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THE SHAPE, CONSTRUCTION AND IDENTIFICATION OF TRADITIONAL HIVES

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Introduction

Survival of knowledge about traditional methods of beekeeping is inevitably endangered by the current spread of more effective methods. One result is a quickened interest in the methods and equipment that have been in use, almost unchanged, for centuries or even millenia. Recent discoveries of actual examples of ancient hives (and pseudo-hives) have given this interest a popular appeal. With the relative ease of travel nowadays to what used to be remote and inaccessible places, there is a need for some sort of classification scheme and identification guide for primitive and traditional hives, and suggestions towards these ends are made here. It is hoped that they will be useful as a framework for reference and for discussions, and as an aid in identifying objects as hives (or as not hives) in further searches for evidence of early beekeeping. It seems more useful initially to publish a short introductory account than to provide documentation on all the hive types referred to.

The classification suggested is based on a consideration of types of primitive hives that still survive, or of which we have firm evidence. Most such hives are used for *Apis mellifera*, but some are for *Apis cerana* (e.g. Fig. 6) and others for stingless bees and other bees which build different types of nests from the parallel combs of the two *Apis* species. *Apis dorsata* and *Apis florea* are excluded here, because they do not nest in a cavity or hive. These species have traditionally been exploited by honey hunting —and recently *Apis dorsata* has also been "kept" in open hives.

Hive materials and construction

Most primitive hives were constructed mainly from plant materials, either wood (W), or stems/twigs (S), or fruits/leaves (F), using one of the following techniques:

Wood (W)

W1 Hewn out from a tree trunk (Fig. 1)
W2 Made from a section of bark removed from a tree trunk, including cork (Fig. 5)
W3 Carpentered from wooden boards

Stems/twigs (S)

S1 Woven twigs, cane, reeds, etc. (Fig. 4)
S2 Coiled-work of straw, sedge, reeds, etc. (Fig. 3)
S3 Plaited grass, straw, etc.
S4 (Straight) stems of reeds, ferula, etc., bound together

Fruit/leaves (F)

F1 Gourds
F2 Large nut shells
F3 Constructed from leaves/flower parts in various ways } (Fig. 6)

The other important source of hive material was the earth, which yielded mud, stone, and clay—which could be sun-dried or baked:

Earth (E)

E1 Unbaked clay/mud (with additives)
E2 Baked clay/earthenware (Fig. 2)
E3 Brick
E4 Stone

I do not know of traditional hives made of any other main materials. Animal products, especially hides, were used for containers of various sorts, but not for hives. (The dung of cows, and possibly of other animals, was a common component of the protective coating of S hives, and cow dung was mixed with mud for making E1 hives.) Similarly, no traditional hives made of metal are known, although metal containers were used from early times. There have been various circumstantial reports of a bronze hive in the museum at Naples/Pompeii, but A. J. Graham (not yet published) has now established that the vessel referred to is not made of metal, and was never a hive.

Hive shape and angle of erection

By and large, the many different shapes of primitive hives can be grouped as follows:

— — *long hives,* narrow horizontal cylinders (recumbent, tunnel, pipe, etc.); see Fig. 1
— *squat horizontal hives,* some egg-shaped (e.g. clay water pots); see Fig. 2
o *equidimensional hives,* with similar dimensions in all directions (e.g. gourds, some skeps); see Fig. 3
\+ *squat upright hives* (e.g. some wicker and straw skeps); see Fig. 4
\+ \+ *long upright hives* (e.g. log, cork); see Fig. 5

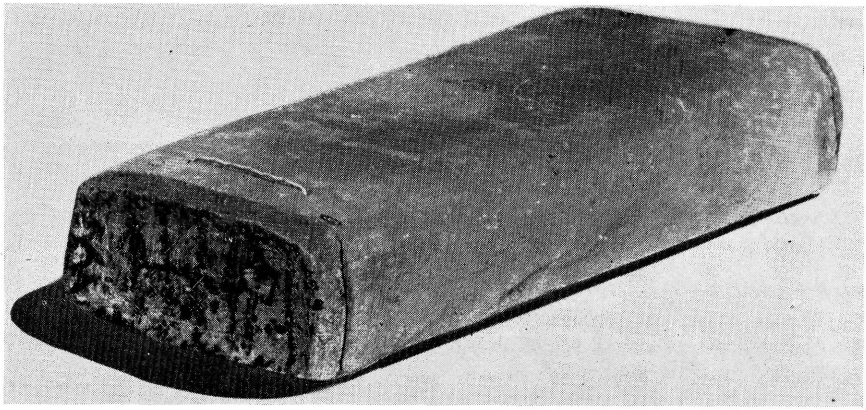

FIG. 1. W1 (— —) Hewn wooden hive (Saudi Arabia), which has internal longitudinal grooves as comb-guides. Internally 100 × 36 × 11 cm, 41 litres. B68/16* Most hewn wooden hives are, however, circular in cross section.

