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KOPRONES AND OIL PRESSES AT HALIEIS

Interactions of Town and Country and the Integration of Domestic and Regional Economies

In this article I address archaeological evidence from several 4th-century B.C. houses at Halieis in the southern Argolid that explicitly ties this small polis to its *chora* in general, and its agricultural lands in particular (Figs. 1, 2).[1] It is fortunate that we are able to do this at Halieis, given what has been, until quite recently, the dearth of work carried out on smaller, lesser-known Greek poleis;[2] the general neglect of domestic architecture until recent times by classical scholars; and the difficulty of meaningfully connecting material remains in an urban context with what we know to have been the complementary and sustaining presence of the countryside. Indeed, the agricultural role of the *chora* was fundamental to the economy of both the domestic sphere and the polis.[3]

1. I would like to thank Susan E. Alcock, Virginia Anderson-Stojanović, Harriet Blitzer, Victor D. Hanson, Louise Hitchcock, Michael H. Jameson, Madeleine S. Kaufmann, Lisa C. Nevett, Wolf W. Rudolph, Curtis N. Runnels, Anthony M. Snodgrass, and three anonymous reviewers for *Hesperia,* who read drafts of this paper at various stages and provided me with encouragement and numerous helpful suggestions; and Alcock, John F. Cherry, and Jack L. Davis for collegial debate on matters presented here. I also acknowledge the American School of Classical Studies at Athens and the Fulbright Foundation of Greece for providing me with facilities and financial support during the period in which this article was initially written. Finally, thanks go to Panagiotis N. Doukelis and Lina G. Mendoni, the organizers of "Rural Structures and Ancient Societies," and the Ionian University of Corfu for their cordial hosting of the 1992 colloquium at which the first presentation of this paper was made (Ault 1994b). A subsequent version was also read at the 94th Annual Meeting of the Archaeological Institute of America, New Orleans, Louisiana, December 27–30, 1992 (abstract in *AJA* 97, 1993, pp. 324–325). Figures 1 and 11 are reprinted from van Andel and Runnels 1987, with the permission of Stanford University Press, ©1987 by the Board of Trustees of the Leland Stanford Junior University. All other illustrations are by the author or are reproduced courtesy of the Halieis Excavations Publication Committee.

Excavations at Halieis were conducted in the 1960s and 1970s under the auspices of the American School of Classical Studies at Athens, the University of Pennsylvania, and Indiana University. For a listing of preliminary reports see Foley 1988, p. 194; Jameson 1969, p. 313, note 3; and Rudolph 1984, p. 123, note 1. For the most complete overviews of the urban plan and domestic architecture of the city see Ault 1994a, Boyd and Jameson 1981, and Boyd and Rudolph 1978.

2. See Gehrke 1986 for an exemplary study of numerous poleis not often in the public eye, in spite of the fact that these made up the majority of the Greek social and political collective.

3. See, e.g., Osborne 1987. Hanson (1995) has recently taken this proposition further by arguing that "yeoman" farmers provided the structuring element for not only Greek but also subsequent achievements of Western civilization. While acknowledging the primacy of the role played by the family farm, I would broaden this scheme to include the full spectrum of the *oikos* and its activities.

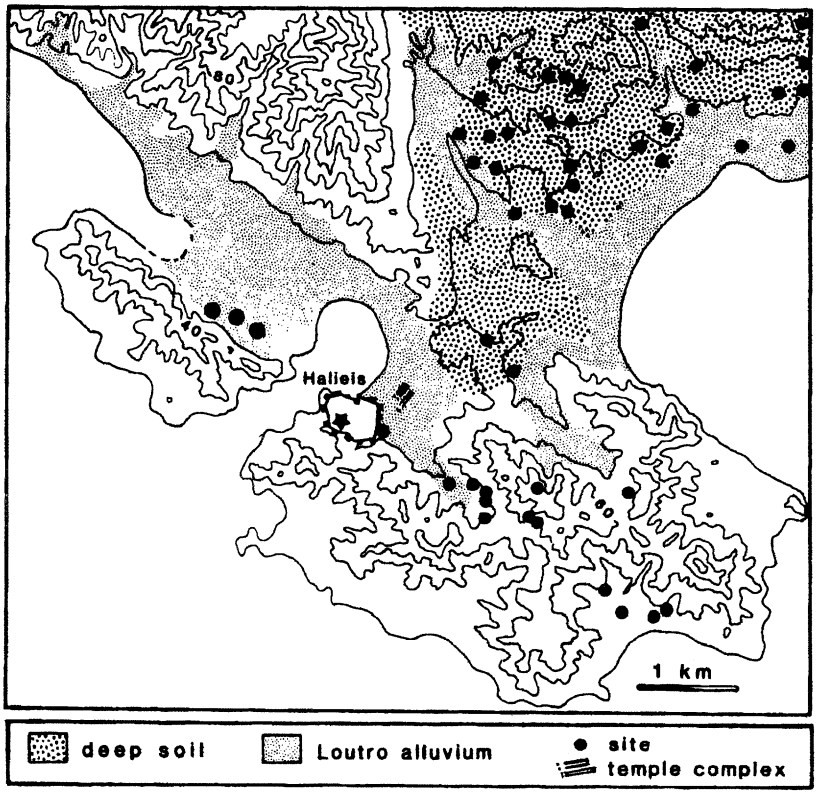


Figure 1. Map of Halieis and surroundings ca. 300 B.C. After van Andel and Runnels 1987, p. 108, map 21

EVIDENCE FOR *KOPRONES*

In a number of houses excavated at Halieis, sizable stone-lined pits are sunk into the surface of the courtyard. Originally identified as cellars, they range in shape from square in House A (Fig. 3), to rectangular in House 7 (see below, Fig. 9), to trapezoidal in House D (Fig. 4); they measure from less than 1 m to 2.5 m on a side. Three have been fully cleared to their earthen bottoms, which lie approximately 1–1.5 m below the surrounding floor level (see below, Figs. 6, 10).[4] Taken with their areal coverage of ca. 2.25–5 m^2, the pits have a capacity of 3–5 m^3. At the time of excavation, all three features brimmed with artifactual material (e.g., Fig. 5).[5]

4. Boyd and Rudolph 1978, p. 347 (House A), p. 350 (House D), and p. 351 (House 7). In addition to these three examples, there is evidence that the cistern in the court of House C may have been inserted into the space formerly occupied by such a feature (Ault 1994a, p. 141). A similar construction exists in the courtyard of House B. Although referred to erroneously as the only "indication of a staircase" excavated at Halieis (Boyd and Rudolph 1978, p. 349), and built into a corner above the surface of the court, rather than sunk into it, its unplastered rubble walls enclose an area of ca. 1.5 m^2. An unexcavated feature in a poorly defined and unpublished house, partially excavated by the Greek Archaeological Service in the early 1980s, at the northwest end of Area 6, may constitute another example. A seventh such feature may also be posited in the square, stone-lined "well" that lay north and presumably outside of the hostel/*hestiatorion* in the submerged Apollo sanctuary. Noted to have been filled with pottery, it is also said to have "contained a sticky grayish clay unlike the soil from the rest of the sanctuary area" (J. A. and C. Dengate, pers. comm. 1992; see Jameson 1974, p. 115, where the feature is noted as "I" on the accompanying plan).

5. Some cultural materials were surely introduced into these pits at the time of the abandonment of Halieis, generally placed early in the 3rd century although the precise date and circumstances remain in question (Jameson, Runnels, and van Andel 1994, especially p. 86). Other artifacts may have entered the features with the subsequent collapse of the houses themselves, particularly in the case of roof tiles that tended to spill across courtyard surfaces. But I assume that the bulk of the excavated fill (see below) was integral to the features and their intended function, and dates from the final phase, be it weeks or months, of the city's life. It is anticipated that final study of the Halieis pottery will bear this out.

