeycombs. The opinion that "the interior scoring is the only feature that distinguishes body sherds of beehives from other coarse wares"[20] is like a dogma in modern archaeology. Neolithic ceramic "beehives" have been recognized solely on the basis of interior incision on the sherds of "gouged bowls"[21]. It must be noted, however, that, as I will show below, the sole presence of scoring in the interior of potsherds does not necessary mean the object was a beehive, since scoring was used for other prehistoric vessels too, as, for example, vessels used in the production of dairy products[22] and even in cups[23].

It is probable that the Minoans of Crete had acquired the knowledge of Egyptian apicultural techniques and adopted the use of the horizontal beehive[24], but no certain archaeological findings of horizontal beehives exist from prehistoric Greece. However, there is pictorial evidence to support this. It has been proposed that ideogram *168 from Linear B, found exclusively in clay tablets from Knossos, depicts a prehistoric horizontal ceramic beehive[25]. This, how-

praise for the non-smoked honey is well known.
17 Crane and Graham 1985; Francis 2000 and 2001; Hayes 1983; Di Vita 1993; Crane 2000, 190-2; 198-202.
18 Rotroff 2006, 124–5.
19 Lüdorf 1998–1999, 142, fig. 22, no. B17.
20 Anderson-Stojanovic and Jones 2002, 349, no14.
21 Vitelli 1993, 185, fig. 40.
22 Morris 2014, 209; 218.
23 Poursat and Knappet 2005, 50.
24 In the tomb of Rekhmire, scenes with Cretans (Keftiu) offering gifts are depicted (Davies 1936), indicating that contacts between Minoan Crete and pharaonic Egypt were regular at that time.
25 Davaras 1986.

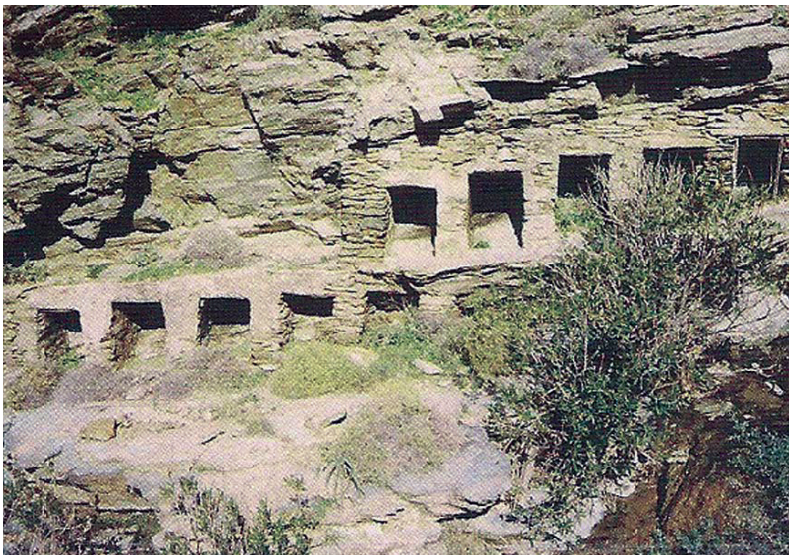

Fig. 4 Traditional stone beehives on the island of Andros, Greece (photo A. Bikos).

ever, is merely a speculation[26].

I have recently argued elsewhere[27] that a horizontal beehive, depicted in a vertical position, is represented on a gold signet ring (CMSII3, 114) found in a tomb (Tombe dei Nobili) in Kalyvia, Crete, dating to the Late Minoan IIIa period (*c.* 1400 BCE), where a capture of bee swarms from a tree is also represented (**Fig. 3**, 1st row). Similarly, a horizontal beehive and a bee swarm capture can been recognized on another gold signet ring (CMSI, 219), from Vapheio in Lakonia, mainland Greece, dating to the Late Helladic IIa period (*c.* 1500 BE), found in a tholos tomb (**Fig. 3**, 2nd row).

Besides these horizontal beehives, one can also notice another type of post-antique beehive on another gold signet ring: the stone hive that was widespread in the Aegean and the Ionian islands, as well as on mainland Greece (**Fig. 4**)[28]. I believe that stone beehives, open at the front, are represented on a famous gold signet ring (CMSI, 126) from a tomb in Mycenae dating to LH II-LH IIIA1 (*c.* 1400 BCE) (**Fig. 3**, 3rd row), where vertically growing honeycombs in the interior of the hives are also depicted[29]. The appearance of beehives in a coherent beekeeping context makes much more sense than the previously supposed "religious" scenes of these rings. This makes their owners not priests, as it was supposed, but "officials" or rich merchants, who controlled honey trading.

The second form of ancient ceramic beehive is a bucket/flowerpot-like container with a much shorter length than the horizontal variety. Its base is always solid and flat, and the rim broad and flaring. This is the upright (also called vertical) beehive. Archaeological findings in Attica, Korinthia, Delos, Agathonisi and Chios confirm that upright beehives have existed since the archaic/classical period[30] (**Fig. 4**). The most famous example is the 3rd c. BCE "Orestada" beehive from Isthmia, with horizontal handles and a flight hole cut into the lower wall[31] (**Fig. 5a**, 3rd row, left). Post-antique upright ceramic beehives show the manner in which these hives functioned: laths or sticks ("top-bars") placed across the open mouth served as the attachment point for the honeycombs,

26 Vandenabeele and Olivier 1979, 281-2. This interpretation would contradict the textile interpretation by Dhoux 1975, who proposes 'loincloth', used as matrix.

27 Harissis and Harissis 2009; see also Crowley 2014.

28 Mavrofridis 2014b.

29 For more apicultural scenes on signet rings and seals from Minoan and Mycenaean periods, see Harissis and Harissis 2009.

30 Crane and Graham 1985. Attica: Jones et al. 1973; Lawall et al. 2001; Ludorf (1998/1999). Isthmia: Anderson-Stojanovic and Jones 2002. Delos: Siebert, 1988, 763, fig. 31. Agathonisi: Trantafyllidis 2010, 40. Chios: Anderson 1954, 137; 142, fig. 5, no 28, 78; Jones et al. 1973, 399, no 27.

31 Kardara 1961; Kardara and Papadopoulou 1984; Crane 2000, 398; Anderson-Stojanović and Jones 2002, 355, no. 7, fig. 8; 371, fig. 17; Evershed and Dudd 2003; Mavrofridis 2013.

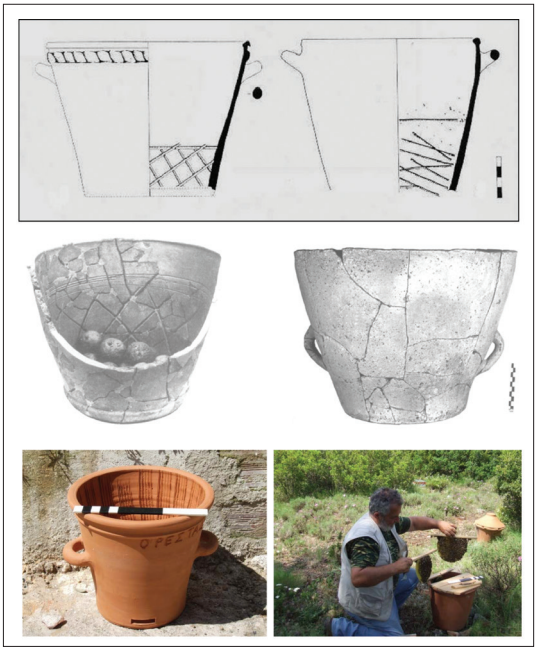

Fig. 5a 1st row: Minoan "upright beehives" from Kommos (left) and Nerokourou (right) (Melas 1999, plate CVIIb,c); 2nd row: Minoan clay beehive from Kato Syme, Crete (left) (Lembesi 1983, pl. 247c) and from Kondokefalo, Karpathos (right) (Melas 1999, CVIIIa,c); 3rd row: a reconstruction of an ancient upright ceramic beehive from Isthmia (left) and its working principle with top-bars (right) (both photos G. Mavrofridis).

