A Neolithic Household at Piana di Curinga, Italy

Albert J. Ammerman
Colgate University
Hamilton, New York

Gary D. Shaffer
Louis Berger and Associates
East Orange, New Jersey

Nicholas Hartmann
Narbeth, Pennsylvania

The report gives the first detailed description of an early Neolithic house in the Western Mediterranean. Among the wattle-and-daub structures excavated at Piana di Curinga, a settlement of Impressed Ware Neolithic age located on the Tyrrhenian coast of southern Italy, the best preserved is the one found in Area H at the site. Excavations here have led to the recovery of more than one ton of baked daub fragments representing the walls of the structure. The many impressions left in the daub by timbers and wattles belonging to the wooden framework of the structure permit detailed studies to be made on the materials and techniques used in its construction. The report also examines the lithic remains, predominantly worked pieces of obsidian, found in association with the house. Attention is paid to the reduction technology used in the working of obsidian and to traces of microscopic wear observed on the edges of obsidian blades. The report considers the question of the use and organization of space as seen at the household level in Area H at Piana di Curinga. It also discusses several cases of resource exploitation and some of their wider implications for the study of Neolithic economics.

Introduction

This report has three main objectives. The first is to present in some detail one of the wattle-and-daub houses excavated at the site of Piana di Curinga. Neolithic studies in the Western Mediterranean to date have been marked by a limited knowledge not only of the number and layout of such structures at settlements but even of the nature of individual houses themselves.[1] It is only in the last decade that this situation has finally begun to change. For example, our fieldwork in the Acconia area of Calabria, the region comprising the toe of southern Italy, has brought to light the first good series of wattle-and-daub buildings of Impressed Ware Neolithic age in this part of Europe (Ammerman, Bonardi, and Carrara 1980; Ammerman 1987a). Of the structures excavated to date, the best preserved is the one that was found in Area H at the site of Piana di Curinga. More than 1000 kg of daub fragments, representing the walls of the collapsed structure, were recovered during the course of excavations. The numerous impressions of timbers and wattles in the daub offer a wealth of information not previously available on early Neolithic building materials and techniques. The second aim of the report is to examine the lithic remains, predominantly worked pieces of obsidian, recovered from the occupation surface associated with the house. Since the time of its abandonment, this occupation surface has remained more or less sealed under the mass of daub fragments generated by the collapse of the structure itself. Particular attention will be paid in this report to questions that concern reduction technology, microscopic wear traces on tools, and patterns in the spatial distribution of different classes of lithic remains. The third objective is to discuss in somewhat broader terms several questions that relate to the exploitation of natural resources and to the

1. For a review of the limited state of knowledge on Neolithic settlement patterns in the Western Mediterranean as late as the mid 1970s, see Phillips (1975); Evans (1976); and Guilaine (1976). For overviews on the current situation, see Geddes (1986) and Guilaine et al. (1987).

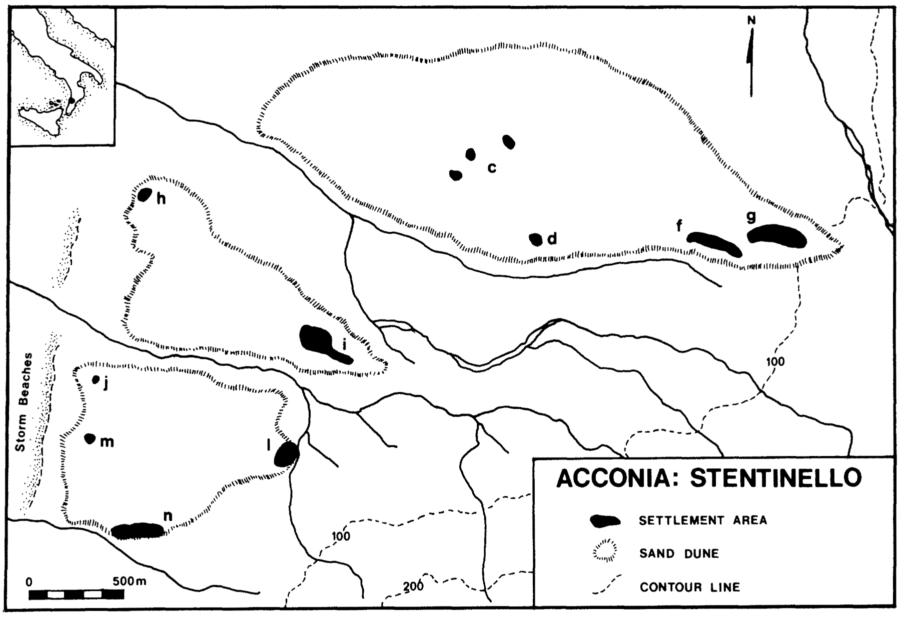


Figure 1. Map of settlements of Stentinello age in the Acconia area of Calabria. Piana di Curinga is settlement *i*.

interpretation of spatial patterns as seen at the household level.

Piana di Curinga, as shown in Figure 1, is one of 10 sites of Stentinello age to be identified by means of surveys undertaken in the Acconia area of Calabria (Ammerman 1985a; Ammerman 1987a). This distribution map presents the densest pattern of Impressed Ware Neolithic settlement to be recognized so far on the west, or Tyrrhenian, coast of Italy. Comparable patterns of occupation are well known in the Foggia area on the east, or Adriatic, coast of Italy (e.g., Cassano and Manfredini 1983). A combination of thin soils and deep plowing in this century has meant, however, that notwithstanding extensive fieldwork on the Tavoliere over the last 40 years, very few Neolithic houses (or occupation surfaces that are still intact) have been recovered in this area (e.g., Tinè 1983). It is worth adding that there are 11 other areas in Calabria, in addition to the one at Acconia, where Stentinello Impressed Ware is now documented (Ammerman 1985a: fig. 7.3). This is a recent development resulting from survey work conducted in the region during the last 15 years. In fact, prior to 1970, Stentinello pottery was almost unknown in the region; the Neolithic period was represented only at a few cave sites in the northern part of Calabria.