* This and similar reference numbers denote objects in the IBRA Collection of Historical and Contemporary Beekeeping Material.

With a few exceptions, that may well be accounted for by the instability of certain types of construction, every long hive type is used both horizontally (− −) and vertically (+ +) in different parts of the world. This is less true of the squat hives (−,+), whose opening is often large and can be (*a*) at the side or bottom, but not the top (e.g. a water pot), or (*b*) at the bottom, or—if fitted in with wooden bars—at the top, but not at the side (e.g. a shallow open basket).

Table 1 shows a considerable polarization of these hive shapes. The most widespread shape, with the greatest number of variants, is long horizontal (− −). There are many more types of these and the long upright (+ +) hives than of squat horizontal (−) or squat upright (+) hives. Comparatively few types have similar dimensions in all directions (o). The ratio of length to width of the long hives can be as much as 3 or 4, or even 7, though it is more commonly between 2 and 3. All, or almost all, the (− −) and (+ +) hives are purpose-built as hives.

Unlike long hives, many of the squat hives (+, −), with a length to width ratio between say 2.0 and 1.1, are similar to, or even identical with, containers used for other purposes. Water pots and baskets are notable examples. In many parts of Africa and Asia the usual hive is in fact a clay water pot laid on its side; many straw skeps are hardly distinguishable from a carrying basket or a static basket-work container, except that the skep has no handles and it might have a flight hole for the bees.

The rarer equidimensional types of hive (o), which include skeps, gourds and structures of brick or stone, are sometimes but not always variants of a general utility vessel. The Irish 56-lb butter box, almost exactly cubical, is a late example of the adoption of a widely used container as a fixed-comb hive.

Hive extensions

Consider first a primitive hive to which no extension can be added as the colony grows in size during the active season. The new occupant of the hive would normally

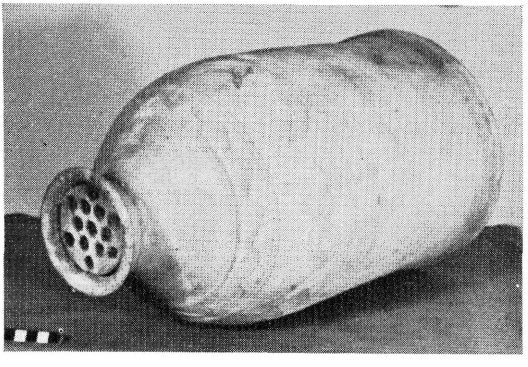

FIG. 2. E2 (−) Baked earthenware hive (Malta); the far end is closed with a vertical board, or a cylinder may be inserted as an extension to the hive. Internally 37 cm long, diameter at open end 22 cm, 11 litres. B69/71

TABLE 1. Hives of different materials, with examples of areas where they were/are in use. Place names in italics marked (c) refer to *Apis cerana*; marked (s) to stingless bees.

		Long horizontal — —	*Squat horizontal* —	*Equidimensional* o	*Squat upright** +	*Long upright* + +
Wood (W)						
W1	Hewn/ hollow(ed)	E Africa Arabian peninsula Afghanistan Turkey *S/C America* (s)				N/C Europe
W2	Bark/ cork	E Africa N Africa				Spain Portugal Canaries
W3	Boards	Yugoslavia Italy Turkey				N Europe
Stems/twigs (S)						
S1	Woven	Ethiopia Turkey Ruanda *China* (c)			N/W Europe Greece Greece (v)	N/W/E Europe
S2	Coiled	Algeria	N/W Europe	N/W Europe	N/W Europe	
S3	Plaited	Africa				
S4	Bound stems	Italy Egypt				Portugal
Fruits/leaves (F)						
F1	Gourds		Nigeria	Malawi Nigeria Togo *India* (c) *S/C America* (s)		
F2	Leaves	Sudan				
F3	Nuts/ leaves	*Bali*, *Indonesia* (c)				
Earth/clay/mud/stone (E)						
E1	Unbaked	Egypt	Ethiopia			
E2	Baked	Egypt Cyprus	Turkey Nigeria *Sri Lanka* (c)	Denmark**	Greece Crete (v)	Portugal Azores
E3	Brick	Madagascar				
E4	Stone		Yugoslavia			

* Entries marked v refer to top-opening movable-comb hives.
** *Jydepotten*, local and unusual.

be a swarm, and this could be suitably housed at the top of a long narrow upright hive, or at one end of a long horizontal hive. Some long horizontal hives were splayed out at both ends, and the honey was stored there; the centre was narrower and provided suitable quarters for a new swarm.