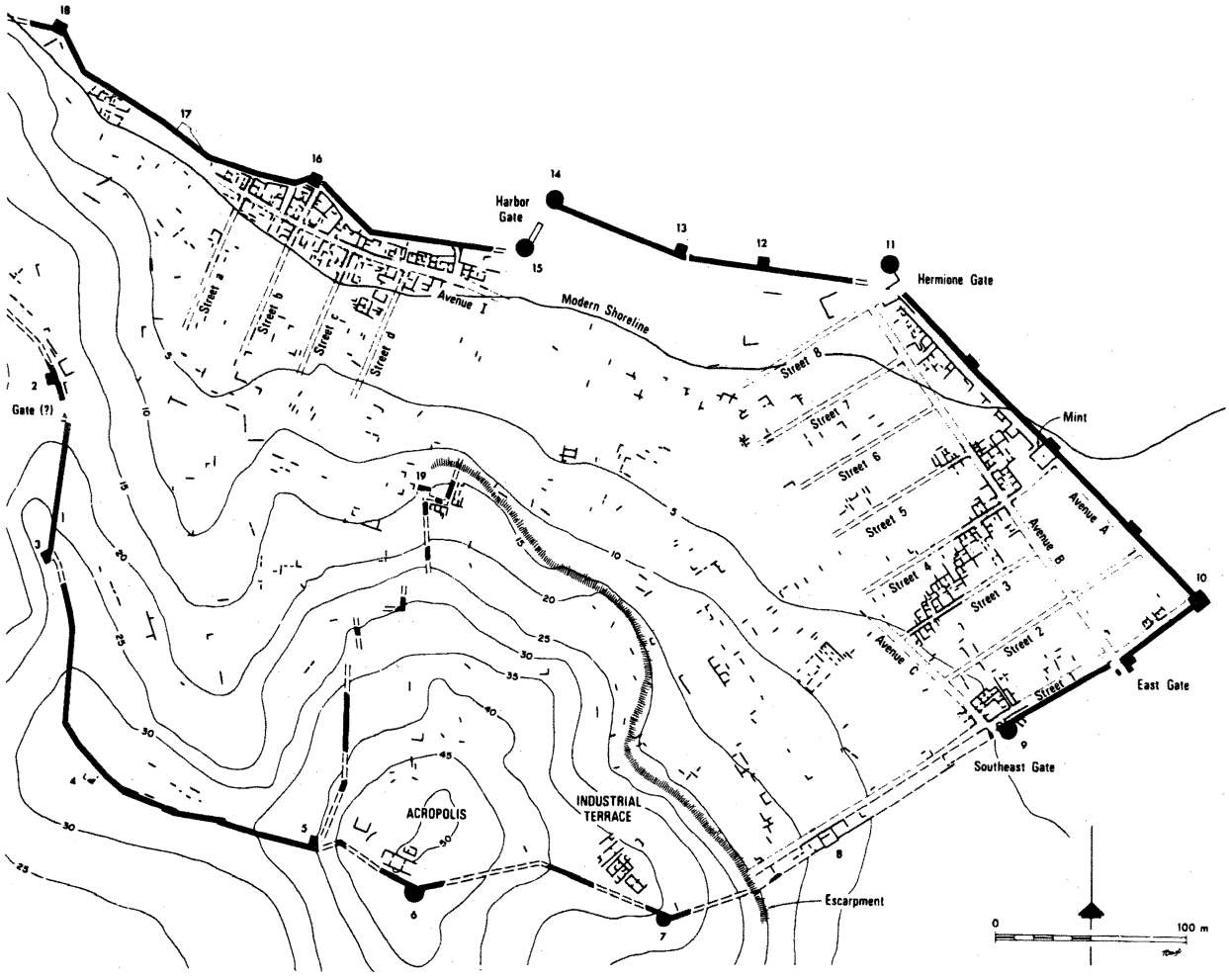


Figure 2. Topographic plan of Halieis. Courtesy of the Halieis Excavations Publication Committee

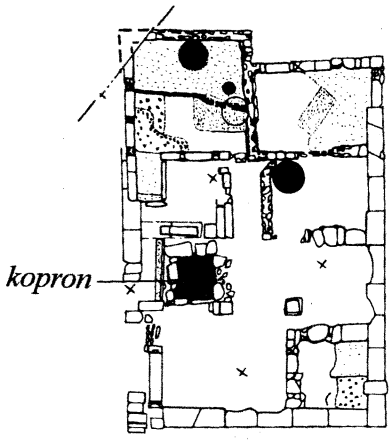


Figure 3 *(above)*. **Plan of House A.**
After drawing by T. D. Boyd

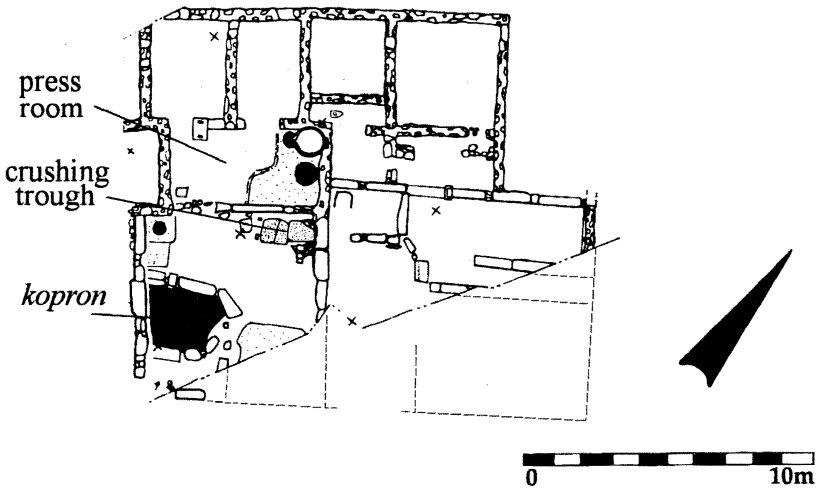


Figure 4 *(right)*. **Plan of House D.**
After drawing by T. D. Boyd

Figure 5. The *kopron* in House D (from northeast) with fill

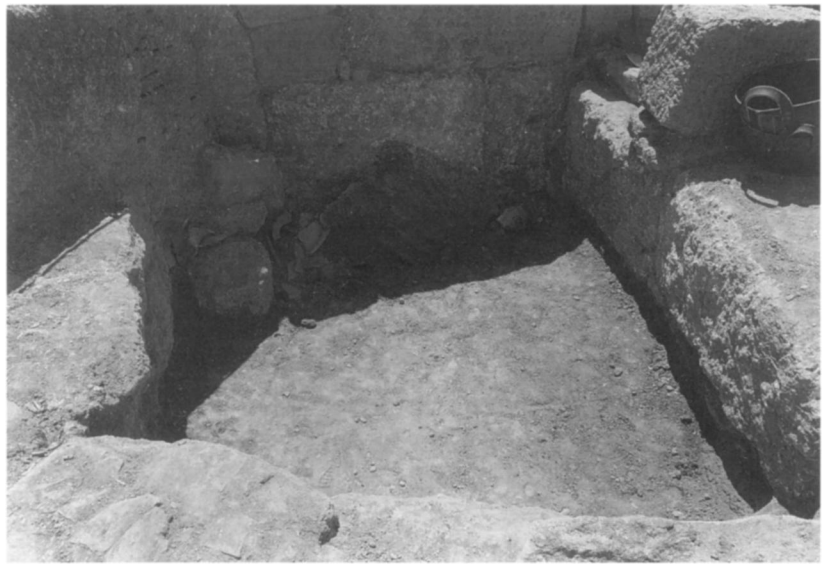


Figure 6. The *kopron* in House D (from northeast) emptied of fill

More than 1,500 ceramic items were recovered from the example in House D (Fig. 4), in addition to more than 1,000 roof tile fragments (Appendix 1).[6] Figures 5 and 6 show the feature during and after excavation, respectively. Many of the roof tiles in the upper part of the feature actually spilled out onto the courtyard surface, and so may have been introduced to the deposit with the collapse or deliberate dismantling of nearby roofs. As part of an unpublished study, Louis Jerkich examined the roof tile debris from the upper strata of this feature and was able to reconstruct portions of seventeen pan and nine cover tiles (examples of which are seen in Figs. 7 and 8).[7] Nevertheless, the ceramic items present account for some 35% of the ceramic assemblage recovered from the latest habitation levels of House D, which yielded more than 4,500 pieces overall.[8] Counting rim and base fragments separately, at least 144 vessels are represented from the

6. While sherd counts from individual stratigraphic levels (designated in the Halieis excavation notebooks, and hereafter referred to, as "units") were assiduously made, roof tile counts were often abbreviated into relative quantities. Hence, entries frequently specify "one small box," "one-half" or "one-quarter small box pan tile body fragments." The estimated equivalencies I have adopted to reconstitute these assemblages are as follows: one small box equals 200 fragments, half of a small box equals 100 fragments, and so on.

7. Jerkich 1974. In contrast to these tiles, other artifactual debris from the features here and in House 7 was distinctly more fragmentary and less complete.

8. The assemblages from the latest habitation levels of Houses 7, A, C, D, and E are fully detailed in my doctoral dissertation (Ault 1994a), currently being revised as a contribution to the forthcoming series *Excavations at Halieis,* C. Dengate, ed.

feature (Appendix 1). Of these, perhaps four complete or nearly complete (but fragmentary) vessels were recovered while another seventeen or so could be reconstituted as full profiles. Other material recovered from the deposit includes a single lamp fragment, three loomweights, various metal objects including one coin (a bronze issue from Troizen dated 370–300), and, perhaps curiously, only a small amount of identifiable organic material (shell and carbonized wood and seeds). In order to demonstrate that artifactual material was spread throughout the deposits filling the feature, and not merely confined to its upper strata, a stratigraphic matrix of the fill is presented in Appendix 2, which includes the unit number, the numbers of sherds and roof tiles recovered from that unit, and the depth of the unit itself.[9]

The contents from the pit in House 7 (Figs. 9, 10) are comparable. Of 6,230 ceramic items recovered from the latest habitation levels of the house, over 900 sherds and more than 300 roof tile fragments came from the fill of this negative feature (Appendix 1). Most of these roof tiles should be integral to the deposit since the number of tile fragments was far fewer

Figure 7. Pan tiles from the *kopron* in House D. Maximum preserved length of pan tile, 0.65 m.