which hung directly down into the container without any attachment to its walls. The open mouth was then closed with mud or a ceramic lid or a flat rock to protect the bees from the rain and the heat. What's more, such a set-up rendered the removal of combs much easier and facilitated the apiarist in the continuous replacement of full bars with empty ones, thus increasing the production of honey[32] (**Fig. 5a**, 3rd row, right). A hole near the base of the beehive allowed the entry and exit of the bees. The upright beehive with movable top-bars is correctly regarded by some authors as the forerunner of the modern beehive with "movable frames"[33]. Such vertical beehives ("vraski"), with a height of 36 to 41 cm and a mouth measuring 35 to 41 cm in diameter, were in use up to recent times in Crete[34]. The same type existed in Crete and in Attica since at least the 17th c. ("anastomo kofini"), in Kea ("ypseli"), in Kythera and in Peloponnesus[35]. Since upright beehives with movable top-bars permit the close observation of bee habits, Aristotle's detailed knowledge of apiculture, as presented in his biological works, could be due to the existence of such beehives in his time[36].

No pictorial evidence exists for upright hives in prehistoric Greece. However, it has been argued that the upright type of ceramic beehive was in use since the Middle Minoan II period in Crete, and on the neighbouring islands of Kassos and Karpathos. Such a complete "beehive" (from the Middle Minoan III - Late Minoan I period) with inner surface scoring was found at Kato Syme Viannou in Crete[37] (**Fig. 5a**, 2nd row, left). The fact, however, that loom weights were found in its interior, perplexes its identification with a beehive. Another almost complete example comes from Kommos (height 18.3 cm, rim diam. 42 cm, bottom missing), dating to the MMII-LMI period[38] (**Fig. 5a**, 1st row, left). Scoring was present on the lower half. From Nerokourou, Crete, comes another almost complete beehive, missing only the base (**Fig. 5**, 1st row, right) and three other fragmentary ones[39]. Scoring was present in the interior of the vessels. Eleven fragments of coarse vessels with interior scoring, presumably belonging to upright beehives, have been reported from Sphakia in Crete[40]. A further find from Kokkino Frydi near Zakros may be the base of an upright hive, dating to the LMI period [41] (**Fig. 5b**, 2nd row, left). On the two neighbouring islands of Kasos

32 For a detailed description of the use of upright hives with movable top bars in 17th c. Greece, see Wheler 1682; Harissis and Mavrofridis 2012.

33 Georgantas 1957; Ifantidis 1983; Bikos 1998; Crane 2000, 457-460; Protopsaltis 2000. Beehives with movable top-bars have also existed in N. Vietnam at least since the 19 the c. (Crane 2000a, 400-2, fig. 49.4a).

34 Zymbragoudakis 1979; Crane 2000, 397, table 39.A; Nikolaidis 1955; Harissis et Mavfofridis 2012.

35 Crete: Harissis and Mavrofridis 2012; Attica: Wheler 1682; Cyclades: Rocca 1790, ii, 465-6; Argos: Efthimiou-Hatzilakou 1981-2.

36 Harissis and Harissis 2012.

37 Lembesi 365, pl. 247c; interpreted as a smoking pot by Melas 1999, 487, pl. CVIIIa.

38 Watrous 1992, no 439, fig. 22; Melas 1999, 487, pl. CVIIb. Watrous (1982, 60 and 73 no 17, plate 19e:D) also reports a "beehive" fragment (he originally called it a "cup") with interior incisions and a handle stump preserved at rim from Lasithi plain, dates to Early Minoan II-III period.

39 Kanta and Rocheti 1989, 101-272; Melas 1999, 487, pl. CVIIb-e.

40 Nixon 2001. A photo of the sherds can be found in http://crete.classics.ox.ac.uk/U4S1/U4S1L2.html (visited in 03/01/2015).

41 Chrysoulaki 2000, 585, fig. 3ζ.

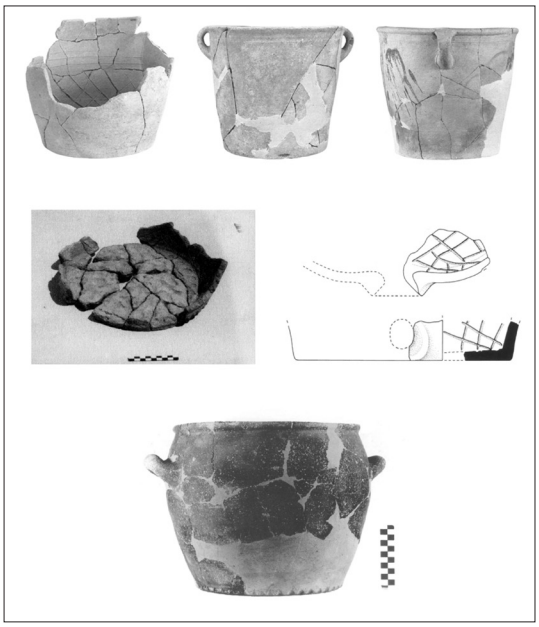

Fig. 5b
1st row: "beehives" from Malia (Poursat and Knappett, 2005, plate 13 no 222, 223, 225);
2nd row: (left) "beehive" from Zakros (Chrysoulaki 2000, 585, fig. 3ζ), (right) "beehive" from Mochlos (Smith 2010, 66 (IIb.579), fig. 26);
3rd row: "beehive" from Chania (Hallager 2003, 241-3, fig 51 no 8).

and Karpathos, thirteen MM - LMI period sites produced numerous fragments of pottery, mainly wall pieces and a few base fragments, with interior scoring believed to belong to beehives[42]. Two belly pieces have a horizontal handle attachment. They have been compared[43] with "basins" or "open hole-mouthed jars", fragments of which have been discovered at many sites, such as that of Palaikastro[44] (MM-LMI), in Lasithi[45] (EM-MMIII) and in Mallia[46] (MMI-II). These (five in total) objects ("cuves") from Malia (**Fig. 5b**, 1st row) with vertical handles with a height of about 34 cm, a diameter between 40 and 46 cm, and a capacity of 29 to 35 litres have interior incisions, and hence have been considered beehives[47], although this hypothesis was rejected by the excavators[48]. An almost complete (restored) example of a similar "beehive" comes from a Minoan site in Kondokefalo, Karpathos (**Fig. 5a**, 2nd row, right). It was found on the floor of a storeroom/ kitchen along with various other pots. It is 31.5 cm high and its mouth measures 45.6 cm in diameter. It has two vertical loop handles halfway up its walls and a small hole through the centre of its bottom. It has deep cross incisions (scoring) that cover the entire inner surface[49]. The scoring bears no resemblance to that found in Greco-Roman beehives: it looks more like a diagonally incised draughtsboard rather than the fine combing typical of later ceramic hives, and so its identification with a vertical beehive has been disputed[50]. The appearance of a spout in the lower wall close to the base, on a fragmentary basin with interior crosshatched incisions, from Mochlos (**Fig. 5b**, 2nd row, right), which dates to LMIIB[51], has led to the suggestion (although not by the excavator) that this basin could be a beehive[52]. I believe that the relatively large diameter of the spout (approximately 5 cm), being twice as large as the known post-Minoan examples, which measure 1-3 cm[53], renders it rather unsuitable for a bee entrance. A "large jar" that dates to LMIIIB with an estimated base diameter of 26 cm, rim diameter of 32 cm, a height of about 30 cm, with incised diagonal grooves on the interior lower body, and with two horizontal handles attached to the upper body found in Kastelli, Chania in Crete (**Fig. 5b**, 3rd row), was characterized as a probable upright beehive[54]. No hole in any of the walls existed, but the larger part of the lower vessel and base were missing. A body fragment of a similar vessel, which dates to LMIIIC, was found at the same site. Another LMIIIC