The more nearly equal the dimensions of a hive become, the more likely it is to be too small for a fully grown colony if it is suitable for housing a new swarm. We might therefore expect to find some of the squat or equidimensional hives equipped with an extension to provide extra space when the colony is larger, and/or during honey-producing periods. Straw (but not wicker) skeps have in fact been enlarged above by a smaller skep known as a cap, and below by a cylindrical ring known as an eke. Some of the horizontal clay hives have an extension ring at one end. The size of some horizontal cylindrical hives is adjusted by moving the circular end closure in (making a smaller, squat, hive space) and out (making a larger, long, hive). Varro (116-27 BC) referred to this reduction of hive size, which was carried out "so that they [the bees] do not lose heart in a wide empty space".

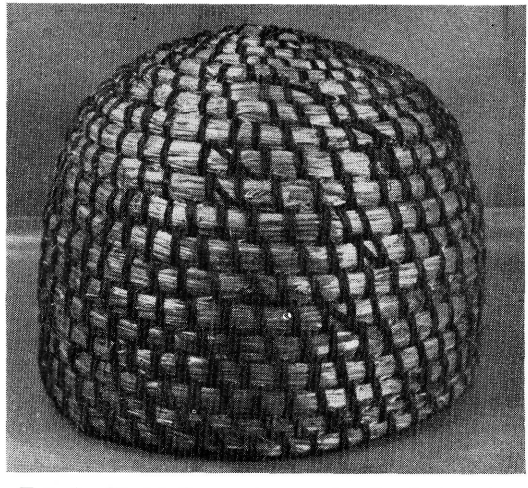

FIG. 3. S2 (o) Straw skep made of coiled-work, bound with bramble (Cornwall, England). Internally 35 cm high, diameter at base 40 cm, 30 litres. B53/86

Top-opening bar hives

In principle the hives discussed were accessible (or could be opened) from the side or end, or from the bottom. They could not be opened from the top, since the combs there were most firmly attached to the fabric of the hive.

One type of traditional hive (+ type), known so far only in Greece and Crete, is shaped like a large upright flower-pot, its wide opening being closed by wooden bars whose width is the natural comb spacing. This is in principle a movable-comb hive, and is denoted in Table 1 by v. The only v entries, both +, are S1 and E2: woven wicker hives in Greece and earthenware hives of the same shape in Greece and Crete.

The siting of hives

In dry subtropical areas where it is not detrimental, and also in some less clement conditions elsewhere, hives may be stood directly on the ground. Unusual stone hives on the Dalmatian island of Brać are even embedded in the ground. In parts of the north temperate zone where the ground may be damp or cold, it is more common to stand hives up on a stool, shelf or other base. More permanently, the base may be a shelf in a covered shelter or bee house, or a recess in a wall; there may be several tiers of hives. In the dry subtropics (and elsewhere, for instance in Afghanistan) hives may be embedded in a thick wall that provides thermal insulation, as well as protection against thieves. Or tiers of such hives may constitute a structure that resembles a wall, as in Egypt.

In wooded tropical areas, protection is often needed more against animal and human enemies than against inclement weather. Here, hives are usually suspended by a rope or hooked stick, in trees or (Fig. 6) under the eaves of dwellings, or wedged in trees. All these sites provide some shade. The hives may be up to 10 metres above the ground. In the forests of northern Europe, and for instance Turkey, log hives may be attached to the trunk of a tree, at heights up to or exceeding 25 metres.