The settlement of Piana di Curinga is situated on the upper part of the central dune at Acconia. As can be seen in Figure 1, there is an average spacing of less than 1 km between the sites at Acconia. The preferred location for a settlement would appear to be near the edge of a dune and in proximity to a small stream. The occurrence of this number of sites in a dune area raises questions of interest with regard to Neolithic practices of land use (e.g., Ammerman 1985a; Ammerman 1985b). It should be mentioned that the dune area at Acconia is not a unique case in Calabria; similar patterns of Stentinello occupation are observed in the dune area near Nicotera (Ammerman 1985a: fig. 7.4). At Acconia, the formation of the system of paleo-dunes dates to the end of the Pleistocene and the early Holocene (Remmelzwaal 1985). The dunes formed over fluvial terraces of earlier Pleistocene age. Incised in the terraces are stream valleys which run from the hills in the interior toward the coast. Two such narrow valleys delimit the north and south sides of the dune where the site of Piana di Curinga is located. The streams in these valleys, which are fed by natural springs in the interior, are normally active even in the drier summer months. The coast in Neolithic times, as seen from the series of storm beaches on the young coastal plain, would have been only about 1.5 km west of Piana di Curinga.

Figure 2 gives the distribution of 48 wattle-and-daub structures of Stentinello age at the site of Piana di Curinga. The work that led to the structures' identification was based upon a field strategy that combined a magnetometer survey and an extensive series of hand borings and exca-

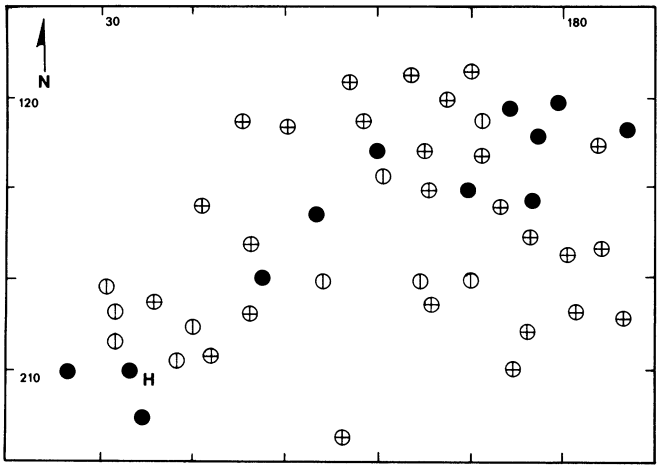
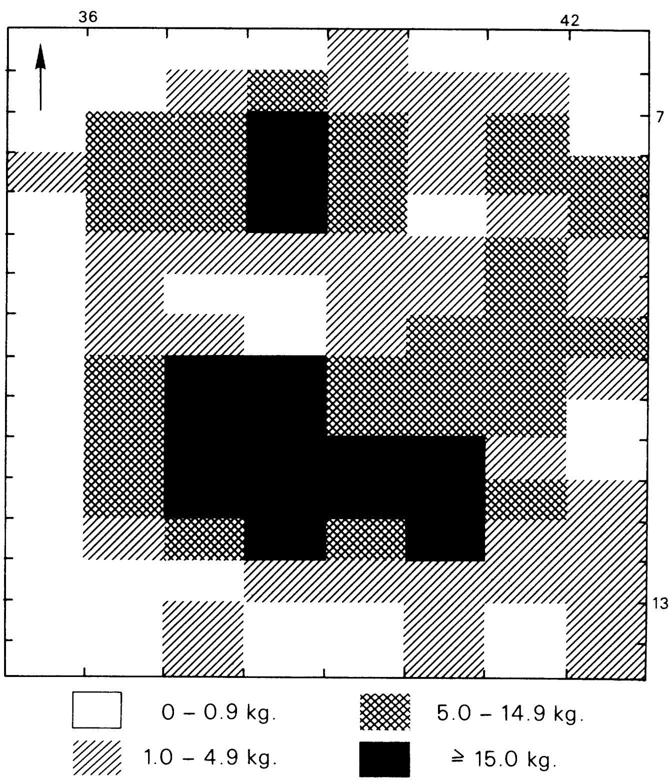


Figure 2. Map showing the distribution of known wattle-and-daub structures at the site of Piana di Curinga. Circles with a cross indicate those cases (26) where a structure was first identified by the magnetometer and then confirmed by hand borings. Solid circles represent those cases (12) where a structure was tested by excavation following initial identification by the magnetometer and borings. Circles with a vertical line comprise those cases (10) where a structure was identified by means of hand borings alone. The grid system is in meters.

Figure 3. Distribution map of daub weight in Area H at Piana di Curinga. The weights are displayed in terms of 128 spatial units which each measure 1.0 m in length and 0.5 m in width.



vations (Ammerman 1987b). This is, in effect, the first plan showing the distribution of structures within a settlement of Impressed Ware Neolithic age in the Western Mediterranean. The comment should be made that it is unlikely that all 48 structures within the approximately 2-ha area of the settlement were actually occupied at the same time. Without going into an extended discussion of various alternative models of site occupation here (see Ammerman 1987b), it is much more likely that the distribution represents a palimpsest of structures inhabited at different times during the life of the settlement. The aim of this report, as indicated at the outset, is to focus attention on the level of the individual household—specifically the one in Area H on the sw side of the settlement. This is in keeping with the view that households are, as it were, fundamental building blocks in the study of Neolithic settlement patterns and that what has been lacking in the literature on the Western Mediterranean to date is due attention to this level of social and economic organization. The present report is an attempt to make an initial step in this direction.

By way of introduction, it is useful to say a few words about the methods employed in the excavations. The structure in Area H was first identified during the course of a preliminary magnetometer survey made in the spring of 1977. As part of initial excavations conducted in the autumn of that year, a small exploratory trench was excavated down to the top of the daub of the collapsed structure. This revealed the excellent state of preservation of the structural remains in Area H. The daub was left in place and the test trench was backfilled with sand to await further work at a later date. In 1977, major attention was paid to the excavation of the structure in Area C at the site, which also yielded more than a ton of fire-hardened daub (Ammerman, Bonardi, and Carrara 1980). In planning for the next field season, there was the opportunity to refine methods used for the recovery and recording of daub fragments. All pieces of daub measuring 9 cm or more in length were now individually recorded in terms of their orientation in the ground as well as their coordinates in three dimensions.[2] A total of 1,065 daub fragments were recovered in Area H in this way. In addition, all smaller fragments of daub were collected in terms of excavation units measuring 0.5 m × 1.0 m; this material was used for the construction of a map showing the spatial distribution of the weight of daub remains (FIG. 3). The

2. The recording system, which was developed by Shaffer, includes the north orientation of each daub fragment and its dip and strike. Each plotted piece of daub was assigned an individual number in the field, drawn on a plan, and individually collected. Exposed daub surfaces were also recorded by means of vertical photographs in stereo pairs.

actual excavation of the structure in Area H was done over a period of 15 weeks in the spring of 1979.[3]