Figure 8. Cover tiles from the *kopron* in House D. Maximum preserved length of cover tile, 0.715 m.

9. The most complete presentation on stratigraphic matrices generally is Harris 1989. Employing matrices has proved invaluable for studying the Halieis deposits since they essentially amount to schematic reconstructions of stratigraphic sections and sequences.

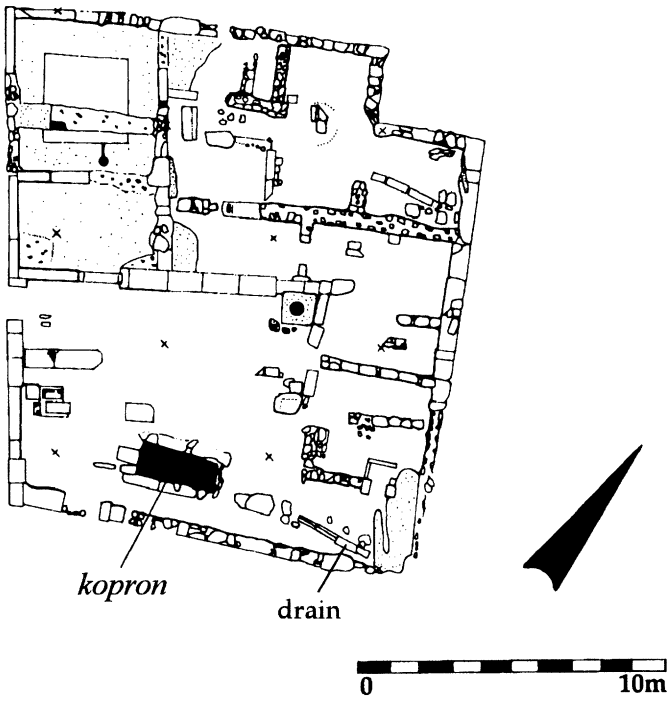


Figure 9. Plan of House 7. After drawing by T. D. Boyd

than in House D, and no complete or nearly complete tiles were recovered. Nor was the feature, located to the side of the courtyard in a corner house, as likely to have collected roof-collapse debris as the example in House D, which backed up on an internal party wall supporting a roofed section of the adjacent house (House E, Rooms 6-21 and 6-22). Of the ceramic material recovered, a minimum of 230 vessels is represented. No whole vessels were recovered from the deposit, even in a fragmentary state, although full profiles could be reconstructed for eleven fineware pieces. In addition, the assemblage recovered from the feature includes six lamp fragments, four loomweights, and numerous metal objects, plus a small quantity of bone and shell. Appendix 2 presents in matrix format the very simple stratigraphic sequence of the pit's fill, showing that while the uppermost unit of the deposit contained the greatest concentration of artifactual material, ceramics and roof tile fragments were present throughout. The fills from the negative features in House D and House 7, then, represent cross-sections of nonperishable household inventories.[10]

I am not satisfied with interpreting these structures as cellars for two reasons. First, there were other areas of the houses in question better suited for storage, rooms termed the *pitheon* or *tamieion* in the primary sources.[11] Second, and more important, they would have been damp: the example in House 7 is clearly associated with a drain that flowed into it from the adjacent street (Fig. 9). Nor can the features have served as cisterns. Although they are lined with stones in each case, there are no traces of hydraulic plaster and, as already noted, the floors are earthen.[12] To this end, then, the features did serve as "soak-aways,"[13] but that function is, I believe, ancillary to their main purpose. Finally, the debris that comprises most of the fill of these features appears to have been deliberately discarded; it is a concentration of unusable material.

10. Unfortunately the artifactual contents from a third such pit, in House A (Fig. 3), were lost and so were never processed.

11. For ancient references to the πιθέων (also πιθών) and ταμιεῖον, see the "Reference List of Some Greek Words Concerned with the House," in *Olynthus* XII, pp. 468 and 470, respectively. These are, however, frequently difficult to locate archaeologically (Ault 1994a, pp. 237–241; and forthcoming).

12. The single cistern that has been identified at Halieis lies in House C, and is of the well-recognized, flask-shaped form (Ault 1994a, pp. 140–141; and Boyd and Rudolph 1978, p. 350).

13. As noted in Alcock, Cherry, and Davis 1994, p. 169.

In considering the function served by these constructions, a study by E. J. Owens on the organization of urban refuse disposal in Classical Athens proves extremely useful.[14] Owens points out that although the collection of garbage was supervised by the state (in Athens, at least, by the *astynomoi* or *epistatai koprononon*), a large part of the operation may have been in the hands of private entrepreneurs (the *koprologoi*) who were able to turn a profit first by collecting waste material, and then by recycling and reselling it as fertilizer.

Owens notes that the domestic collection facility was called a *kopron,* and he cites several examples mentioned in Attic mortgage *horoi.*[15] He also identifies archaeological examples from published accounts of three houses at the north foot of the Areopagus in Athens and at the 5th-century "palace" at Larissa-on-the-Hermos.[16] Among the posited Athenian *koprones,* which tend to be located in the courtyard or in the street just in

Figure 10. The *kopron* in House 7 (from northeast) emptied of fill

14. Owens 1983.

15. Owens 1983, p. 48, with notes 42 and 44. These include *IG* II² 2496 (in Piraeus); *IG* II² 2742 (Finley 1952, p. 142, no. 86); and Fine 1951, p. 8, no. 16.

16. Owens 1983, p. 47, with notes 31 and 36. For the Areopagus houses, see below, note 17. For Larissa-on-the-Hermos, see Boehlau and Schefold 1940, p. 88, fig. 5.

front of the doorway, a number are lined with stones.[17] Wolfram Hoepfner and E.-L. Schwandner also suggest the presence of *koprones* in the houses at Olynthus; although not defined as negative features, the structures are located below the roofed portion of the courtyards adjacent to *prothyra* entries.[18]

Elsewhere, on Thasos, a stone-lined construction $1.70 \times 1.25 \times 0.75$ m deep was discovered in one of the houses just within the Silenus Gate, in a courtyard adjacent to the doorway to the street.[19] While a function was not suggested by the excavators, I am inclined to see the sunken features at both Thasos and Halieis as *koprones.* After the initial identification of *koprones* at Halieis, examples have also been tentatively identified at Stymphalos and Gravina di Puglia.[20]

COMPOSITION AND APPLICATION OF THE *KOPROS*

Having identified *koprones,* then, we may now turn briefly to their contents, *kopros.* Like English "manure," French "fumier," and Modern Greek "κοπριά," ancient *kopros* need not refer strictly to animal or human waste as it has generally been defined.[21] Particularly in the context of the *kopron, kopros* should include all debris deposited into it: animal and vegetal matter such as kitchen refuse and table scraps, and waste materials from domestic industrial activity, as well as human and animal excrement. It is also likely that other items to be discarded—broken pots, for example—went into the *kopron.*[22] When domestic *kopros* was added to naturally accumu-

17. Thompson 1959, pp. 101–102 (where the features are referred to as "cesspools"), with pls. 17 and 21:a–b. Thompson also points out two similar constructions in houses in the "Industrial District" west of the Areopagus (1959, p. 102, note 26; citing Young 1951, pp. 194–195, with fig. 7, and pl. 66d [House A], and p. 201 [House B]).

18. Hoepfner and Schwandner 1994, p. 97; see also Carroll-Spillecke 1989, p. 44.

19. In Insula II, House *a*, period 3 (dated mid-4th century; *Thasos* XII, pp. 223 and 230, with pls. 74:5 and 77 [phase 4.1]). One could apparently have stepped down into the feature via two treads located along its western side. This arrangement compares well with what may be steps in the northwest corner of the sunken feature in House D at Halieis.

20. The possible *kopron* at Stymphalos, which remains unexcavated due to the high watertable at the site, is briefly discussed in Williams 1996, pp. 95–96; and illustrated in plan in Williams et al. 1997, p. 25, fig. 1. For the *sterculinum* at Gravina di Puglia, see Small et al. 1994.

Middle Bronze Age precursors to these *koprones* may be found in Minoan Crete. It has recently been argued that the enormous stone-lined circular pits known as *koulouras* in the West Court areas of the first palaces at Knossos and Phaistos served not as underground granaries, but as refuse pits and soakaways or "blind wells" (Strasser 1997; as Evans himself had originally argued). If this is correct, we might well infer that the *koulouras* were Middle Minoan versions of *koprones.* Cf. the response to this argument by Halstead (1997).