42 See Melas (1985, 105), who reports potsherds from "beehives" from nine sites on the plain of Afiartis, in the south Karpathos and from two sites from Lefkos, on western Karpathos. From Kasos, he reports beehive fragments from four sites located at Khelatros.
43 Melas 1985, 105.
44 Melas refers to a wide-mouth jar, 33cm in height with two vertical handles and finger impressions on the plinth, repeated inside round the bottom, but with no hole from Palaikastro (Bosanquet 1923, 65, fig. 52).
45 Watrous 1982, 73 no 17, plate 19e:D.
46 Chevalier et al. 1975, 79f, plates XXVIII:6-7, XXIX:1-2, XXX:5-6 ; Poursat and Knappett 2005, 50, fig 6 no 1, plate 13 (222, 223, 225), plate 46 (222, 226).
47 D'Agata and De Angelis 2014, 353, plates CXb, CXIe, CXIIa.
48 Poursar and Knappett 2005, 50: "rien au Quartier Mu, ne soutient une telle interprétation.".
49 Melas 1999, 488, pl. CVIII c, d.
50 Barnard and Brogan, 2003, 56; Christakis 2005, 68; 68; Kanta 2012, 176; Moody 2012, 254.
51 Smith 2010, 66 (IIb.579), fig. 26.
52 D'Agata and De Angelis 2014, 355.
53 Anderson, Stojanovic and Jones 2002, 349.
54 Hallager 2003, 241-3, fig 51 no 8.

basin with internal incisions, found at Knossos[55], has also been ascribed to the list of probable vertical beehives[56].

Again, it must be emphasized that the sole presence of scoring in the interior of potsherds does not necessary link them to a beehive, since scoring, as mentioned above, was used for other types of vessels, too. Scoring on ceramic surfaces is useful for providing adhesion, not only for honeycombs, but also for any material that was intended to line the interior surface of the vessel. It can also be used for abrasion or grinding. According to a hypothesis[57], interior scoring helped the firing of thick-walled vessels. Post-antique beehives from Greece only rarely have interior incisions, and, in any case, interior scoring at the top facilitates comb construction only in the case of horizontal hives, while for upright hives, interior scoring serves no useful purpose for the bees[58]. Hypotheses claiming that internal scoring in upright hives was an unconscious habitual practice that remained from the construction of horizontal hives or that it can be explained as an attempt to imitate wicker baskets[59], are rather weak. The modern archaeological dogma of "interior scoring makes beehive" has produced some conclusions that, from the point of view of beekeeping, are completely absurd, as, for example, considering vessels with a very small, inadequate volume, to be upright beehives[60]. Several other, more reliable, diagnostic features of beehives have been proposed: a capacity of 40-50 liters, although some hives are nearly twice as large and some basket hives (skeps) are only half the size; vestiges of beeswax on the inner wall and entrance hole(s) for the bees, commonly measuring 1-2 cm across[61]. A flight hole cut into the lower wall represents a much better diagnostic feature of hives than interior incisions. However, it is completely unknown, owing to their highly fragmentary condition, if any of the above-mentioned interiorly incised potsherds had one. The small hole through the centre of the bottom of the vessel from Kondokefalo, was considered to be an entry point for bees[62], and it was assumed that the vessel was laid upside down[63] so that the bees could exit and enter from the hole. Indeed, the two vertical handles set on the lower body are only practical when the vessel was in an upside-down position. If, in fact, this was the case, the hypothesis for the existence of top-bar upright hives in Minoan times cannot be supported. But ethnographic parallels of such upside-down placed hives, contrary to the claims of its discoverer, do not exist. It is possible that this vessel was indeed a top-bar upright hive, similar to the traditional Cretan "vraski", positioned some distance from the ground (on stones), and not upside down, so that the bees could exit from the bottom hole[64]. In this case, however, one should explain the low position of the handles. The above-mentioned "jar" from Chania, with handles on the upper body, could also be a prehistoric "vraski". Nevertheless, in the absence of organic residue analysis proving the presence of wax or propolis, neither of the above-mentioned vessels can be identified as beehives with absolute certainty.

Since areas at different altitudes or latitudes provide florescence at different seasons, and those with different rainfall or soil support different bee-plant species, in order to increase the production of honey, ancient beekeepers used to transport their hives according to the local florescence. Migratory beekeeping (also called transhumance or pastoral beekeeping) was practiced either by land (transporting the hives with animals, like mules as recorded for Spain by Pliny *HN* 21.73- 78[65]) or by sea (transporting the hives by boat). Migratory beekeeping with mules or boats was practiced in 3d c. BCE Egypt: beehives were placed on boats that sailed along the Nile in search of regions with florescence[66]. The same practice was recorded in Egypt almost two thousand years later (in 1740)[67]. Celsus (ap. Columella *Rust*. 9.14.19-20) explained the general principles and precautions of transporting hives and recorded the migratory beekeeping that was practiced in Greece (Peloponnesus, Attica, and Euboea) and in Sicily (Hybla). Columella (*Rust*. 9.14.19) also reports migratory beekeeping by boat from the Cyclades to Skyros in the Aegean. In Greece, migratory beekeeping by boat was a wide-

55 Warren 2007, 331 P2648, fig. 6.
56 D'Agata and De Angelis 2014, 355.
57 Melas 1985, 105.
58 Mavrofridis 2014a.
59 D'Agata and De Angelis 2014, 352.
60 Mavrofridis 2014a, 18.
61 Crane and Graham 1985
62 Melas 1999, 488; Melas and Karantzali 1996.
63 Melas 1999, 488.
64 Mavrofridis 2006.
65 By the late 1800s trains were used, and after the 1900s road vehicles of various types and sizes performed this task (Crane 2000, 347).
66 Newberry 1938. For the transportation of beehives by land, see *P. Cair Zen*. III 59467 (*SB* 6989).
67 Maillet 1735. *Description de l'Egypte*. Paris, vol ii. p. 24; Pococke 1743. *Description of the East* I, 210; Savary 1787. *Letters on Egypt* 2nd ed. vol. ii, 207 (all reported by Newberry 1938 who certifies that he observed the same practice on the Nile in 1890).

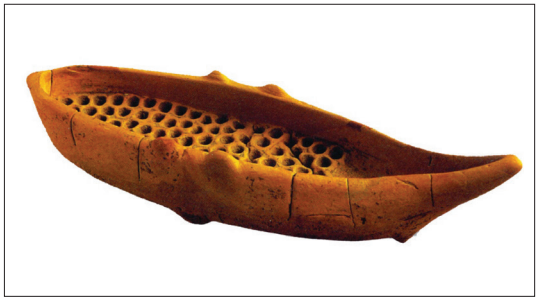

Fig. 6 A Minoan ceramic model of "a boat transporting honey combs" (photo G. Giannelos from Marangou L. (ed.) 1992. Minoan and Greek Civilization from the Mitsotakis Collection. Cycladic Art Museum, Athens, 106).