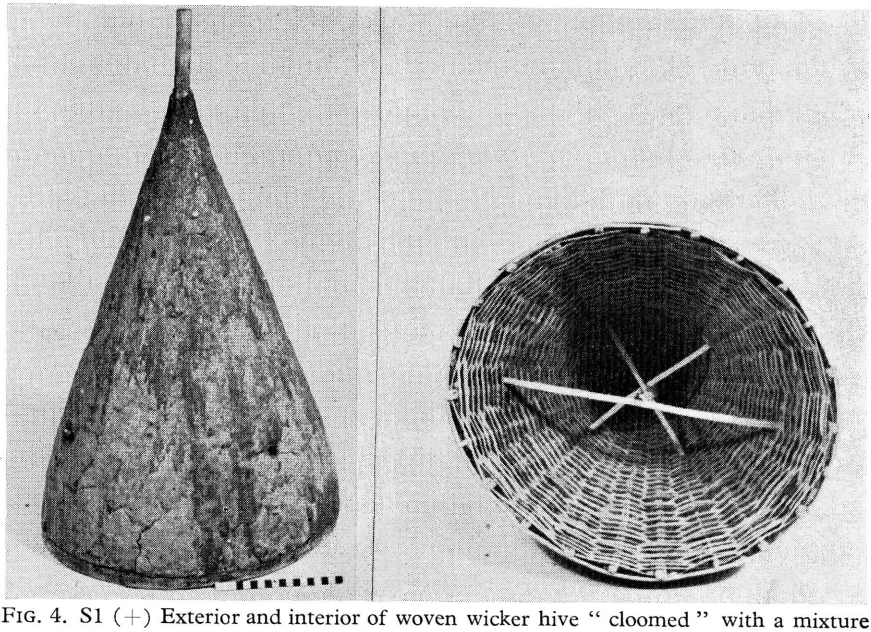

FIG. 4. S1 (+) Exterior and interior of woven wicker hive " cloomed " with a mixture of mud and cow dung (Luxemburg). Internally 60 cm high, 45 cm diameter at base, 37 litres. B53/173

Identification of hives

In assessing whether an object was used as a hive for bees, there are several useful diagnostic characters, although any one may be tantalizingly inadequate. It is easier to believe that something was *made* as a hive if it is suitable for this purpose and for

no other. It may be much more difficult to assess a container that is suitable as a hive for bees if it is also suitable for some other purpose. Many hives (especially + and − types) are adaptations of other vessels, and others are identical with general purpose vessels.

Diagnostic characteristics of a hive are: (1) flight entrance hole(s); (2) means by which the beekeeper can extract honey combs; (3) provision for bees to attach their combs to the hive; (4) a suitable size; (5) the presence of beeswax on the surface of the vessel; (6) similarity to vessels *known* to be used as hives or (7) similarity to described or depicted hives. Singly, none of these is sufficient, and 1, 3 and 5 are absent in many examples of hives. Often only 2 and 4 are mandatory, and 4 can be very widely interpreted.

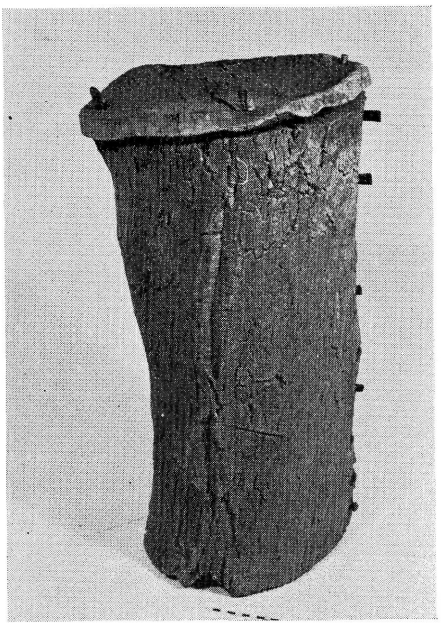

FIG. 5. W2 (+ +) Cork hive (Spain). Internally 60 cm high, diameter 24-32 cm, 29 litres. B70/6

1. *Presence, position and size of entrance holes*

The presence of a narrow slit or one or more entrance holes 8-12 mm in diameter, especially in the side of a container which would rule out its function as a strainer, is useful evidence for a hive. Roman authorities and their followers, at any rate up to the fourth century, favoured several small holes. Palladius then wrote: "There should be two or three [entrances] in a hive, no larger than the size of a bee; for the narrow entry will thus obstruct harmful creatures. If, on the other hand, they wish to besiege the bees, as long as they have another exit, they will go out by that".

2. *Provision for removal of honey combs*

This is not a very selective test for containers that could be broken or taken to pieces. Some unbaked earthenware hives are made without any opening or removable lid; they can be broken to gain access to the combs and restored afterwards by using mud obtained nearby. But in general a hive is provided with one of the following: an opening closed with a lid (e.g. cylindrical wood, bark, clay or mud hives); or a removable base (Carniolan hives); or a permanently open mouth at the bottom that rests on the ground or on a base, the hive being lifted up to remove the honey combs (e.g. straw or wicker skep).

3. *Provision for the attachment of combs*

Some hives, such as that shown in Fig. 1, have parallel grooves; others have protrusions or combing on the upper part of the interior surface. Such features may help to attest a hive, but their absence would not be indicative one way or the other.