The structure occurs at a depth of ca. 90 cm below the modern land surface, where it is found in association with the B horizon of the second and lowest paleosol observed in soil profiles.[4] The texture of the soil is very coarse sand with some small gravel. At the base of the B horizon, which is dark brown in color and continues for a depth of ca. 10 cm below the structure, there is a gradual and smooth boundary to an underlying BC horizon which is lighter in color (dark yellowish-brown). The original A horizon of this paleosol appears to have been intentionally removed during the course of the preparation of the building site. Since the dune slopes off to the south and west in this part of the site, this would have included some leveling of the local dune surface. At the top of the soil profile in Area H, there is a modern (very dark brown) plow zone ca. 29 cm thick. At its base, there is a thin (3 cm) soil horizon that is dark brown in color and locally presents traces of a fine volcanic sediment. This sediment, which is seen in a comparable position in other soil profiles at Acconia, can be linked with the Vesuvian eruption of A.C. 79. As a marker horizon, it reveals that the land surface in Area H has inflated by some 30 cm over the last two millennia. The first paleosol, which occurs between 32 cm and 75 cm in depth, consists of an upper A horizon (very dark brown in color) and a lower BC horizon (dark yellowish-brown). This upper paleosol formed over the collapsed structure in more recent prehistoric times (i.e., after the Stentinello period). In fact, it is the progressive inflation of the dune surface over the last 6000 years that accounts for the remarkable preservation of the Stentinello structures at Piana di Curinga.

By way of introduction, it is worth mentioning here that the pottery found in association with the structure is the subject of a separate study (Ammerman 1983; Ammerman and Bonardi in press). This analysis showed that at least 21 different fine-ware vessels—each decorated with carefully stamped impressions in horizontal bands, the hallmark of the Stentinello pottery tradition in southern Italy—are represented among the ceramic remains recovered from the occupation surface. In terms of absolute chronology, dating for the structure is provided by a ^{14}C determination of 6930 ± 60 b.p. (radiocarbon years).[5] This is the oldest of a series of ^{14}C dates obtained for various Stentinello contexts at Acconia. Such an early date is in accord with the presence of several coarse-ware sherds with cardial decorations (i.e., a motif obtained by rocking the edge of a shell over the surface of a vessel) in Area H. This kind of decoration, which belongs to the earlier part of the Impressed Ware pottery sequence in the Western Mediterranean, is not found in the other excavation areas at Piana di Curinga.

Structural Remains

Perhaps the most striking aspect of the structural remains in Area H is their sheer abundance. As mentioned above, a total of 1065 large fragments of fire-hardened daub were individually plotted. Detailed studies of the structural remains in Area H have been made by Shaffer (1983) as part of his thesis. Only a synthesis of the various analyses carried out will be presented here. It is convenient to begin by considering the overall size and shape of the original structure. There are five lines of evidence in the present case that can contribute to such a reconstruction: 1) the spatial distribution of weights of daub; 2) the spatial distribution of large daub fragments (i.e., those ≥ 9 cm in length); 3) the spatial distribution of cobbles (used as filler in the walls); 4) soil stains in the subsurface just below the structure; and 5) spatial patterns in the joins of ceramic vessels. In Figure 3, it can be seen that not much daub was recovered in the center of Area H or at its periphery. Dense concentrations of daub, which reach 30 kg or more in weight per sq m, are observed in

3. Support for the fieldwork was provided by grants from the National Science Foundation (BNS 76-15095, 79-06187 and 81-11348). We would like to thank the following for their help on various aspects of the research: the late Dr. G. Foti, Superintendent of Archaeology in Calabria; Dr. S. Bonardi of the University of Parma (excavation supervisor); Dr. A. Remmelzwaal of the FAO (soil studies); Dr. A. Bartlett and A. David of the Ancient Monuments Laboratory in London (magnetometer survey); W. Andrefsky and N. Benco of the State University of New York at Binghamton (lithic classification); Dr. P. Vaughan of the University of Pennsylvania (advice on the microwear analysis); Dr. S. Van der Leeuw of the University of Amsterdam (ceramic technology); Dr. A. Scolari of the University of Padua and D. Curran of the State University of New York at Binghamton (mineralogical studies); Dr. S. Marchiori and Dr. S. Razzara of the University of Padua and Dr. J. Pals of the University of Amsterdam (palaeobotanical studies); and Dr. E. K. Ralph of the University of Pennsylvania (radiocarbon dating).

4. A description of the basic sequence of horizons (A-B-C) encountered in soils on the dunes at Acconia is given in Remmelzwaal (1985). The soil colors follow the system of the 1975 *Munsell Soil Color Charts*; the soil colors cited here are those for soils in a moist condition. For the grain-size distribution of samples of sand from Acconia, see Remmelzwaal (1985: table 2.2). Faunal remains are not preserved in the coarse-grained sands at Acconia.

5. The laboratory number is P-2946; the sample is a single, long piece of charcoal recovered at the SW corner of the structure. It is likely that Stentinello occupation at Acconia lasted for most of the fifth millennium b.c. (uncalibrated radio-carbon years). Examples of other ^{14}C dates for Stentinello contexts at Acconia are 6710 ± 80 b.p. (P-2949) and 6430 ± 90 b.p. (P-3047). When they are calibrated (Klein et al. 1982; Stuiver and Kra 1986), the earlier Stentinello dates would go back to the middle of the sixth millennium B.C.

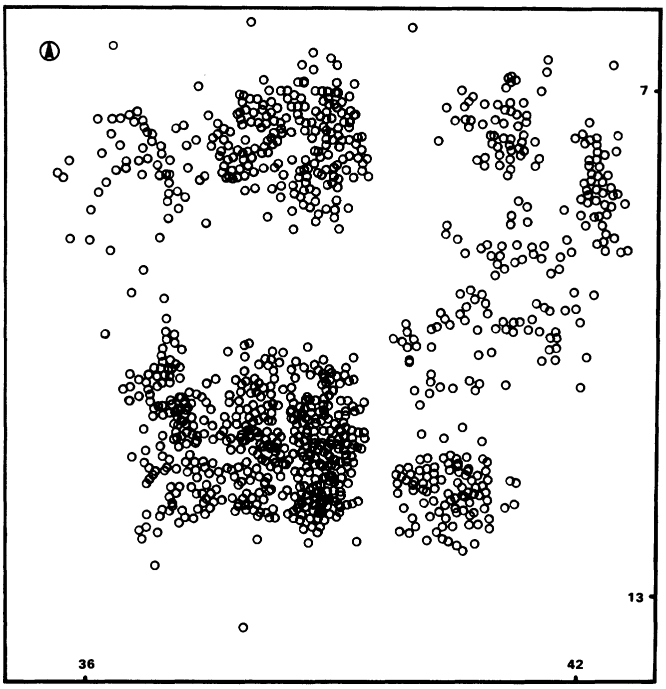


Figure 4. Distribution map of large daub fragments in Area H at Piana di Curinga (after Shaffer 1983: fig. 29). Each of the daub fragments plotted here measures 9 cm or more in length.