Fig. 7 Greek skeps (photo H. Harissis, Collection of A. Bikos in the Geoponic Institute, Athens).

spread apiarian practice until recently[68]. In 1790, Della Rocca recorded the transportation of beehives along the coasts of Asia Minor[69]. Beehives from Arnaia in Chalkidike, Northern Greece, were transferred to Mount Athos in springtime[70]. Also, in Chalkidike, until 1960, small boats loaded with beehives circumnavigated the gulfs[71]. In Ios, Cyclades, they transported the beehives with fishing boats[72]. Similar accounts exist also for France, Belgium, China and Japan, America and Romania[73]. In China, the boats transporting the beehives had marks on their hull in order to indicate the increase of draught due to the increase of weight from honey accumulated in the beehives during the voyage. Precisely the same strategy is described by Pliny (*HN* 21.43) in Hostilia in Italy, where Roman apiarists loaded their beehives in boats and travelled along the river Po to exploit the rich florescence. That the Minoans transported beehives by boat can be deduced by the discovery of a pottery boat model (of the Middle Minoan I period) carrying honeycombs in its cargo hull[74] (**Fig. 6**). Because it was found in a human grave, it was interpreted as a symbol of an "after death voyage", but its purpose could be simply to denote the activities of the grave's occupant during his lifetime.

Hives most suitable for migratory beekeeping were light, but sturdy, such as those made of wooden boards or the woven wicker beehives[75]. A bell-like wicker beehive (skep) was widespread up until recently in Greece, especially in the Chalkidike peninsula[76] ("epistomo kofini"), in Europe and other parts of the world[77] (**Fig. 7**). However, its existence in ancient Greece has been questioned and it has been suggested that the skep came to the Mediterranean in the 12th c. from Northern Europe[78]. Nevertheless, I believe that a skep appears in a 6th c. mosaic in Jordan (Madaba)79, depicting the fourteenth Idyll of Theocritus with bees stinging Eros as he steals honey from a woven beehive[79]. The Grammarian Philoxenus of the 1st c. BCE (fr. 531) and Virgil (*G*. 4.33) call the beehive a woven vessel[80]. The description of Petronius (*Sat*. 39.14) of a round as an egg beehive (*quasi ovum corrondutata*) confirms, in my opinion, the existence of skeps in Roman times[81].

Ideograms *134 and *190 of Linear B, are dome-shaped with three horizontal dashes crossing or flanking each side of the dome. It has been proposed that they could represent woven beehives[82]. I believe that symbol 7 from the disk of Phaistos (which Evans

68 Crane 2000, 347-352. For Greece, see Typaldos-Xydias 1927.
69 Della Rocca 1790.
70 Gaitanou-Giannou A. (unpublished notes 1930) in Kyrou 2000, 377. See also Eckert 1943 (reported by Petropoulos 1957, 356).
71 Papagelos 2000, 199.
72 Rammou and Bikos 2000, 423.
73 Crane 2000, 349.
74 Davaras 1984, table 6a-b, fig. 1.
75 Crane 2000, 219; Georgandas 1957; Rammou and Bikos 2000, 430.
76 Leontidis 1986, 40.
77 Crane 2000, 219-21; 232-6; 241-57; 265.
78 Crane 2000, 183; 219.
79 Piccirillo 1993.
80 Κυψέλη· πλεκτόν Αγγείον. The beehives mentioned in the Attic *Stelai* (*IGI3*, 426,56) were considered, by Pritchett (1956, 260), to have been made of wicker.
81 It could correspond, however, as has been suggested to me by G. Mavrofridis, to a vertical woven beehive.
82 Melas 1999, 489; cf Melena 2014, 140.

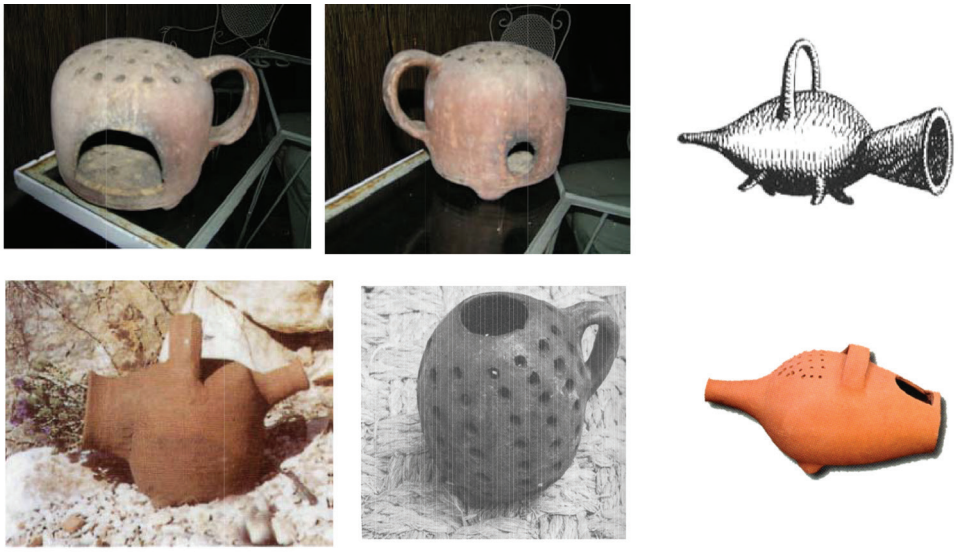

Fig. 8 Different types of post-antique beekeeping smoking pots from Greece.
1st row: (left and middle) traditional smoking pot without a nozzle (photo http://epoptisf.blogspot.gr/2009/10/blog-post_09.html), (right) Syros island Greece (Della Rocca 1790, v. ii, pl.11);
2nd row: (right) Lesbos (Koutri 1999, 320), (middle) Tunisia (Crane 2000, 342, fig. 34.2b), (left) Paros island (Bikos 2008, 312, fig.15).

identifies with a "woman's breast")[83] can also be recognised as a woven beehive. The same interpretation has been proposed for ideogram *179 of Linear B[84].

In conclusion, although no certain archaeological examples of prehistoric beehives exist - as is also the case for Egypt, for which, however, we know for certain from pictorial evidence that beekeeping in hives did exist - several principally pictorial indications point to the conclusion that apiculture with beehives of various types (horizontal, stone hives and possibly upright hives and skeps) was probably practiced in the Late Minoan/Helladic period in Greece. So far, the earliest beeswax residue dates to the Late Minoan IA period and comes from lamps and conical cups found in Mochlos in Crete[85]. The fact that in prehistoric Crete beeswax was used for lighting, which necessitated great quantities of beeswax, implies organized beekeeping and not occasional wild honeycomb hunting[86].

83 Evans 1921-1935, v. i, 651, no 1. Davaras (1986, 40 no.13) mentions the opinion of L. Pomerance that the Phaistos Disc sign 24, the so-called "Lydian tomb", could represent a woven beehive.
84 Proposed as a likely depiction of an omphalos-like woven beehive by P. Faure in a letter of 1971 (Vandenabeele and Olivier 1979, 287).
85 Evershed et al. 1995.
86 Morse 2000; Mavrofridis 2006.

Smoking pots

Just as modern apiarists do, ancient apiarists smoked the bees in order to pacify them (Pl. *Phdr* 91 C; Arist. *Hist. an*. 623b; Plin. *HN* 11.15.45; Verg. *G*. 4.228; *Geoponica* 15.5, 15.6)[87]. This practice is already depicted on a relief from an Egyptian temple (where horizontal beehives are present as well), which dates to *c*. 2400 BCE[88], and on wall paintings of the Egyptian grave of Rekhmire, of 1450 BCE[89] (**Fig. 2**). The most primitive technique of smoking the bees was with torches, a practice used until recently in certain regions of Greece[90]. However, smoking pots of a particular shape are needed in order to avoid burning the bees or the beehives (made of flammable materials such as wood or wicker) and to be able to direct the smoke more accurately onto the bees[91].