21. Cf. the view espoused by Robinson in connection with *kopron* as "a place for dung," but he seems to prefer "privy, or latrine" in the domestic context (*Olynthus* XII, p. 462; followed by Alcock, Cherry, and Davis 1994). Both Amouretti (1986, p. 62) and Hodkinson (1988, p. 49) realize that the latter definition is too narrow. While Alcock, Cherry, and Davis (1994, p. 147) acknowledge that *kopros* "had a wide semantic field," they continue to emphasize its fecal component above all others. Although this is fine for the farm, where animals were kept and their manure collected, *kopros* generated by urban households would have had differing constituent elements.

22. See Epictetus 2.4.4: "What confidence am I to place in you? If you were a vessel so cracked that it was impossible to use you for anything, you would be cast forth upon the *kopros* heap (κοπρίας) and even from there no one would pick you up; but if, although a man, you cannot fill a man's place, what are we going to do with you?" (cited in Alcock, Cherry, and Davis 1994, p. 150; their extensive consideration of the literary, ethnographic, and archaeological evidence for manuring practices provides a welcome wealth of data with which to pursue the topic further).

lating debris in gardens and fields—fallow crops (also known as "green manure"), brush, weeds, prunings, and the dung of grazing animals—a plentiful and powerful source of fertilizer was available. The *kopron* should thus be viewed not only as a cesspit or garbage pit, but also as substantively contributing to a profitable compost heap or mulch pile.[23]

The acknowledged value of *kopros* as potential fertilizer is probably as old as agriculture itself. Odysseus's faithful dog Argos lay atop *kopros* in the courtyard of his master's house (*Od.* 17.296–299). Although noted explicitly as comprising the dung of mules and cattle, it is also made clear that this *kopros* will be carried out to the fields for fertilizer.[24] Indeed, by the time we have surviving treatises dealing specifically with agricultural practices (from Hellenistic and Roman sources), a developed science of *kopros*-composition and application exists. Especially useful in this regard are discussions by Cato (*Agr.* 5.8; 29.1; 36.1; 37.2; 50.1), Columella (2.14–15), Theophrastos (*CP* 3.9 and *HP* 8.6.3), and Varro (*R.* 1.38).[25] Columella (1.6.21; 2.14.6–8) and Varro (*R.* 1.13.4) also give advice on the construction and maintenance of the *kopron* (or *sterculinum*), numerous points of which accord well with what we can observe in the *koprones* at Halieis; these include the need for protection on the top and sides (the advantage of a pit) and the ability for water to flow in or moisture to be retained.[26]

Both traditional as well as contemporary methods of manure collection on farms from the Mediterranean to the Midwestern United States employ the aboveground piling of animal waste from the yard and stalls (where, as litter, it is mixed with straw used as bedding). The location of these manure piles is generally off to the side of the farmyard. From here the manure is periodically collected and transported to another location where it may be used as fertilizer. Given the corporate scale of much modern commercial agribusiness, the by-products of these latter-day Augean stables may constitute as much of an environmental biohazard as they do

23. Although "not apparently a standard clause" (Garnsey 1992, p. 151), a public land lease from 4th-century Arkesine on Amorgos imposed a fine of half a drachma for each basket of manure not applied to the area from a required annual application of 150 basket loads (*Syll.*[3] 963). See Osborne 1987, pp. 36–37 for a full translation of the inscription and pp. 42–43, table 2 for several other leases that specifically prohibit the removal of manure (presumably for reuse or resale) from leased properties.

The objection to locating *koprones* within houses based on the odor that they must have emitted is one easily mitigated. In this instance, our 20th-century olfactory predilections are largely irrelevant. For safety reasons, *koprones* would probably have been planked over. If their smell was still a concern, the addition of lime (as a "sweetener") would have kept the stench down as well as provided additional nutrients to the mixture. I would like to thank V. Lambrinoudakis for emphasizing the latter point.

24. Richter (1968, pp. 104–105) discusses the evidence for manuring in the Homeric context, which he assumes to have been widespread.

25. White (1970, pp. 125–145) gives the best overview of the ancient sources supplemented by modern agronomic commentary. See also Alcock, Cherry, and Davis 1994; Burford 1993, passim; Amouretti 1986, pp. 62–63; and Hodkinson 1988, pp. 49–50. Although Skydsgaard repeatedly discourages consideration of Latin authors for shedding light on ancient Greek agriculture (1987; 1992, pp. 10–11; and Isager and Skydsgaard 1992, p. 4), such evidence may be just as usefully, and as carefully, taken into account as ethnographic studies of traditional practices (see note 26, below).

26. For an ethnographic scenario from Turkey where village households each maintain their own compost pit, see Dittemore 1983. Although I have not had direct access to this work, I owe its reference to the kindness of H. Blitzer, who will also provide extensive treatment of refuse disposal, collection, composting, and manuring in her forthcoming study of traditional industries in Greece (Blitzer, in preparation).

the "farmer's friend." The essential point to be kept in mind here is the urban location of these ancient *koprones* and their integration within households, rather than their being out on farms.

In terms of archaeological methodology, the *kopron* provides an urban correlate to and generating mechanism for the "off-site" sherd scatters explained frequently by survey teams as resulting from the manuring of fields.[27] While the identification of *koprones* at Halieis has been welcomed by some in the community of survey archaeologists (particularly Anthony Snodgrass[28]), others have expressed reservations about overrelying on this aspect of their explanatory potential (especially Susan Alcock, John Cherry, and Jack Davis).[29]

The domestic *kopron* and its contents should not be considered the only explanation for off-site sherd scatters. Indeed, Robin Osborne has already made clear in a limited study of the epigraphic evidence that the nature and complexity of settlement in the *chora* itself, and hence the presence of artifacts there, are far more varied than the archaeological evidence on its own can fully explicate.[30] Similarly, the thoroughgoing study by Alcock, Cherry, and Davis has demonstrated the difficulty in connecting ancient manuring practices to the dispersed landholdings frequently attested for both ancient and traditional Greek agriculture.[31] The authors take exception to explaining rural sherd scatters primarily in terms of manuring, in part because of the sheer number of artifacts that characterize the scatters in relation to the quantity of manure available for use as fertilizer, and in comparison to the size and scattered nature of the landholdings of individual *oikoi*.[32] Their objections also extend to the identification of the stone-lined features at Halieis (and, by extension, those elsewhere) as *koprones*. They cite the lack of soil analysis of the fills (for confirmation of their high organic content), as well as how "little is known about the rates of ceramic consumption and discard in either town or country," and the "number of variables for which only the vaguest of 'guesstimates' can be offered—for instance, the number of times the *kopron* was cleaned out, [and] the proportion of the cultural debris in the *kopron* actually removed at each cleaning."[33]

27. E.g., Bintliff and Snodgrass 1988; and Wilkinson 1982. Members of the Southern Argolid Exploration Project initially remarked on the absence of off-site sherd scatters that would indicate the transfer of domestic *kopros* to the fields as manure (see Snodgrass 1990, pp. 121–125, especially p. 125, citing van Andel and Runnels 1987, p. 33). This situation is in marked contrast to the findings of the Cambridge-Bradford Boeotia Survey and Nemea Valley Archaeological Project, among others. More recently, however, it has been acknowledged that while "low density artifact distributions between sites were noted" in the course of the Southern Argolid Survey (Jameson, Runnels, and van Andel 1994, p. 221, note 3; cf. Osborne 1996, p. 168), they were not subject to the degree of scrutiny that subsequent projects have given to similar evidence.

28. Snodgrass 1994, pp. 199–200.

29. Alcock, Cherry, and Davis 1994, pp. 169–170. Questioning the relevance of the problem and attendant debate, and *pace* the reviewers of Morris 1994 (where an exchange on the matter between Alcock, Cherry, Davis, and Snodgrass takes place), Spivey has chastised the contributors to the volume for wallowing in the figurative and literal "dung-heaps" of the New Archaeology (Spivey 1994). S. P. Morris (1985, p. 185) proclaimed that a discourse about the significance of off-site sherd scatters is tantamount to "making a mountain out of a manure-hill."

30. Osborne 1985.

31. Alcock, Cherry, and Davis 1994.

32. Alcock, Cherry, and Davis 1994, p. 154, table 8.1; but here again, they do not give full weight to the range of constituent elements that may have contributed to *kopros,* particularly those generated in the household in addition to the farmyard (see above, note 21).

33. Alcock, Cherry, and Davis 1994, pp. 169–170. It should be noted that

Although it is not possible to test the soil matrix that formed part of the fill of the putative *koprones* at Halieis (they were excavated in 1974 and 1975), recent excavation and study of a comparably sized pit in the Late Hellenistic villa at Gravina di Puglia in Southern Italy yielded 35.6 kg of pottery and 93 kg of tile in addition to an array of other artifacts, including faunal and floral remains.[34] Soil analysis conducted there showed extremely high levels of phosphorus, indicating the rich organic content of the feature. The excavators do not hesitate to identify it as a *sterculinum*.