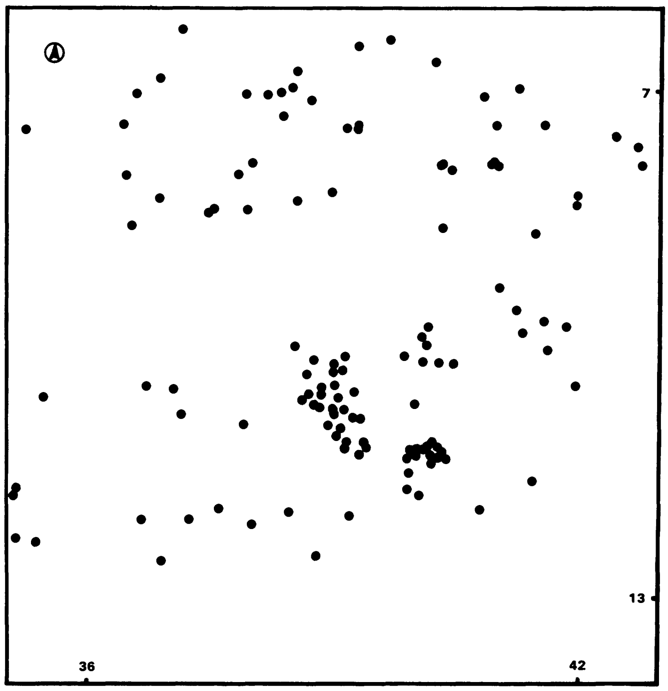


Figure 5. Distribution map of cobbles in Area H at Piana di Curinga. Each of the stones plotted here measures 9 cm or more in length.

essentially two main bands that both run in an E–W direction. When a wattle-and-daub wall collapses, it tends to generate a band of daub fragments on the order of 2 m wide, which reflects the original "run" of the wall. Such wall runs are observed, for example, in the case of the experimental structures in wattle and daub that we built and then fired at Acconia (Shaffer 1981). The main mass of daub in a wall tends to collapse within 1 m of the original wall line. Thus, it is reasonable to infer that the two dense bands correspond respectively to the north and south walls of the structure.

Figure 4 shows much the same pattern: few large pieces of daub are seen either in the center or at the outside of the area. Concentrations of large fragments are again likely to reflect wall runs. The careful analysis of the spatial distributions seen in Figure 3 through 5 leads to the estimates of wall lengths given in Table 1.[6] When the three estimates for each wall are displayed together on a map of the area, the sets of wall lines match quite closely. They reveal a slightly elongated building with an E–W orientation. This reconstruction is corroborated when it is compared with the map of soil stains below the structure (Shaffer 1983: fig. 34). The dark stains observed in the sub-soil show that the west side of the structure, which probably had an opening, would have run approximately along the 37 E line of the grid system. There are also stains that correspond to the north wall (running in an E–W direction essentially along the 8 S grid line) and to the south wall (running again in an E–W direction along the 11 S grid line). In addition, evidence from the joining of sherds that belong to ceramic vessels broken in situ just outside the south wall of the structure (see Ammerman and Bonardi 1986: fig. 3, where the main group of sherds belonging to vessel A, for example, occurs between 11.25

Table 1. Estimates of the length in m of the north, east, and south walls of the structure in Area H at Piana di Curinga based on the analysis of the spatial distributions shown in Figures 3 through 5 respectively (see note 6).

	North Wall	*East Wall*	*South Wall*
Weight of daub	4.9	3.4	4.0
Daub fragments (≥9 cm)	5.1	3.9	3.3
Cobbles (≥9 cm)	4.7	2.9	4.1

6. The method used for estimating the ends of a given wall segment is based on computing the center of gravity of the set of points or weights in a spatial distribution (see Shaffer 1983). For a plan of Area H in which the different estimates of wall lengths are displayed together (superimposed), see Shaffer (1983: fig. 34). Daub was not used for either the roofs or the floors of Stentinello structures at Piana di Curinga.