The simplest smoker consisted of an open vessel holding the fuel, such as a general use container, and

87 Kukules 1951, 354.
88 From the sun-temple of Neuserre, Abu Ghorab (Crane 2000, 163-4, fig. 20.3a).
89 Davies 1944; Crane 2000, 164, fig 20.3b).
90 Loukopouos 1983, 398. For the same practice in other countries, see Crane 2000, 54; 59; 341.
91 Crane 2000, 341.

Fig. 9a Prehistoric smoking pots from Greece. 1st row: (left) smoking pot from neolithic Sesklo, Thessaly (photo H. Harissis), (middle) Early Bronze Age smoking pot from Macedonia, Greece (photo Y. Patrikianos from Grammenos, 2004), (right) Early Helladic smoking pot from Archontiko, Macedonia (Papanthimou 1997, fig.11); 2nd row: (right) smoking pot from Zakros, Crete (photo G. Papadakis, Herakleoin museum), (middle) Smoking pot from Zakros (Davaras 1987, Sitea Museum 4522), (left) smoking pot(?) from Knossos (Ashmolean Museum - a similar one exists in Herakleion Museum No. 7742); 3rd row: (middle) Early Bronze Age III smoking pot from Olympia (photo G. Fafalis from Hatzi, 2008), (left) Early Helladic/Middle Helladic period smoking pot (?) from Palamari, Skyros (Skyros Museum. The findings of Palamari. Hellenic Ministry of Culture. 11th Ephorate of Classical Antiquities. 2005, photo 4), (extreme left) tripod brazier from Karpathos (Melas 1985, plate 103).

the smoke was directed onto the bees by blowing the smoke towards them, a process which placed the bees at risk as smoked dizzy bees or queens could fall into it[92]. I shall call such an open smoker, a type I smoking pot. An example of a type I smoking pot can probably be seen in the above-mentioned depiction of *c*. 2400 BCE from Egypt, with an inscription above it that reads: "to create a current of air"[93]. Another example is depicted on a wall painting of Rekhmire's tomb (**Fig. 2**). A vessel from the prehistoric (Early Helladic/Middle Helladic period) settlement of Palamari in Skyros[94] could be identified as a type I smoking pot (**Fig. 9a**, 3rd row, left). But any open vessel with traces of burning that is usually labelled as "brazier" or "incense burner" could have served as a bee smoker of type I. Like the "tripod brazier", dating to the Late Minoan III period, that was found in a tomb at Vonies, in Karpathos[95] (**Fig. 9a**, 3rd row, extreme left). A LMIIIB brazier "made to hold coals" from Chania[96] could also be a type I smoker. A more sophisticated, "semi-closed" smoking pot (type II), invented probably in order to reduce the above-mentioned risk, is an earthenware container closed from all sides except for a big aperture on the top, which served to put the burning material inside, and several small holes in order that the air required to keep the smoker alight could enter (**Fig 8**, 2nd row, middle).

However, the safest for the bees and, at the same time, the most effective for controlling the direction of smoke, is the smoking pot which I shall call type III. It is characterized by two large side apertures (or nozzles) and several small holes in the walls, while it is closed at the top. The basic functional and constructional principle of this type III smoking pot is given by Columella (*Rust*. 9.15.5): "This vessel [an earthenware smoking pot] has handles and is shaped like a narrow pot in such a way that one end of it is sharper through which the smoke may issue through a small aperture, while the other end is broader and has a rather wider mouth, so that the coals can be blown upon through it. When a pot of this kind is applied to a hive, the smoke is conveyed to the bees by the movement set up by the breath." In this type of smoker, several small holes need to be made in the side walls of the container in order to keep supplying the air necessary for continuous

92 Della Rocca 1790, v. ii, 260 no 1; 496.
93 Crane 2000, 164, fig. 20.3a.
94 *Skyros Museum. The findings of Palamari. Hellenic Ministry of Culture. 11th Ephorate of Classical Antiquities*. 2005, photo 4.
95 Melas 1985, 39, 74 no 1040, plate 103.
96 Hallager 2003, 245, 241 fig. 51, no 19.

burning[97]. Many smoking pots incorporated a handle to be used when the pot became too hot to hold. The type II and III smoker characterizes most post-antique smoking pots, as can be seen in pictures of post-antique smoking pots from Greece and elsewhere (**Fig. 8**). An example of a type III smoking pot is the one from the Aegean island of Syros (**Fig. 8**, 1st row, right), which Della Rocca used in the way described by Columella, but when he wanted to smoke the bees heavily, he could alternatively blow through the small opening and direct smoke onto them from the large opening[98]. A variant of a type III smoker is the post-antique one shown in fig. 8 (1st row, left and middle), which has two openings (a large one, which served to place the burning material inside, and a smaller one for the exit of smoke), but has no nozzle.

It appears that type III smoking pots already existed in prehistoric times, since such smoking pots were found in Neolithic and Bronze Age stratums in Northern and Southern Greece (**Fig. 9a** and **9b**). Fragments of tubular vessels, which, as has been suggested, might have been smoking pots, have been found in Franchthi Cave in Argolis[99]. The smoking pot, from the "altar" east of Pelopion tumulus in Olympia, dating to the Early Bronze Age III period (**Fig. 9a**, 3rd row, middle), is, in principle, similar to that of the type III used in traditional beekeeping on the Aegean islands and in Crete (**Fig. 8**, 2nd row, left)[100]. In 1908, Tsountas published his finding of a perforated ceramic vessel from the Final Neolithic settlement of Sesklo in Thessaly, which he identified as a smoking pot for bees[101] (**Fig. 9a**, 1st row, left). Albeit without a nozzle, it indeed fulfils the basic properties of the type III smoker described above. A similar smoking pot (wrongly characterized as a "portable brazier used to carry lighted coals"), dating to the Early Bronze Age, was found in Axiohori, Macedonia, Northern Greece (**Fig. 9a**, 1st row, middle). The two above-mentioned smoking pots resemble, in principle, another Early Bronze Age type III smoking pot from Macedonia (**Fig. 9a**, 1st row, right)[102]. These smoking pots, as far as I know, constitute the world's oldest apicultural vessels. A Middle Minoan II (*c*. 1900 BCE) beekeeping smoker

Fig. 9b 1st row: smoker from Enkomi (Karageorghis 1972); 2nd row: (left) "smokers" from Ayia Irini, Keos (Georgiou 1986, plate 20, no 169, 170), (right) smoker from Phaistos (Levi 1976, plate 149e); 3rd row: smokers from Phaistos(Levi 1976, plate 149b, i, d).

was found in the gorge near the Zakros "palace"[103] (**Fig. 9a**, 2nd row, middle). It is an open cylindrical vessel tapering at one end, rounded, in which there are rows of holes above and a large circular opening below. It has one handle on top, four feet below and a collared socket at its other end. The fabric is coarse and there are signs of burning inside. Similar vessels with burn marks were found in "oikia H, room Y" (Middle Minoan II-III)[104] and in the "House I, room 14"[105] (Late Minoan I, *c*. 1500 BCE) (**Fig. 9a**, 2nd row, right and 3rd row, right) of the nearby Zakros town. The last item, of coarse fabric, is a cylindrical vessel tapering to rounded end, in which have been cut a large circular opening on one side and a number of rectangular slots all over the end. Below this, two stout handles