As to the question about rates of ceramic consumption and discard, my work with the domestic assemblages from Halieis, as well as comparison with data from elsewhere, indicates the presence of large inventories of domestic pottery in the Classical household combined with their rapid turnover.[35] Similar scenarios have been documented in numerous ethnographic studies,[36] and are a basic premise upon which survey archaeology itself operates. In short, large amounts of inorganic debris as well as compostable organic waste existed (as today) that periodically had to be removed from dwellings.

OIL PRESSES

In addition to *koprones,* at least five, and perhaps eight, olive-oil press installations can be recognized in the houses at Halieis.[37] As many as twenty more examples of press furniture have been noted on Classical to Hellenistic-period sites identified by the Southern Argolid Exploration Project within the territory of Halieis and its neighbors.[38] Recently, Lin Foxhall has called into question the function of the Halieis press installations, and the identification of urban presses in general, as having been used for oil extraction.[39] She attempts to resuscitate an early misidentification of the Halieis presses as having contributed to a local industry producing purple dye from murex shells. This hypothesis was first published by John Young with regard to the remains on the so-called Industrial Terrace (for which,

these objections were raised in a postscript to their original article, and that the authors were initially as unaware of my work with the Halieis *koprones* as I was of theirs. Indeed, in recent discussions, Alcock has supported the identification of the Halieis *koprones*. What remains a matter for debate is the extent to which their contents can be taken to account for off-site sherd scatters.

34. Small et al. 1994.

35. Ault 1994a; Ault and Nevett 1999.

36. See the overview in Rice 1987, pp. 293–306 (with bibliography), with table 9.4 and fig. 9.4.

37. Definite presses: Area 4, house (press bed; Jameson 1969, p. 328; Young 1963, pp. 3–4); Area 6, Room 6-4 (press bed), and Room 6-29/House D (entire press room cleared; discussed below); Area 7, Room 7-20 (press bed); Industrial Terrace (entire press room cleared; discussed below). Possible presses: Area 6, Room 6-83/House A (perhaps in the process of conversion to a press room; see below, note 54), and Room 6-91/House B (weight block); Greek Archaeological Service excavations (northwest of Area 6; weight block).

38. Jameson, Runnels, and van Andel 1994, pp. 384–385, with table 6.6, where it is noted that press installations occur at "a ratio of one out of six [i.e., houses and sites] in both town and country" during the Late Classical and Early Hellenistic periods. For a historical overview of olive cultivation in the southern Argolid, see pp. 268–276. Press furniture from the Southern Argolid Survey (comprising press beds, weight blocks, and *trapeta*) is treated in Runnels, Pullen, and Langdon 1995, pp. 128–133.

The most important studies of olive culture in classical antiquity generally include Amouretti 1986; Amouretti and Brun 1993; Forbes and Foxhall 1978; Foxhall (in press); and Mattingly 1996.

39. Foxhall 1993, especially pp. 184–187.

see below).[40] Michael Jameson began to doubt this interpretation early on, and has since gone to some length to refute it.[41] David Reese, while also acknowledging the well-attested prominence of nearby Hermioni in the murex dye industry, does not find the evidence from Halieis in any way compelling enough to support the hypothesis.[42] The quantities of shells required for extracting the pigment known as "Tyrian purple" (where 12,000 *Murex brandaris* were needed to produce enough dye to trim a single garment[43]) are nowhere in evidence. Elsewhere, Virginia Anderson-Stojanović has recently shown that two other so-called dye works, those from Isthmia and Hellenistic Mycenae, were almost certainly oil-press installations.[44]

Two of the domestic press complexes at Halieis have been fully cleared and are discussed here in order to illustrate their workings. The first is located in House D (Figs. 4, 11, 12), in a room carefully finished with a plaster pavement that continues up the surrounding walls. A marble press bed, 1 m in diameter, is situated upon this pavement, its spout extending over a small hemispherical jar (Depth 0.28 m; Diam. 0.42 m) sunk into the pavement. Adjacent to the press bed is a much larger sunken pithos (Depth 0.78 m; Diam. 0.70 m) probably used as a settling basin for the pressed oil prior to its decanting. A weight block to which the press beam was once attached, most likely by means of a wooden capstan and ropes, lies 4 m away to the west.[45] The mechanism by which the press operated would therefore have been a lever press of the sort described by Cato (*Agr.* 18), an example of which has been reconstructed in the Villa of the Mysteries at Pompeii.[46]

40. Young 1963, p. 6, with a plan and photographs on p. 7, identifying the press remains on the Industrial Terrace as a dye works.

41. Jameson 1969, p. 324; and Jameson, Runnels, and van Andel 1994, pp. 316–319, especially p. 317, note 21.

42. Reese 1989, and pers. comm. 1991.

43. Reese 1987, p. 204.

44. Anderson-Stojanović 1996, especially pp. 91–93; 1997a; and 1997b. In a recent conversation (1997), L. Foxhall stressed the multiple functions presses might have served, over and above having been designated for any single purpose (cf. Foxhall 1997, pp. 258–259). I find such a position more accommodating, but will continue to refer to the Halieis installations as oil presses.

45. A roughly circular conglomerate stone found upon the marble press bed (visible in Fig. 12; Diam. ca. 0.60 m; Th. ca. 0.12 m) is probably in situ and, so, integral to the press itself, having served as the upper pressing stone. Other artifacts recovered at Halieis probably associated with oil extraction include a series of large shells, generally identified as conch, *tonna*, or whelk, which until recent times continued to be used to skim oil off the water also exuded as part of the pressing process. One such shell was identified in the excavation notebook as having been found adjacent to the press in House D (trench notebook for 065/330, unit 17), but it was not recorded as such in the accompanying finds notebook along with other artifactual material recovered here. Catalogued examples of possible shell skimmers or ladles from Halieis include HV305 and HV307; the latter comes from House E, Room 6-13, a room with a markedly industrial character (see Ault 1994a, especially pp. 194–196). An uncatalogued "conch" skimmer is also noted to have come from the L-shaped room south of the press room on the Industrial Terrace (Jameson 1969, p. 323).

46. See Drachmann 1932, p. 101, with p. 145, fig. 12, and p. 164, fig. 34. The reconstructed (wine) press in the Villa of the Mysteries is illustrated in Amouretti 1986, pl. 32:a.

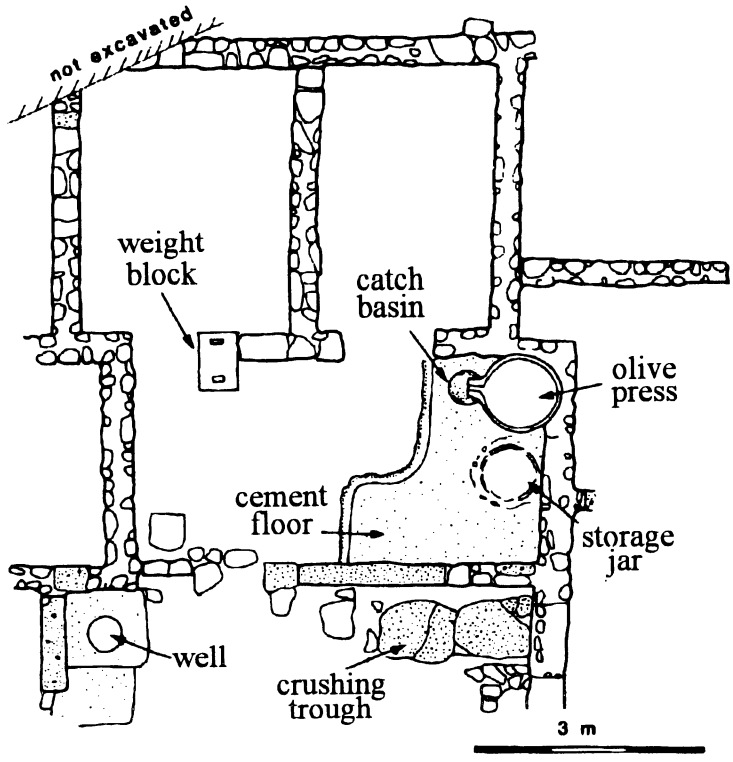


Figure 11. House D, detail of state plan (Fig. 4) with press complex.
Drawing by T. D. Boyd; after van Andel and Runnels 1987, p. 106, fig. 6

Figure 12. Press room in House D (from south)