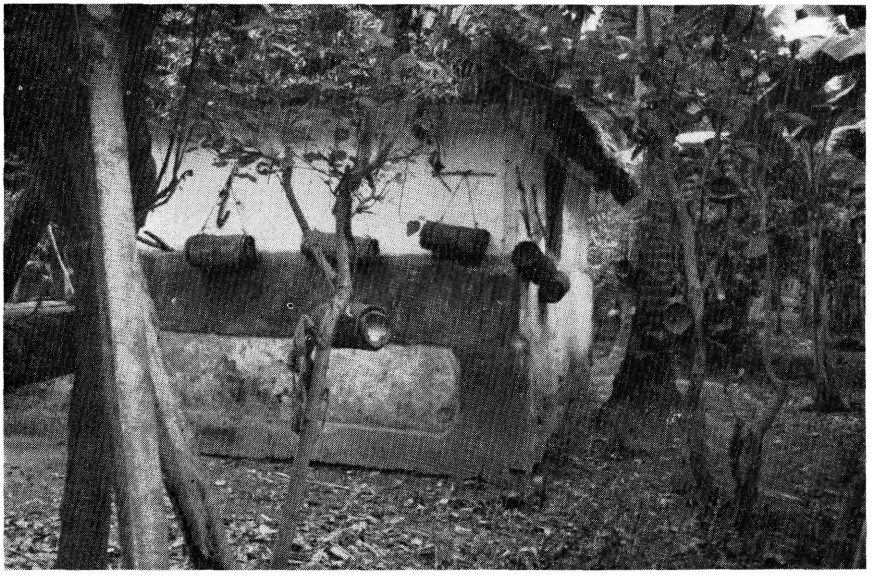

FIG. 6. F3 (−) Hives constructed of the bark and flower spathe of the coconut palm, each end closed with half a coconut shell (Bali, Indonesia). Internally 37 cm long, 18 cm diameter, 9 litres. Used for *Apis cerana* not *Apis mellifera*. B74/16

4. *Evidence of size*

Traditional hives vary greatly in size as well as shape. Those in the IBRA Collection of Historical and Contemporary Beekeeping Material vary from 12 to 82 litres in total capacity; hives for *Apis cerana* may be smaller than 12 litres. The largest, 60-80 litres, are cylindrical (− −) hives from Africa, but two such hives are only 19 and 20 litres. The smallest are straw skeps (−); many of these have a capacity less than 20 litres, although some are over 60 litres. (The capacity of a Langstroth brood box is about 41 litres.)

Any capacity between 10 and 90 litres seems to be possible for a purpose-built hive without an extension. It is likely that smaller or larger containers might also be used upon occasion, either temporarily, or when a normal hive was not available. If so, bearing in mind that a modern nucleus hive may be no more than one-third the size of a brood box, vessels considerably smaller than 10 litres should not necessarily be ruled out as hives. Similarly, 120 litres (3 Langstroth brood boxes) would not seem an excessive upper limit*.

The smallest internal cross-section of a hive is sometimes no less relevant than the total capacity, since a swarm would normally occupy only a small part of the length of a long hive. In the hives referred to above, a common smallest cross-section is circular, with an internal diameter about 30 cm but sometimes as little as 18 cm; the hive shown in Fig. 1 is $36 \times 11 \times 100$ cm internally. The three cross-sections quoted are about 700, 250, 400 cm^2, respectively, in area.

5. *Physical evidence of occupation by bees*

Visible evidence of the attachment of beeswax combs to a vessel establishes that bees have occupied it. Evidence from gas chromatography of the presence of beeswax on a vessel or sherds must rate high—unless of course there is some other factor that might account for this. Evidence from the presence of parts of bees, of propolis, or of pollen of types collected by bees, could be very supportive, although the last is more likely to occur in honey containers than in hives.

6. *Similarity to known hives*

This evidence is to be rated highly where the known hives are not used for any other purpose, but less highly where vessels identical or similar to the known hives have alternative functions. In one individual case it may provide a convincing argument; in another it may provide none.

7. *Written, oral and pictorial descriptions*

Any of these might provide valuable evidence, for instance: "In Ruritania the common water pot is everywhere used as a beehive"; or "The basket you found is what my grandfather used for bees"; or a painting might show a receptacle, very similar to the one in question, with bees flying in and out. On the other hand, some written or oral descriptions are too vague, and some illustrations too stylized, to be of any diagnostic use at all.

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*A recent paper by T. D. Seeley and R. A. Morse (*Insectes Sociaux* 23(4): 495-512 (1976)) records the volumes of 21 natural cavities in trees that were occupied by honeybee colonies. Except for one of 440 litres, they ranged from 10 to 115 litres.

Reprints of this paper (M90) are obtainable from the International Bee Research Association, price 35p or $0·65 each, post free.