97 Della Rocca 1790, v. ii, 496.
98 Della Rocca 1790, v. iii, 384.
99 Vitelli 193, 179; 187 no 6.
100 Rambach 2002, 194, fig. 29, no 114 with references.
101 Tsountas 1908, 274, fig. 198.
102 Papaefthmiou-Papanthimou 1994, 8:90, photo 11; Papaefthmiou-Papanthimou 1997; Papaefthmiou-Papanthimou 1998, 122:855, fig. 163.
103 Platon 1962, 166; Davaras 1989; Evely 2000, 364, Fig. 144, no 6; 365 with comments.
104 Dawkins 1903, 258, fig. 35; Evely 2000, 365.
105 Hogarth 1900-1, 141, fig. 51; Evely 2000, 365.

are attached to one side, and four small feet (in two pairs) to the opposite one. Midway between the handles and feet and nearer the large open end are two more pairs of cut-out slots. The smoking pot from Zakros' gorge has the nozzle on the side. The smoker from the town has no nozzle but its pointed front end, which has many holes, could serve as a nozzle, a fact that was verified by an archaeological experiment[106]. The smoking pots from Zakros have been compared to the items from the "House of Sacrificed Oxen from Knossos termed "Ariadne's Clew (ball of thread) Box" by Evans"[107] (MMIII-LMI) (**Fig. 9a**, 2nd row, left) with marks of discoloration from smoke[108]. The comparison, however, is disputable[109]. Several tubular objects, four from Phaistos (MMIIA period) and two from Ayia Irini, Keos (periods vi-vii corresponding to LMI period) were proposed as possible smokers. The vessels from Ayia Irini are both tall cylinders (35 cm and 28 cm) with a hollow base, slit sides and a vertical loop handle attached to one side (**Fig. 9b**, 2nd row, left and middle). However, neither had traces of burning nor stub feet a fact that makes dubious their usage as smokers[110]. The pieces ("vasi a corna e unguentari") from Phaistos[111] (**Fig. 9b,** 2nd row, right and 3rd row), with marks of burning[112], stood vertically on large plates with a fitting for the opening on the wider end[113]. The so called corns at the side could actually be feet and this renders the hypothesis of a smoker probable. Another oblong clay tube, semi-circular in section, with a flat base, ascribed to the Late Bronze Age, was found in a tomb in Enkomi, Cyprus[114] (**Fig. 9b**, 1st row). One end is closed and rounded while the opposite one is open. There are three perforations along its long sides, three along its upper part and three along its closed end. A small portion of the upper part is missing. The dimensions are: length 37 cm, width 11 cm, height 14 cm. This object could have indeed functioned as a bee smoker[115].

106 Stamataki et al. 2009.
107 Evans 1928; 304, 308-309, fig. 176f , 179a, b; Davaras 1989, 4-5, fig. 3, pl. 1ε. An identical object exists in Ashmolean Museum.
108 Georgiou 1986, 42.
109 Evely 2000, 498, 499 fig 201 no 3 who supports the use for threads; Chapouthier 1941, 7.
110 Georgiou 1986, 42, plate 11, 20.
111 Levi 1956, 53, 101, 306, 396, plate 149e.
112 Georgiou 1986, 42.
113 Herakleion Museum 10190, 10723, 18451; Georgiou 1986, 42.
114 Karageorghis 1972; Davaras 1989.
115 Davaras 1989.

Fig. 10 Vessels from the private house of Knossos (Evans 1935, 95, fig. 109).

Although not very probable, it cannot be excluded that all known examples of prehistoric beekeeping smokers from Greece were used exclusively for harvesting wild honey. It has been suggested that the smokers from Zakros were suitable only for horizontal beehives[116], thus indicating systematic apiculture, whose existence in the Late Minoan period was already hinted at above while reviewing the evidence of beehives. However, the Zakros smoker raises the chronology of the existence of systematic apiculture to an earlier period, the Middle Minoan period. To this period dates a unique beekeeping toolkit that was found in Knossos, which I will examine below.

Beekeeping paraphernalia from the "Snake Room" in Knossos

In 1930, Arthur Evans discovered a private house, located near the walled-pits ("kouloura") of the west court, southwest of the "North-West Treasury House"[117] of the Minoan "Palace" of Knossos. This little room opened onto a passage-way. By the entrance of the little room stood a large jar (pithos), 71 cm in height and about 30 cm wide, which was a repository for what appears to have been a complete set of clay

116 Suggested by A. Bikos (in Stamataki et al. 2009).
117 Evans (1935, 94) by mistake writes "South-West Treasury house".

vessels and other utensils dated to the Middle Minoan IIIb - Late Minoan II period (**Fig. 10**). Both the jar itself and its contents were broken. This is how Evans describes the findings[118]: "North of the line of the Koulouras the outer enceinte wall enclosed a closely set conglomeration of houses, in their later shape dates to the very beginning of the late Minoan Age, and practically corresponding in their duration with that of the later Palace. The Late Minoan structures here to a certain extent intruded on the line of the o. i enceinte wall, parts of two houses having been obviously domestic continued west of it. [...] the most remarkable discovery in this region was a room of a private house, belonging to the same LMII period, containing a complete set of utensils - some of them coiled round with serpents moulded in clay - designed for a domestic snake cult of a type more primitive than that in which it was taken over by the Minoan Goddess as Lady of the Underworld". Evans called the particular room the "snake room" and devoted a special section to this "unparalleled discovery which throws new light on the most primitive stratum of Minoan cult"[119]. However, recently, I was able to suggest a completely different hypothesis concerning their nature and usage[120].

Among the vessels found in the room, some are perforated (No 1, 2, 3, 10 in **Fig. 10**). One of them (No 2 in **Fig. 10** and **Fig. 11** left) has a big opening at the top, a large tubular opening on either end and many small holes on the sides. Due to its snake-like handles, it is generally identified as paraphernalia for a snake cult[121]. But it could have been, instead, a smoking pot since it has many features in common with type III smoking pots, mainly the two tubular openings, which enable the beekeeper to blow on the fuel in the pot through one of them so that the smoke could emerge from the other. It has a unique feature of two nozzles. The handles, which are necessary for all smoking pots, were snake-like for decorative purposes. Another perforated vessel, with a height of 11.2 cm (No 3 in **Fig. 10** and **Fig. 11** right), has only one opening at the top and many small holes on the sides. It is probably a smoking pot too, but of a type II (**Fig. 8**, 2nd row, middle)[122]. We should not be surprised by the use of different types of smoking pots within the same region, since such practices are not uncommon: it is reported that in 1985, six or seven different styles of

Fig. 11 The vessel No 2 (left) (Evans 1935, 155, fig. 119) and No 3 (right) from the private house of Knossos here identified as smoking pots (photo Y. Patrikianos from Dimopoulou - Rethemiotaki 2005, 101).

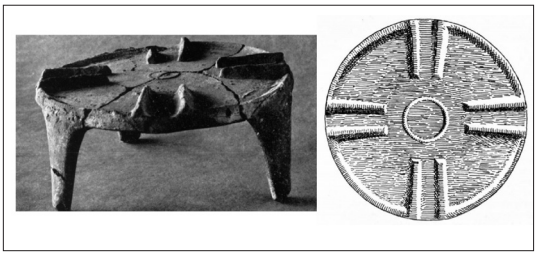

Fig. 12 (left) Object No 8 from the private house of Knossos, here identified as a honeycomb press (Zervos 1956, no 603), (right) The same vessel in ground plan (Evans 1935, 149, fig. 115a).