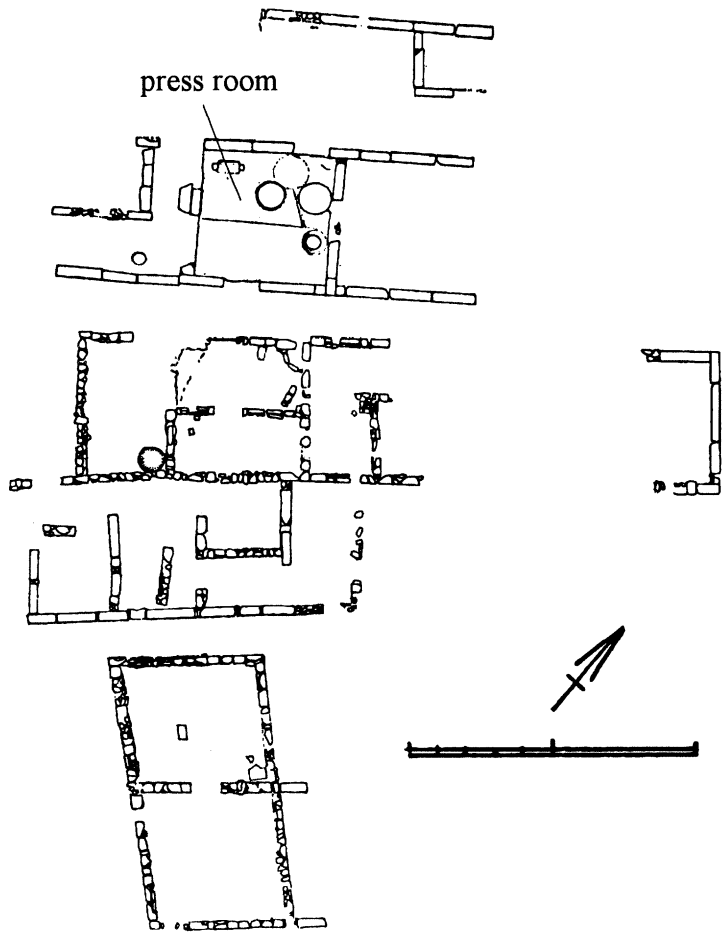


Figure 13. Plan of the Industrial Terrace. Courtesy of the Halieis Excavations Publication Committee

In addition, in the adjacent courtyard is a trough probably used for the preliminary crushing of the fruit prior to its actual pressing (Figs. 4, 11). Measuring ca. 1.0 × 2.30 m, the bottom of the trough is recessed 10–20 cm into the surface of the latest floor level and comprises at least two fine-grained conglomerate slabs.[47] Finally, as we have already seen, but perhaps even more significant once its olive press is taken into consideration, House D also has the largest *kopron* known from the site. Into this *kopron* could have been fed the not insubstantial by-products from the oil-production process. Such residues include the *amurca,* or bitter lees, initially produced by the olives, as well as the spent press cakes, which also would have made a good fuel for heating or cooking.[48]

The second fully excavated press installation at Halieis lies in a house on the Industrial Terrace, just downslope east of the acropolis (Figs. 2, 13–15).[49] Although the press bed is not a separate element situated above floor level, a circular impression in the pavement may indicate that a bedding stone lay below the plaster surfacing. In this arrangement, the pressed oil was channeled into a ceramic basin that lay 1.5 m to the southeast, set into a lower elevation of the pavement. Flanking the outflow channel of the press bed were two sunken pithoi, one of which survived in situ with its rim set just above floor level. These would have served as settling basins, perhaps for two distinct grades of oil.

47. Such troughs are rarely encountered in situ in the archaeological record, presumably because they generally consisted of movable and multipurpose furniture. While the more specialized milling device, the *trapetum*, is now attested from Late Classical contexts (Foxhall 1993, pp. 190–191; 1997, p. 259; contra Forbes and Foxhall 1978, pp. 41–42), it too survives infrequently from them. An upstanding crushing trough not dissimilar to that at Halieis has been identified by Forbes and Foxhall (1978, p. 41, fig. 3) in the Hellenistic house at Praesos in the same room as remains of an oil press (cf. Bosanquet 1901–1902, pp. 259–270). Recent excavations on Cyprus have brought to light other crushing troughs, where cylindrical rollers of calcarenite have been found in association with them (Hadjisavvas 1992, pp. 7–8, citing examples from Syria and Israel as well).

48. Among the finds from the excavations of Roman Karanis (Egypt), displayed in the Kelsey Museum of Archaeology at the University of Michigan, are what were long identified as loaves of bread. Recovered from one of the city's granaries, they have been shown by recent analysis to consist instead of "pressed olive-matter," probably destined for use as fuel. I would like to thank S. E. Alcock for sharing this information with me. See Amouretti 1993 for a full discussion of the by-products of oil and wine production and their potential economic significance.

49. Although surely erroneous in positing the identification here of a dye works (as discussed above), see Young 1963, p. 6, with p. 7, for a plan of the room (top right: "Dye Works-Area C"), and a photograph from the northwest (lower right: "The main room of the dye works"). See also Jameson 1969, pp. 323–324, with p. 322, fig. 4, and pl. 81f.

The most curious point regarding the mechanism of the press on the Industrial Terrace is the position of its weight block. Like the possible stone bedding of the press, it too was sunk below and covered over by the pavement. Two rectangular holes for affixing the *stipites,* or uprights, into the lewis-holes of the weight block indicate its location 2 m west of the press bed. Moreover, it is set perpendicularly to the axis of the bed, which would have mandated that the press beam be parallel rather than at a right

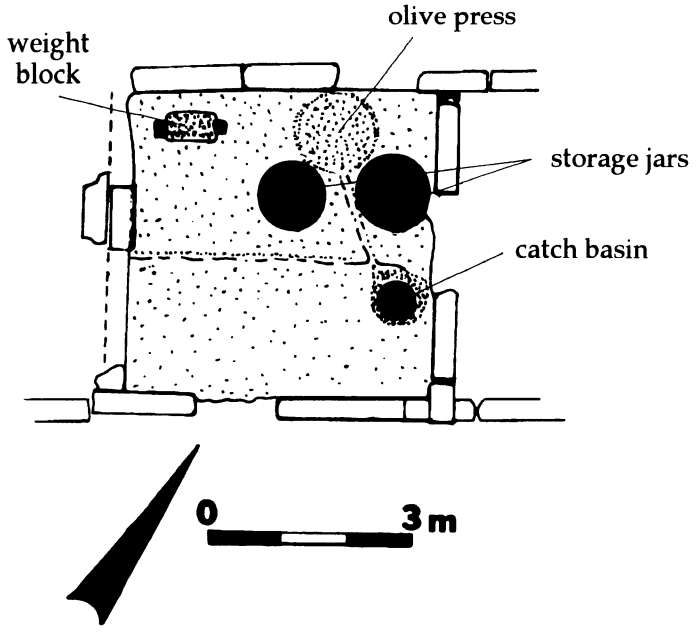


Figure 14. Plan of the press room on the Industrial Terrace. Courtesy of the Halieis Excavations Publication Committee

Figure 15. Press room on the Industrial Terrace (from southeast)

angle to the weight block itself. This arrangement may relate not only to the small size of the room, but to the ability of such a design to maximize leverage on the beam in the limited space available. A similar canting of weight block, uprights, and drum in relation to the press bed can be seen in an alternative reconstruction of Cato's press that takes account of the layout he describes for an oil-press installation (*Agr.* 18).[50]

Good archaeological confirmation for the arrangement of the press on the Industrial Terrace at Halieis has been found in a Hellenistic farmstead in the Tauric Chersonesos (modern Crimea), where, in a press room, the weight blocks for two presses were set with a similar orientation to their press beds.[51] Similarly, on Cyprus, four Roman presses exhibit an arrangement whereby "the drum was placed on the axis of the *praelum* [the press beam], thus proving beyond doubt Drachmann's interpretation of Cato's text referring to [a] 'near' and 'far' *stipes*."[52] Although not yet published in detail, the 4th–3rd century B.C. presses in the Rachi settlement at Isthmia were laid out and presumably functioned in a similar manner.[53]

DISCUSSION AND IMPLICATIONS

The two types of domestic installations briefly discussed here, *koprones* and oil presses, are linked via their role in increasing agricultural productivity and efficiently processing that yield. The houses in question, however, were clearly not laid out with press installations in mind. These are later features added in the 4th century when the processing amply attested in the contemporary *chora* was deemed insufficient or when any existing (and archaeologically undocumented) communal press facilities were overworked as a result of intensification of olive cultivation and oil production.[54]

As to the forces motivating a concerted effort toward olive production and oil processing, Tjeerd van Andel, Michael Jameson, and Curtis Runnels have pointed out that areas with the highest-quality cultivable soils in

50. Drachmann 1932, p. 103, with p. 165, fig. 35, and pp. 115–117, with p. 166, fig. 36.

51. Functioning as a winepress, only one of the weight blocks remained in situ at the time of excavation. See Dufková and Pečírka 1970, pp. 167–173 (Farmhouse Strzheletskii 26, phase II), especially pls. VIII:10, VIII:11.