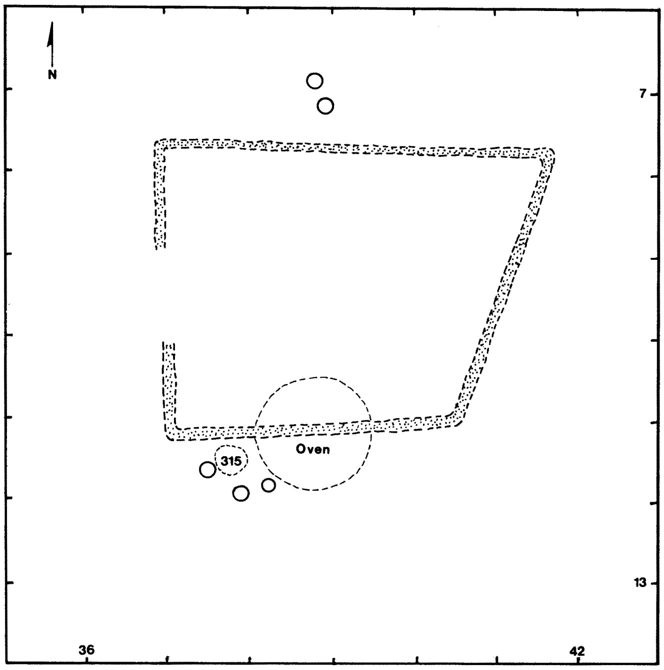


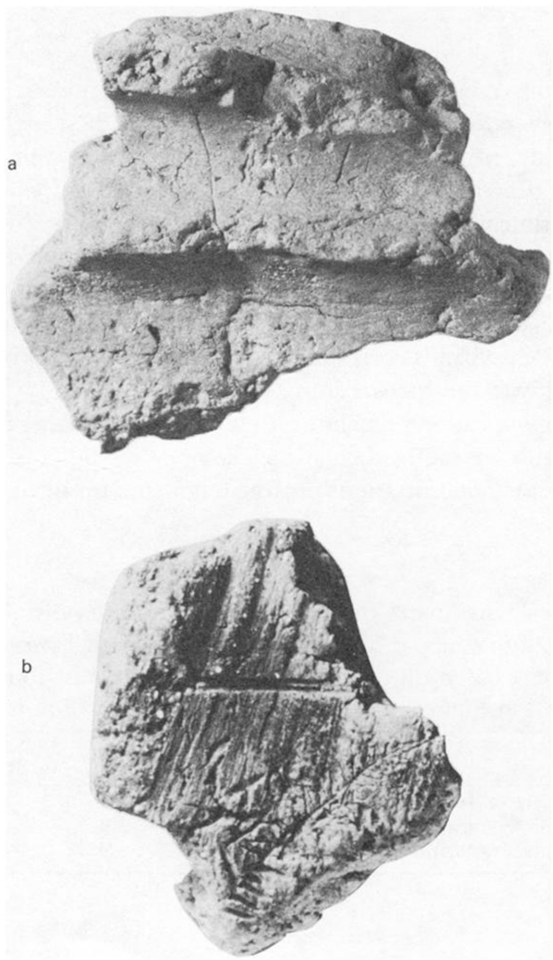
Figure 6. Plan of the wattle-and-daub structure in Area H at Piana di Curinga. The reconstructed wall lines are those which best fit the distribution for daub remains and cobbles. A possible oven is shown as built into the south wall of the house. The plan also gives the locations of rock feature 315 and five ceramic vessels found in situ just outside of the structure.

and 11.75 S on the grid system) indicates that the south wall had to stand to the north of ca. 11.25 S on the grid system. Thus, the house would measure approximately 4.5 m in length by 3.5 m in width. As is well documented in the case of the house in Area C at the site, it is likely that the structure was subrectangular in form.[7] An overall reconstruction of the plan of the house in Area H is given in Figure 6. From a comparative point of view, it is worth adding that the other wattle-and-daub structures excavated to date at Piana di Curinga have much the same size as the one in Area H and that clay floors are observed at none of the structures. The floor of a house was simply the leveled surface of the dune itself.

In considering the steps involved in constructing a wattle-and-daub structure, the next step after preparing the building site was to erect the timber framework. Information on this aspect of the structure in Area H is provided by the impressions left by the framework in more than 900 of the large fragments of daub. A total of 172 fragments shows evidence for timbers and saplings that run parallel to one another (FIG. 7). One of the implications here is that the wooden framework was a reasonably dense one. There are 20 fragments that reveal the impressions of two or more pieces of wood running more or less at right angles to one another. Such fragments document the occurrence of horizontal wooden members in the framework. Examples of sizeable horizontal wattles measuring up to 3.5 cm in diameter are observed in Area H. In addition, 14 fragments contain impressions that show the cut end of a timber or sapling (Shaffer 1983: fig. 35). There is good evidence that the framework included large primary supports; 17 fragments of daub preserve timber impressions that measure 15 cm or more in diameter.

A more detailed picture of the relative abundance of timbers and wattles of different sizes in the framework is

Figure 7. Photographs of daub recovered in Area H at Piana di Curinga: (a) impressions of three round timbers running parallel to one another, and (b) impression of a split timber (running from top to bottom) with the superimposed imprints of the stipe and blade of bracken fern (*Pteridium aquilinum*). The maximum dimensions of the pieces are respectively 13.6 and 10.6 cm.



7. In Area C, the north corner of the structure reveals a well-defined wall band in the subsoil; this clearly shows two straight walls meeting at a right angle (Ammerman, Bonardi, and Carrara 1980: fig. 3). The structure in Area C measures approximately 4.5 m × 3 m.

shown in Figure 8. These histograms are based on measuring the actual length of the impressions belonging to a given size class or diameter.[8] The total length of timber and wattle impressions observed in the daub remains from Area H is 67.9 m. A distinction is made in the histograms between round or whole pieces of wood and those that have been split (FIG. 7). The impressions in the daub reveal that the lengthwise splitting of a timber or sapling was a fairly common practice. The total length of impressions of split pieces of wood in Area H comes to 27.1 m. As can be seen in Figure 8, there is some tendency for split pieces to have smaller diameters than round pieces. It is also evident that the diameters predominantly represented in both cases are between 4 cm and 9 cm. In fact, more than two-thirds of the total length of impressions would fall in this size range. One implication of such sizes is that the framework as a whole was a reasonably robust one; another is that young trees or saplings were extensively exploited for building the framework. At the same time, it is important to bear in mind the wide range of different sizes of timber and wood that is observed.

Once the frame was in place, the next step in the building process was to daub the walls of the structure. Clayey sediments are required for this purpose, but they do not occur naturally on the sand dune itself. The nearest potential source of such material is to the south of the site where the fluvial terrace underlying the dune is exposed along the lower slopes of the stream valley. In the case of Area H, the procurement of material for making daub would have involved the transport of such sediment over a distance of 100 m or more. The actual use of local sediment from the fluvial terrace is confirmed by mineralogical analyses made on daub fragments (see the technical report by D. Curran which appears as an appendix in Shaffer 1983). In addition, cobbles of gneiss and gabbro, which occur locally in the stream valleys at Acconia, were used as a filler in the daubed walls (Shaffer 1985a).[9] Evidence documenting such a practice takes the form of daub adhering to cobbles and also a join between a cobble and its impression in a piece of daub. As seen previously in Figure 5, there may be as many as 124 cobbles that

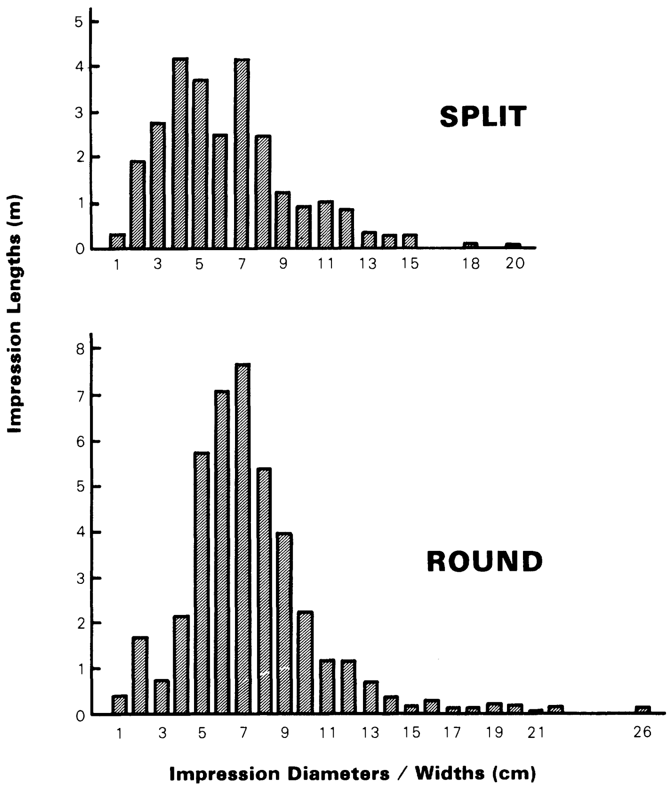


Figure 8. Bar charts showing the frequency distribution of the diameters of timbers and saplings as measured from impressions left in daub fragments from Area H at Piana di Curinga. These are given respectively for round and split timbers (see note 8).