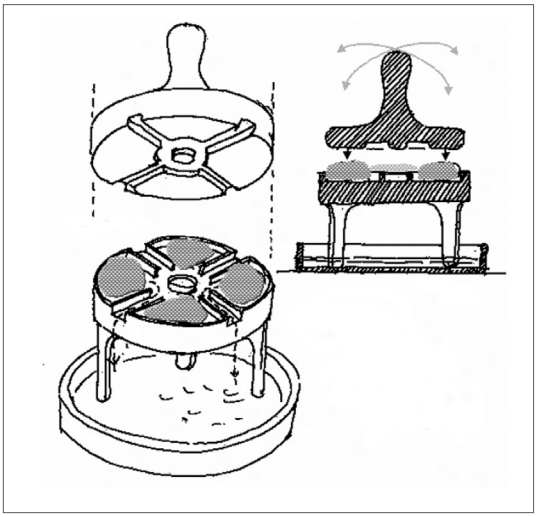

Fig. 13 The suggested function of vessel No 8 from the private house of Knossos for honey separation (drawing V.A. Harissis).

118 Evans, 1935, 76.
119 Evans 1935, 155-156, fig. 118; 119.
120 Harissis and Harissis 2009.
121 Nilsson 1950, 90.
122 For a photo, see Crane 2000, 342, fig 34.2b.

smoking pots were in use simultaneously in Crete[123].

Another utensil found in the jar is a circular object (height 10 cm, diameter 25 cm), divided into four parts by four channels and standing on three legs (No 8 in **Fig. 10** and **Fig. 12**). I consider Evans' hypothesis of a vessel for food offering to snakes ("snake table")[124], to be improbable, and certainly unprovable. It could, however, be a honeycomb press (**Fig. 13**). Combs could have been placed in the four compartments between the channels and then manually pressed with a wooden board (not preserved). Pressure would result in honey escaping through the four channels and flowing into vessels (or a big dish) placed below the edge of each channel (such vessels could be the jugs No 18, 19, 20 and 22 in fig. 10 that Evans calls milk-jugs for snake offerings). A press with channels for the flow of honey was used by traditional beekeepers in Cyprus[125] and in Greece[126] (**Fig. 14** and **15**).

The three "cylinders" or "tubes" (height 28 cm and exterior diameter of base 9.6 cm) (No 4, 5, 6 of **Fig. 10** and **Fig. 16**) found in the "snake room", have two pairs of cups, symmetrically attached to their sides. Evans suggested that these cups were "made to contain some kind of drink offering to snakes" and labelled them "cylindrical snake vessels"[127]. I believe, however, that the cups were used as receptors for the excess liquid content of the tube. More specifically, I propose that these vessels served as wax extractors from the combs once honey was extracted[128]. The

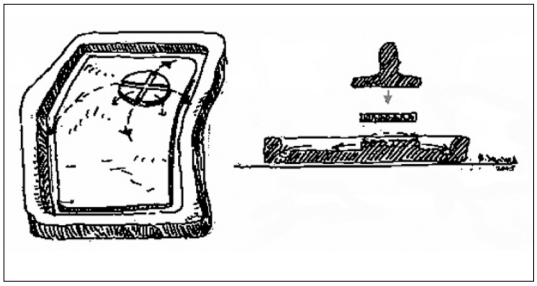

Fig. 14 A traditional basin for pressing honey combs from Cyprus and its working principle (drawing V.A. Harissis based on a photo by Rizopoulou-Igoumenidou 2000, 404).

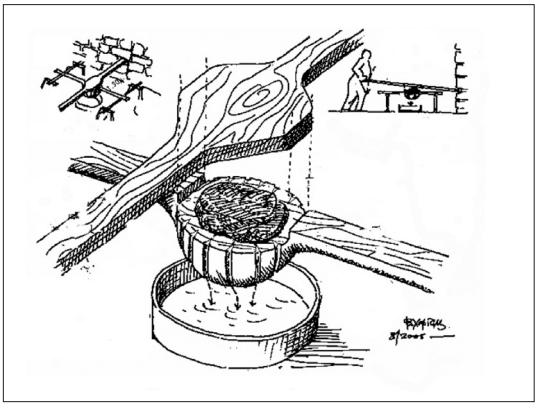

Fig. 15 A traditional honey extractor, as described by Loukopoulos 1983, 400-1 (drawing V. A. Harissis).

extraction of wax from the remaining elements of the comb (pollen, brood) is achieved, as Pliny (*HN* 21.83-84) and Columella (*Rust*. 9.16.1) recommend, with the use of boiled water. The wax, being lighter than the other comb components, floats in boiled water and is collected from the surface. The same principle was used by traditional beekeepers in Greece[129].Thus, I suppose that combs were placed in these Minoan containers and the vessel was then filled with boiled water. The heating of the water was probably done by placing little water jugs (such as No 9 and 23 in fig. 10) over a fire alight in vessel No 7 in fig. 10, which

123 Crane 2000, 342.

124 Evans 1935, 76, 149, fig 115b; Nilsson 1950, 90.

125 Nikolaidis (2000, 135) reports that the traditional comb presses were similar to those for grapes.

126 Loukopoulos 1983, 400-1, fig. 53. The simplest vessel for wax extraction from the comb was a ceramic strainer into which the comb was placed, and with manual pressing the honey was separated from the wax (see for an example see Crane 2000, 483, fig. 46.1b). For such a Neolithic perforated vessel from the Northern Aegean, see Decavallas 2007.

127 Evans 1935, 142, fig 111; Nilsson 1950, 90.

128 In a perforated dish from Knossos, Faure (1999, 171-2) recognizes a honey extractor. He compares it with similar objects from Troy and Neolithic Switzerland. By putting the comb in the vessel and by applying pressure, the honey spilled from the holes while the wax remained in the vessel. Melas (1999, Plate CVIIIe) presents a completely different conical vessel, which he considers to be a honey extractor. The vessel from the Knossos "Snake Room" (fig. 11. right) which here I recognized as a smoking pot, could alternatively be a vessel to separate honey from wax, like the one used by traditional apiarists in Poland (for a photo, see Crane 2000, 483, fig. 46.1b). However, the small diameter of the opening (insufficient for placing the combs) argues against this hypothesis. Traditional beekeepers used to place the combs inside a simple linen sac. By applying pressure on the sac the honey seeped out of the sac and was separated from the other comb components that remained in the sac.

129 Liakos 1996, 371-2.

Fig. 16 Cylindrical vessels from the "snake room" of Knossos, identified here as wax extractors (photo Y. Patrikianos from Dimopoulou-Rethemiotaki 2005, 100).

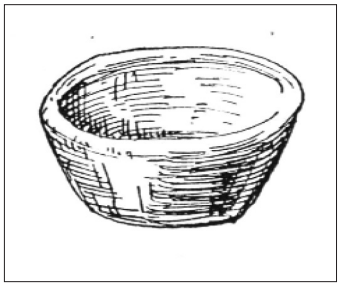

Fig. 17 A traditional vessel for beeswax (Vrontis 1939, 236).

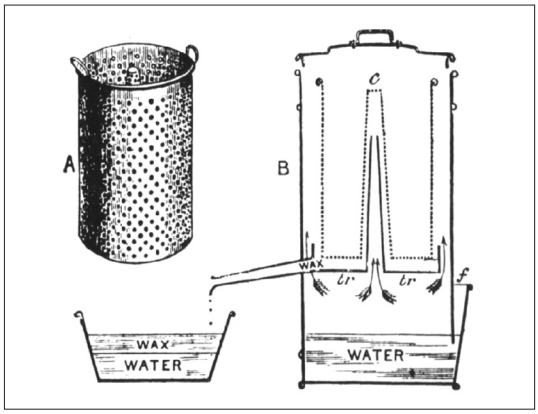

Fig. 18 The "Gerster Wax Extractor" (Cheshire 1888). (A) Depicts the strainer pot where thecombs are put and corresponds to the main body of the cylindrical Minoan vessel. The pot isplaced on a tray (tr) which was filled (through f) with boiled water passing through the opening of the main cone (c) into the comb strainer. Through the holes of the strainer the wax and the water flow into a dish, just like the cups of the Minoan cylindrical vessel.

had traces of ash. Filling the tube with boiled water forced the molten wax to rise to the surface, and by deliberately overflowing the container, the wax was gathered in the cups[130]. The wax, after cooling, was removed from the cups, having taken their hemispherical form. The form and the diameter of the cups resemble both traditional and Byzantine vessels, used for the same purpose[131] (**Fig. 17**). Based on the same principle (molten wax rising to the surface of boiled water), two metal wax extractors, the "Gerster Extractor" (**Fig. 18**) and the "Mountain Gray Extractor", were in use in the 19th and 20th c. respectively[132].