52. Hadjisavvas 1992, p. 119.

53. Anderson-Stojanović 1996; and pers. comm. 1996. Also see Blackman 1997, pp. 18–20, with figs. 19–21, for reconstructions of the Rachi press installations.

54. Acheson's observation (1997, p. 181) that the intraurban presses at Halieis may have been used to deal with "bumper" harvests, which with traditional methods of cultivation come only once every few years, leads one to wonder why extra presses would not simply have been installed in the *chora.* Her point does emphasize, however, the brief period annually during which such installations would have been in use, and that their constituent elements beyond press beds and weight blocks are likely to have been dismantled and stored, or put to other purposes, when not being actively used. Elsewhere, Foxhall has attempted to identify a variety of ancillary pieces of equipment associated with pressing listed for sale in the Attic Stelai (1993, pp. 194–199; 1997, p. 261).

Although no pressing furniture (i.e., weight block or press bed) was encountered there, given the telltale arrangement of its plaster pavement, the probable kitchen in the northwest corner of House A (Fig. 3) appears to have been undergoing conversion into a press room at the time of its abandonment (cf. the press room in House D, Figs. 4, 11; as well as Foxhall's recognition of this fact [1993, p. 187]). Forbes and Foxhall (1978, p. 46) have suggested that in antiquity, as is the case today, as many as ten families might have shared a press given the expense incurred with its acquisition.

the territory of Halieis were fairly limited and lay some 2 km away from the city (these are the "deep soils" noted in Fig. 1).[55] Closer, however, were alluvial soils on hillsides and valley bottoms, which, they observe, while less well suited to grain cultivation, were ideal for olives.[56] They have further suggested that the degree of prosperity attained by Halieis in its final, 4th-century phase, may have been linked to its role supplying olive oil to external markets. Potential customers could have been found in Attica and its commercial dependents, which first were deprived of oil as a result of the annual ravaging of crops during the Peloponnesian War.[57] Also, the territories of Thebes and Megalopolis underwent rapid growth in the 4th century and were located in regions poorly suited to olive cultivation.[58] Finally, in the wake of Alexander the Great's conquests, vast, far-flung, and newly Hellenized areas were opened up as potential markets and sources of exchange.[59]

Much of the potential economic viability of oliculture posited for Classical Greece hinges not only on the retrodiction of evidence for large-scale agribusiness attested in the Roman world, but from more contemporary production figures.[60] Nevertheless, from 4th-century Attica comes a calculation based on [Demosthenes] 42 (*Against Phainippos*) that land planted with olive trees was worth three times the equivalent area sown with wheat.[61] From that same century have been documented widely fluctuating prices of oil, where a *metretes* (39.4 liters) ranged from 12 drachmas at Athens, to 36 drachmas at Lampsakos, to 55 drachmas at Delos.[62] Combining these prices fetched with what is offered as a "highly speculative" but "conservative" estimate that in the every-other-year cycle of olive fruiting, a family might average 250–300 liters of oil from its trees,[63] the potential value of a household's olive harvest could itself fluctuate between 76.14 and 418.55

55. See van Andel and Runnels 1987, pp. 105–109, maps 20, 21 (the latter reproduced here as Fig. 1); and Jameson, Runnels, and van Andel 1994, pp. 383–394, figs. 6.17, 6.18, back-pocket map 8.

56. "Greek informants and observation have shown that bottom lands are fine for olives (in the islands they are especially sure that water accumulates there), but they will produce quality fruit rather than quantity on slopes" (M. H. Jameson, pers. comm. 1992). In all likelihood, grains or legumes were intercropped among the olive trees, as is still the case in many areas today (Jameson, Runnels, and van Andel 1994, p. 385).

Recently, Acheson (1997) has reevaluated the agricultural potential of the soils, especially the so-called Loutro alluvium, in the vicinity of Halieis, and suggests that they were capable of sustaining greater agricultural productivity than was posited by the Southern Argolid Exploration Project.

57. Arguing against the notion of a generation-long gap in the ability of Attica to regain its potential for oil production is Hanson (1998, especially pp. 55–68, and pp. 157–161), who notes the hardiness of olive trees, the difficulty in utterly destroying them, and their rapid properties of regeneration. In spite of their long-term resilience, olive trees are notoriously sensitive, and annual disruptions coupled with their normally fluctuating productivity could have seriously curtailed their yield over the short term even if the trees themselves remained alive. It is also worth noting here that on two occasions, in 430 and again in 425, the *chora* of Halieis was itself subject to ravaging at the hands of the Athenians (Diod. Sic. 12.43.1; Thuc. 2.56.5).

58. See van Andel and Runnels 1987, pp. 107–109; also Runnels and van Andel 1987.

59. Jameson, Runnels, and van Andel (1994, p. 392) acknowledge that numerous other areas in addition to the southern Argolid participated in the settlement boom and dispersal that characterized the century between ca. 350 and 250. It is no coincidence that these are virtually all regions that have been carefully studied by archaeological surface surveys.

60. See, for example, Mattingly (1996) for the Roman world; and Forbes (1993) for cautionary observations about the role of the olive in reconstructing the economic history of the southern Argolid itself.

61. Pritchett 1956, pp. 183–184, citing Jardé 1925, p. 187.

62. Pritchett 1956, p. 184.

63. Forbes and Foxhall 1978, pp. 46–47.

drachmas. But did the domestic (micro) economies of the citizens of Halieis, let alone the economy of the polis, turn on such transactions?

Arguing against sweeping economic explanations, others point out that a distinct lack of market orientation characterized much of the ancient economy.[64] Rather, they emphasize the goal of self-sufficiency, with individuals seeking insurance against low-crop yields and outright failures by incorporating risk-management or buffering strategies at the household level.[65] Given indications that olive cultivation and oil production were so ubiquitous in regions that supported the practices, and not ultimately all that profitable or dependable as a source of income,[66] it has been argued that the apparent Late Classical and Hellenistic boom in olive cultivation in the *chora* of Halieis was primarily of local significance. That is, it was meant to supply the burgeoning population of the Halias peninsula.[67]

Halieis surely benefited from its position at the mouth of the Argolic Gulf. Possessing a fine naturally sheltered bay and harbor, the polis is unlikely to have merely served as a pawn in the military aspirations of others.[68] The enormous quantities of Attic, Corinthian, Argive, and other imported pottery present at the site stand as an index of ongoing commercial activity with the wider Greek world.[69] There is ultimately no reason why any local surplus production of olive oil would not have found its way onto trading vessels passing through (or sent out by) Halieis, although we probably should use caution in not overemphasizing the role of the olive in linking the local economy to wider networks.

Koprones and oil presses in the houses at Halieis reflect a conscious effort to maximize the fertility of the *chora* as well as the preoccupation of householders with agricultural subsistence and wider market orientations. This is true to such an extent that facilities for the collection of domestic waste enabling its transformation into fertilizer and for processing agricultural produce into a commodity of exchange, in addition to its subsistence value, were brought within the city walls, into the households themselves. These household installations mark points at either end of an agricultural and economic cycle. The outflow of domestic waste as fertilizer to the *chora* was in time and in turn met by an inflow of agricultural produce for processing, storage, consumption, and sale. A glimpse at the economic motivations behind material manifestations is one we are rarely offered at a domestic level; at Halieis, we have the additional benefit of documentation from both excavation and regional survey. As is frequently the case, archaeologically generated evidence supplements our understanding by adding a significant nuance to the interpretation of the past. At Halieis, as elsewhere, farmers worked not only in their fields. Practices leading to the enhancement of soil nutrients for greater crop yield and processing had a place in urban household settings and also account for ways in which domestic microeconomies laid the foundations for regional macroeconomies in 4th-century B.C. Greece.

64. E.g., Finley 1973; Austin and Vidal-Naquet 1977; and Cartledge 1983.

65. These strategies include extensive storage of staples like grain and oil, simultaneously pursuing alternative subsistence strategies (from pastoralism to hunting), and polycropping across fragmented landholdings. For specialized studies of risk-management strategies see especially Gallant 1991; Garnsey 1988; and Halstead and O'Shea 1989.

66. E.g., Finley 1973, p. 133; Foxhall 1997, especially pp. 261–262; and Sallares 1991, pp. 304–309.

67. Acheson (1997) has formulated the most explicit version of this argument. She has also emphasized the small-scale nature of the numerous agricultural establishments located by the Southern Argolid Exploration Project in the *chora* of Halieis (especially in comparison with what are clearly more extensive ones), and that they will have had the same subsistence-driven orientation as their urban agriculturally oriented counterparts.

68. Nevertheless, it is the strategic importance attached to the location of Halieis that is behind most of the limited references to the city in the primary sources. For the most comprehensive historical overview of the southern Argolid generally, see Jameson, Runnels, and van Andel 1994, pp. 57–148.