were once incorporated as filler in the walls of the structure. Examination of the daub also reveals the impressions of many small grass-like fragments. It is likely that grass and other plant materials such as ferns were intentionally added to the clayey sediment in order to render the daub more workable during the course of its application to the framework. It is worth adding that pieces of obsidian and Impressed-Ware sherds, anthropic material in circulation on the site surface, were occasionally incorporated in the daub as well. In terms of the thickness of the walls, there are 40 fragments of daub with smooth surfaces in Area H that permit such a measurement. They yield an average size of 16 cm (with an associated standard deviation of 2 cm). It means that the walls, which no doubt showed a certain degree of variability from one spot to the next, ranged for the most part between 14 cm and 18 cm in thickness.

Given the estimates that are available for the size of the structure and the thickness of its walls, it is instructive to estimate, if only as a rough approximation, the volume of clayey sediment that would have been required to daub

8. For the method used in estimating the diameters and lengths of impressions, see Shaffer (1983: 178–199). The histograms shown in Figure 8 do not include small cylindrical performations measuring 2.5 cm or less in diameter; these were observed in a total of 124 daub fragments from Area H. It is difficult to measure the length of such narrow impressions *inside* a fragment of daub. This means that the smaller diameters are underestimated in Figure 8.

9. According to the Wentworth scale, pebbles measure 2–65 mm in their longest dimension; cobbles 64–256 mm; and boulders ≥256 mm. Pebbles of both quartz and quartzite occur naturally in the clayey sediments of the fluvial terraces exploited for daub at Acconia.

the structure in Area H. With due allowance made for openings in the structure and the volume of the timber framework itself, this value turns out to be on the order of 3 cu m.[10] As mentioned above, the nearest source for the clayey sediments would have been at least 100 m from the structure. It is evident that substantial effort was required for the procurement of sediment for a wattle-and-daub house at Piana di Curinga. This is a subject to which we shall return in the discussion at the end of this report.

Leaf impressions left in the daub by various plants may offer valuable information on the time of year when the house in Area H was built.[11] There are only certain seasons when all of the plants listed in Table 2 have leaves that are green and thus could have left impressions in a fresh form (i.e., impressions of curved, flexible leaves). The main season when all of the plants in Table 2 would have been green simultaneously is from the middle of March through June. There is also a brief period of about a week in October when they are all fresh again, but this period is probably too short for purposes of construction. Moreover, building during the autumn and winter months would have presented greater difficulties in terms of seasonal patterns of rainfall. From October through February, on the basis of modern weather patterns (e.g., Remmelzwaal 1985: table 2.1), each month has on average nine or more rain-days. Thus, it would have been more efficacious, assuming that patterns of rainfall during the course of the year were roughly comparable in Neolithic times, to complete the daubing of a structure in May or June, months with fewer rain-days, and to let a new structure slowly dry out during the summer months. In terms of seasonality, construction in the spring, as seems to be the case in Area H, would also have permitted the procurement of wood for the framework to be scheduled during the preceding winter months, a time of the year traditionally recommended for the cutting of timber in the Mediterranean world (e.g., Vitruvius, *De architectura* ii.9.1).

At this point, it is worth describing briefly three features that appear to be associated with the structure. There is good evidence, as mentioned above, for a small rock feature (315) located just outside the south wall of the structure (for information on the number and kinds of rocks used for this and the other two features, see Shaffer 1983: table 45). Three ceramic vessels were found in association with this feature, which measures less than 1 m in diameter (Ammerman and Bonardi in press: fig. 3). Along the middle of the south wall, there seems to be evidence for an oven or small kiln, which may have been built into the wall itself. Several fragments of daub with either a convex surface or a hand-smoothed lip were recovered in this area. In the vicinity of 11 S–39 E on the grid system, a dense cluster of cobbles and rocks, feature 311, is also observed (FIG. 5). This is one of the places in Area H where the sub-soil shows a well-developed reddish stain; one explanation for such a stain here would be the repeated firing of an oven or kiln. A third feature (316) may be present along the south side of the excavation area. It is located some 2 m from the south wall of the structure and consists of a loose cluster of rocks and stones that covers an area measuring ca. 3 m in length (in an E–W direction) and ca. 1 m in width. The feature occurs just beyond the area of the main concentration of daub of the collapsed south wall. It is possible that the feature has become disarticulated (or its rocks and cobbles partially robbed) at a time after the collapse of the structure. In any event, the character of this rock feature is far from clear. It should be added that other features located further away from the structure, where excavations have yet to be conducted, may belong to the household in Area H. It is also worth noting that there is no evidence for the occurrence of features inside the house itself.

Lithic Remains

Most of the material presented in this section was found just below the thick layer of daub fragments that has covered the major part of the occupation surface since the time of the structure's collapse. Such favorable circumstances of preservation are seldom observed at Neolithic sites in other parts of the Western Mediterranean. Obsi-

10. The estimate of the total volume of the walls of the structure is based upon multiplying the perimeter of the building (16.0 m) by the average wall thickness (0.16 m) by the height of the walls, which is assumed here to be 1.5 m. This yields a volume of 3.8 cu m. If a figure of 0.8 cu m is allowed for openings in the walls (doors and possible windows) and the volume of the wooden framework itself, this gives a total on the order of 3 cu m. Note that if the wall height were taken to be 30 cm higher or lower, it would only mean increasing or decreasing this value by about 25%. It is unlikely in light of normal human stature that the walls were much less than 1.20 m in height or much higher than 1.80 m.