Some other vessels (No 11, 12, 15, 16 in **Fig. 10** and **Fig. 19**) from the same room resemble the dish containing honey combs depicted in the mural from the tomb of Thanuro in Luxor (1448-1420 BCE) (**Fig. 20**) as well as in another mural from the 18th Dynasty tomb of Kenamun[133]. This dish, in turn, resembles the traditional comb-dish from Kashmir (**Fig. 21**)[134] and the two dishes, one on top of the other, which can be seen on the wall painting from the tomb of Rekhmire, sealed with mud and containing combs (**Fig. 22**). A similar dish with traces of a honeycomb found in a tomb in Deir-el-Medina, West Bank in Upper Egypt, dates to *c*. 1350 BCE[135].

Object No 1 in fig. 10 (**Fig. 23**), with a height of 14.5 cm, has been identified by Evans[136] as "three sections of a naturally formed wild honeycomb with a snake coiling round the vessel with a grub in its mouth". I have proposed an alternative interpretation: that of a rather sophisticated hornet trap - hornets being the worst enemy of bees in Southern Greece and the Aegean islands[137]. Several kinds of hornet traps were used by traditional beekeepers in Greece, but all of them had the same working principle: bait attracted the hornets to enter a box or a bottle from which they could not escape[138]. Della Rocca says

130 A similar practice was traditionally used by apiarists in Cyprus (Filotheou 1980; Rizopoulou-Igoumenidou 2000, 404).

131 Vrontis 1939, 206. These wax cups are called "*kyparia*" in Chalkidike and in Paros (Papagelos 2000, 198).

132 Crane 2000, 497, fig. 46.7d.

133 Metropolitan Museum accession number 30.4.71, *Egyptian wall paintings*. The Metropolitan Museum of art's collection of facsimiles, 1983, 107.

134 Crane 2000, 165.

135 Crane 2000, 166, fig. 20.3d.

136 Evans 1921-1935, v. iv, 154-5, fig. 118a,b.

137 Reras 2001, 24.

138 Speis 2003, 121-122.

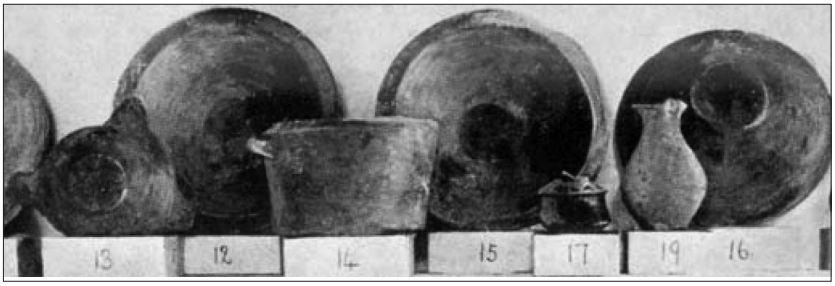

Fig. 19 Honeycomb dishes from the upper shelf of the "snake room" in Knossos (Evans 1935, 95, fig. 109).

that beekeepers used "bottles with baits"[139] against the hornets. Aristotle (*Hist. An*. 627b) reports a way of attracting hornets with a piece of meat placed in a dish and then killing them by throwing the meat into the fire[140]. I believe that the Knossos vessel was deliberately made to resemble honeycombs in order to "deceive" the hornets to enter the vessel. The vessel was probably placed near the beehives, and when several hornets were trapped inside, the beekeeper would pick it up from its snake-like handle and throw it into the water, thus drowning the hornets.

Vessel No 14 in fig. 10 could be an upright beehive, since it resembles one and was found among other beekeeping paraphernalia[141]. Similarly, vessel No 10 in fig. 10 could be another type of smoking pot. The jar itself was probably used for storing honey, a practice that we hear about in the myth about Glaukos, the son Minos, the King of Crete, who was drawn into a jar full of honey (Apollodorus *Bibl*. 3.17). Honey stored in big jars is represented in the previously mentioned Egyptian relief dated to *c*. 2400 BCE[142] and on wall paintings of the tomb of Rekhmire[143].

The existence of smoking pots, a honey extractor, wax extractors, comb-dishes, a honey jar and a probable beehive in this room suggests that it is an apiarist's storage room, and not a room associated with a "snake cult". Given the plethora of apicultural paraphernalia gathered together, one is entitled to conclude that these utensils were used for the production of significant quantities of honey and beeswax, which could only have been derived from a large number of domesticated bees, and not just

Fig. 20 A comb dish depicted on a wall painting (detail) of Thanuro tomb in Luxor (1448-1420 BCE) (copyist C. K. Wilkinson 1926, scale 1:1, 45X76 cm, Metropolitan Museum accession number 30.4.91, photo N. Davies 1936, plate XXXIV).

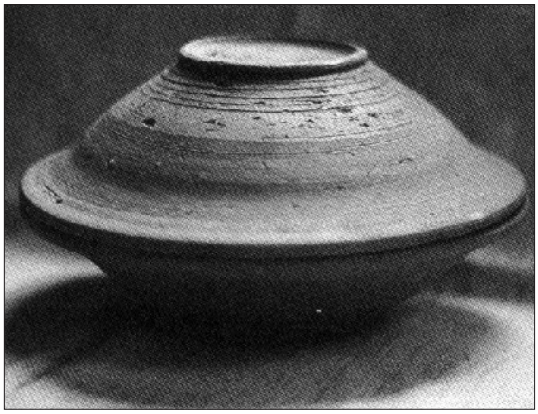

Fig. 21 Traditional comb dishes from Kashmir, India (photo E. Crane from Crane 2000, 282, fig. 29.5d).

139 Liakos 2000, 333.
140 Reras 2001, 24.
141 I consider its use as a honey container improbable. For pictures of stone vessels supposed to be Minoan honey containers, see Melas 1999, 488, pl. CVIIIf,g.
142 From the sun-temple of Neuserre, Abu Ghorab (Crane 2000, 164, fig. 20.3a).
143 Crane 2000, 164 fig. 20.3a; 165 fig. 20.3b.

Fig. 22 Comb dishes depicted on a wall painting of the tomb of Rekhmire (Davies1944).

from occasionally collecting wild honey from limited and isolated wild bees' nests. The fact that the vessels were put in an empty honey jar means that this beekeeper's toolkit was destined for transportation in the jar where the honey extraction took place, not at the beekeeper's house, but somewhere in the countryside where the beehives were usually kept, as they are nowadays. Traces of wax and/or honey residue on these vessels from the private house in Knossos would, of course, help to confirm their use in beekeeping. I believe, however, that there is enough available evidence to reach the conclusion, already anticipated by the pictorial evidence from golden signet rings, that in prehistoric Greece, from the Middle Minoan/Helladic period and onwards, systematic apiculture was practiced.

Fig. 23 Perforated vessel No.1 from the "snake room", identified here as a hornet trap (photo Y. Patrikianos from Dimopoulou - Rethemiotaki 2005, 101).

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