69. To remind ourselves only of the ceramic material recovered from the *koprones,* a minimum of sixty-one vessels associated with food and drink consumption (cups, plates, and small bowls) were characterized by imported fine fabrics and account for 42.4% of the total (144) represented from that feature in House D (Appendix 1). From the *kopron* in House 7, a minimum of seventy-two vessels associated with food and drink consumption were imported fine wares and account for 31.3% of the total (230). Many, if not most, of the remaining vessels in plain and coarse wares from both *koprones* will also have been acquired via market exchange.

APPENDIX 1
INVENTORIES FROM TWO *KOPRONES*

HOUSE 7

A total of 6,230 pottery fragments were recovered from the latest habitation levels of House 7. Of these, 824 is the minimum number of vessels (MNV) represented. The MNV counts are based on vessels for which profiles could be reconstructed and rim and foot fragments. The total includes eleven reconstructable profiles, all of which are fineware vessel forms. No whole vessels were recovered.

The capacity of the *kopron* in House 7 is ca. 3 m^3. The following pottery, other artifacts, and organic remains were found.

Total Sherds		*MNVs by Function*	
72	=	59	(25.6%) associated with cooking
71	=	49	(21.3%) associated with drink consumption (fineware cups only)
69	=	38	(16.5%) associated with serving and pouring liquids (includes fine- and plainware drink-serving containers)
37	=	36	(15.7%) associated with food preparation other than cooking
27	=	23	(10.9%) associated with food consumption (fine wares)
92	=	18	(7.8%) associated with storage
571	=	7	(3.0%) of other or undefined function[70]
T = 939		T = 230	

Other Artifacts

6	lamp fragments
4	loomweights
2	miniature vessel fragments
309+	roof tile fragments[71]
14	metal fragments (2 iron, 2 bronze, 10 unidentified)

70. "Other" includes primarily vessels associated with cosmetics (pyxides, lekythoi, etc.). The majority of the material here, however, is "undefined," comprising undiagnostic body sherds or sherds belonging to indeterminate shapes.

71. See above, note 6, for an explanation of roof tile counts.

Organic Remains

1.5 small bags bone
0.5 medium bag bone
2+ shells

HOUSE D

More than 4,536 pottery fragments were recovered from the latest habitation levels of House D. Of these, at least 601 vessels are represented. The MNV counts are based on whole vessels, vessels for which profiles could be reconstructed, and rim and foot fragments. The total includes four whole vessels and seventeen reconstructable profiles. These include vessel forms in fine, plain, and coarse wares.

The capacity of the *kopron* in House D is ca. 5 m^3. The following pottery, other artifacts, and organic remains were found.

Total Sherds		*MNVs by Function*
70	=	38 (26.4%) associated with drink consumption (fineware cups only)
44	=	27 (18.8%) associated with cooking
24	=	23 (16.0%) associated with food consumption (fine wares)
69	=	20 (13.9%) associated with food preparation other than cooking
299	=	19 (13.2%) associated with storage
100	=	11 (7.6%) associated with serving and pouring liquids (includes fine-, plain-, and coarseware drink-serving containers)
966+	=	6 (4.2%) of other or undefined function
T = 1,572+		T = 144

Other Artifacts

1 lamp fragment
3 loomweights
5 miniature vessel fragments
1,000+ roof tile fragments
11 metal fragments (2 iron, 5 bronze, 4 lead)
1 coin (Troizen)

Organic Remains

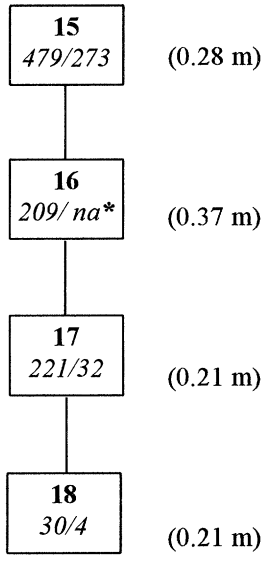
4 shells
carbonized wood and seeds

APPENDIX 2
MATRICES OF STRATIGRAPHY FOR TWO *KOPRONES*

The following schematic diagrams (matrices) represent the stratigraphy from the *koprones* in House 7 and House D. Unit numbers are in boldface type; sherd/tile counts for each stratigraphic unit are given in italics; and the average depth of each unit is listed in parentheses outside each box.

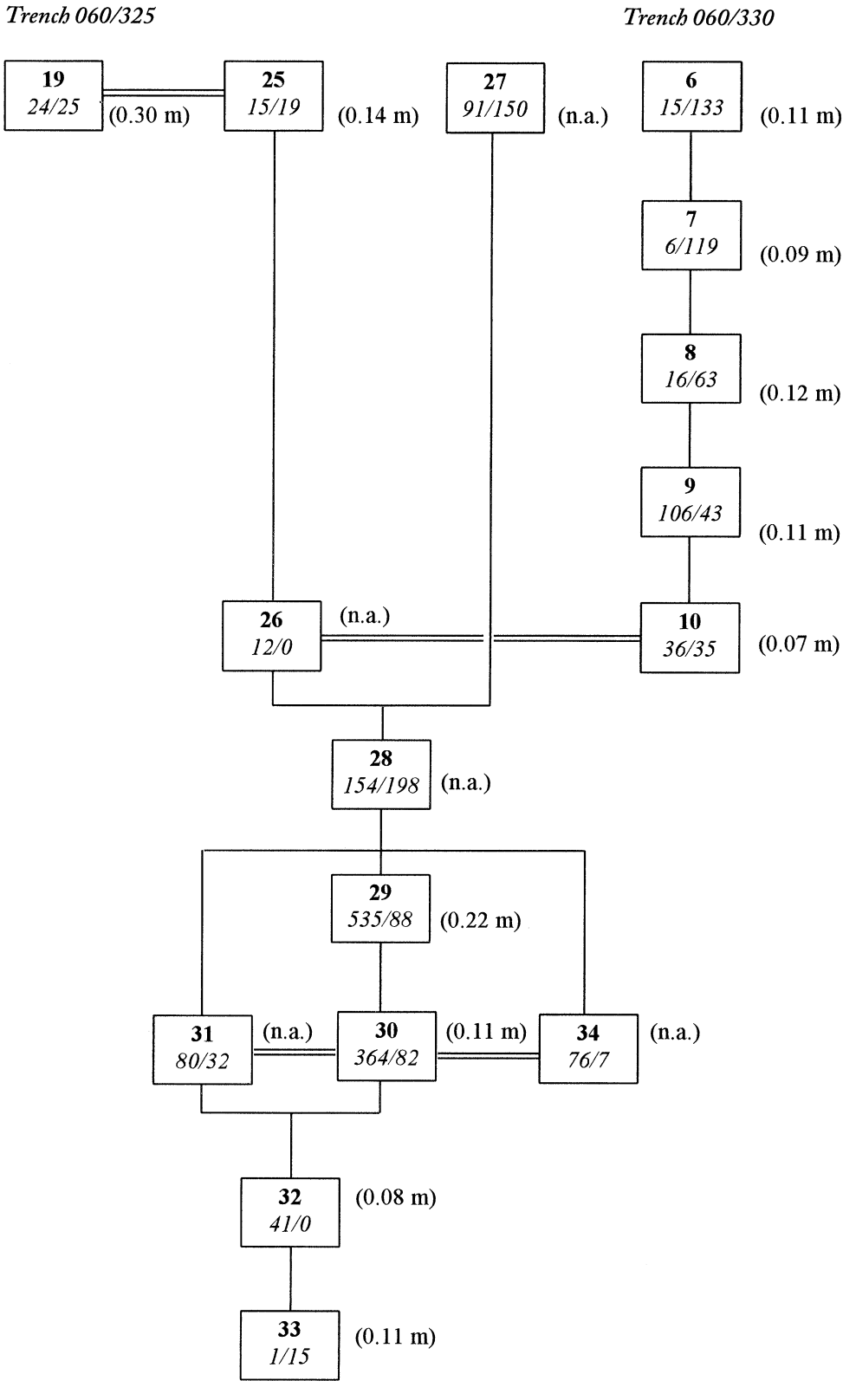
HOUSE 7

Trench 000/355



*The find notebook entry for Trench 000/355, unit 16, indicates that a large number of tile fragments were present, but apparently no precise counts were made.

HOUSE D


Trench 060/325
Trench 060/330
19
24/25
(0.30 m)
25
15/19
(0.14 m)
27
91/150
(n.a.)
6
15/133
(0.11 m)
7
6/119
(0.09 m)
8
16/63
(0.12 m)
9
106/43
(0.11 m)
26
12/0
(n.a.)
10
36/35
(0.07 m)
28
154/198
(n.a.)
29
535/88
(0.22 m)
31
80/32
(n.a.)
30
364/82
(0.11 m)
34
76/7
(n.a.)
32
41/0
(0.08 m)
33
1/15
(0.11 m)

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