11. Many of the plant remains (other than grasses and ferns) were probably incorporated only accidentally in the daub. The plant impressions and carbonized plant remains observed in the daub fragments from Area H are the following: a leaf imprint of *Quercus ilex* (holm oak), a leaf imprint of *Quercus* sp. (oak), a carbonized cupule (the cuplike structure in an acorn that holds the nut), and a cupule impression of *Quercus suber* (cork oak), a carbonized cupule of *Quercus ilex* (holm oak), a definite imprint of *Salix alba* (white willow), a possible imprint of *Salix* sp. (willow), a leaf and stem imprint of the Cyperaceae family (sedge), four stem or leaf imprints of *Phragmites australis* (common reed), 14 blade or stipe (leaf stalk) imprints of *Pteridium aquilinum* (bracken fern), a blade imprint from the Polypodiaceae family (perhaps *Pteridium aquilinum*), a leaf imprint from the Gramineae family (grass), and two carbonized seeds resembling (*Sorghum* sp. The study (in progress) of the charcoal fragments recovered in Area H is being done by Drs. T. Bidal and J. L. Vernet of the University of Montpellier, France.

dian comprises the majority of the pieces of chipped stone recovered in Area H. The high percentage of obsidian is in good agreement with the values observed in the other excavation areas at Piana di Curinga and also during the Acconia Survey (Ammerman, Bonardi, and Carrara 1980; Diamond and Ammerman 1985). Less than 4% of the chipped stone remains are of chert. There appears to be no good source of workable chert or flint at Acconia; sources of a quality good enough for making large blades are not likely to occur within 50 km of the site. Of the nine chert pieces, only one is a blade and it lacks intentional retouch. But it is wide enough (2.7 cm) to be classified as a Stentinello blade.[12] The remaining eight pieces, which can be classified as flakes or core trim, are all quite small. They have an average weight of 0.8 g; only two of them weigh more than 1.0 g. It is interesting to note, however, that two of the eight show evidence of intentional retouch. One of them is an endscraper on a flake. In addition, more than half of the pieces reveal possible traces of use-wear. The high proportion of chert pieces with either retouch or traces of wear is in accord with the findings of the Acconia Survey (Diamond and Ammerman 1985: table 5.2). In terms of spatial patterns (FIG. 9), it is worth noting the cluster of four pieces that occurs on the south side of Area H.

12. The chert blade weighs 6.6 gm. Stentinello blades are by convention those measuring 20 mm or more in width; they take their name form the site of Stentinello in Sicily where they are commonly found. For a discussion of the Stentinello blades recovered during the Acconia Survey, see Diamond and Ammerman (1985: 65).

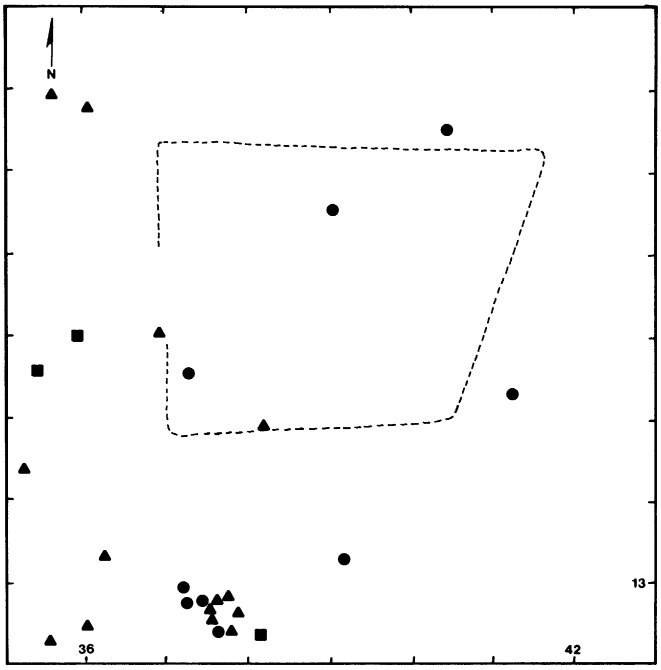


Figure 9. Map showing the distribution of pieces of worked chert (circles), obsidian cores (squares), and obsidian core rejuvenation flakes (triangles) recovered in Area H at Piana di Curinga.

A total of 225 pieces of obsidian was recovered from the occupation surface. Previous studies on the obsidian from Neolithic sites at Acconia indicate that the source of the obsidian was the island of Lipari, which is located more than 100 km from the site (Ammerman 1979;

Table 2. Seasonality of plants whose imprints are observed in the daub fragments recovered in Area H at Piana di Curinga.

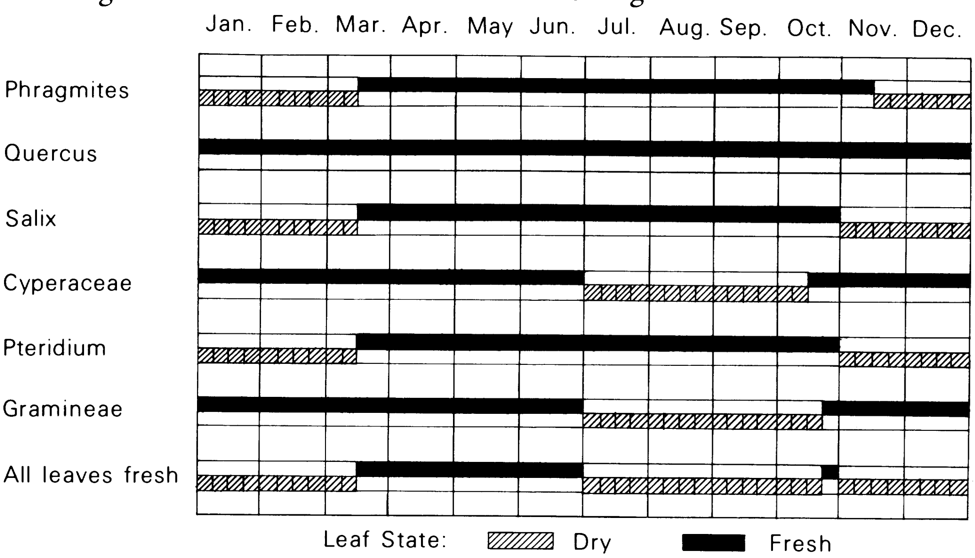


Table 3. Pieces of obsidian recovered from the occupation surface associated with the structure in Area H at Piana di Curinga. Mean weight refers to the average weight of a piece belonging to a given class; weight is in g.

	Count	*% of Count*	*Weight*	*% of Weight*	*Mean Weight*
Core	3	1.3	498.9	66.9	166.3
Core rejuvenation	15	6.7	37.7	5.1	2.5
Core-trim	105	46.7	130.4	17.5	1.2
Shatter	51	22.7	7.6	1.0	0.2
Error	10	4.4	12.0	1.6	1.2
Blade	41	18.2	59.0	7.9	1.4
Total	225	100.0	745.6	100.0	- -

Crummett and Warren 1985).[13] They also show that the reduction technology was oriented primarily toward the production of blades (e.g., Ammerman and Andrefsky 1982: 155–157) and that intentional retouch is seldom observed on obsidian blades or flakes (e.g., Diamond and Ammerman 1985: 68–69). As indicated in Table 3, a range of products and by-products of obsidian reduction is observed in Area H, including three cores whose locations are shown in Figure 9. All three have multiple platforms and none of them can be described as fully reduced or wasted. Nor is any of them a "pre-core" in the sense of a rough-out quarried on Lipari that required further working or preparation before it could be used for the production of blades.[14] The two cores found on the west side of the structure each weigh more than 200 g; they had not yet been subjected to active reduction. It should be noted that most of the actual weight of obsidian, 67% of the total, is represented by the three cores.

Good evidence for the working of obsidian in the vicinity of the structure is provided by the recovery of 15 core-rejuvenation flakes. Such pieces were removed in order to improve or renew the striking platform of a core. The flakes tend to be fairly large in size in comparison with other reduction by-products; their mean weight, 2.5 g, is more than twice that of the other classes (excluding cores themselves) in Table 3. In terms of their spatial distribution, all except one of the flakes occur outside of the house; they are seen only on the south and west sides of Area H. Six of the pieces form a cluster near the core observed on the south side of Figure 9. This location, which also shows a cluster of chert pieces, is an obvious candidate for an area where obsidian was either worked or where the by-products of reduction were discarded.

Core-trim comprises almost half of all the pieces of obsidian recovered in Area H. Most of the pieces are small flakes. Only 21 of a total of 105 pieces weigh as much as 2 g, and only three of them are more than 5 g. The implication is that there is little evidence for core preparation (i.e., the working of "pre-cores", a practice that commonly involves the removal of large flakes) at or near the structure. Instead, the pieces of core trim suggest the working of cores already in essentially prepared form (i.e., cores ready for the actual production of blades). In Table 4, it can be seen that one or more pieces of core-trim is present in 41 of the 1-m squares in Area H. There is, in other words, a broad spatial distribution for remains that represent, for the most part, by-products of the reduction of obsidian. Most of the squares without core-trim occur on the east side of the area. The presence of a certain number of pieces inside the structure is also well documented. The two places with the densest concentration of core-trim are both located outside of the structure, however. One of these is found near the NW corner of the building, while the other occurs on the south side where, as mentioned above, clusters of chert flakes and also obsidian rejuvenation flakes are observed.

Shatter is another class that shows a wide spatial distribution (TABLE 4). These are small pieces—generally weighing less than 0.2 g—that are incidentally produced when obsidian is struck. Such pieces offer no real potential for use as far as cutting edges are concerned; they are simply by-products of the reduction process. One or more pieces of shatter were recovered in 30 of the squares in Area H.[15] As in the case of core-trim, a few pieces are observed inside the structure. The one part of the area that yielded very few pieces of shatter was the SE corner. Taken in conjunction with a similar pattern for core-trim, the suggestion would be that not much in the way of lithic reduction was done in this part of Area H.

Blades, as mentioned earlier, represent the target product of the reduction technology. They constitute just under one-fifth of all of the pieces of obsidian found in the area. But only four of them occur as whole blades; the rest take the form of blade segments. Of these, 20 are

13. The other three sources of workable obsidian in the central Mediterranean—Pantelleria, Palmarola, and Sardinia—are all located more than 300 km from Piana di Curinga. On these sources, see Hallam, Warren, and Renfrew (1976). The obsidian from Area H was visually screened for pieces with a greenish color (characteristic of the obsidian from Pantelleria) or a patinated, opaque appearance (typical of Palmarola); no pieces with these characteristics were recognized.

14. The terminology used in this report (e.g., pre-core, core-trim, shatter) follows that of Ammerman and Andrefsky (1982: 155–157); an "error" involves a mistake in the striking of a blade or a piece of core-trim.

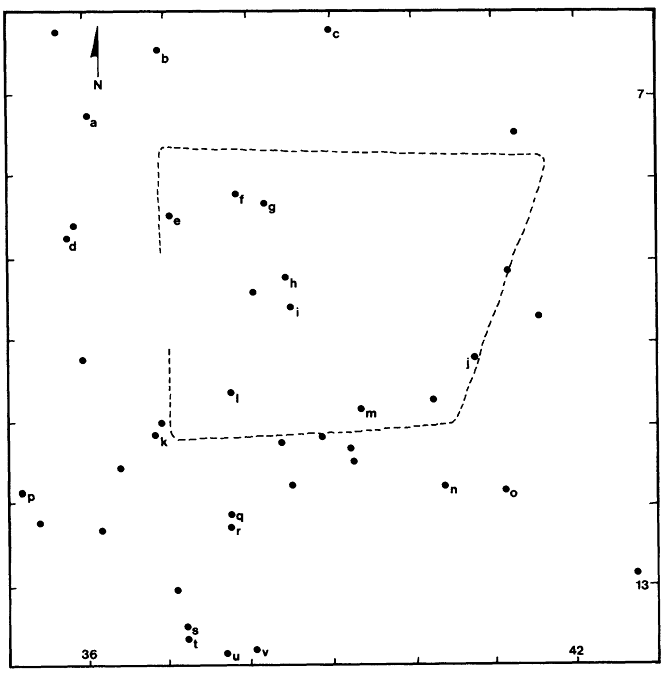
15. Because of the small size of pieces of shatter in combination with the coarse grain-size of the sand at Acconia (see note 4), recovery rates for shatter during the course of the excavations are less well controlled than those for other (larger) classes of obsidian.

Table 4. Pieces of obsidian core-trim (left) and obsidian shatter (right) recovered per sq m in Area H at Piana di Curinga. The coordinates of the grid system are given along the top and left side of the table.

	35E	36E	37E	38E	39E	40E	41E	42E
6S	1 0	3 3	1 3	5 1	0 1	0 0	0 1	1 0
7S	2 1	3 1	5 0	7 5	1 2	0 1	2 1	0 1
8S	1 0	2 1	6 1	1 1	0 1	0 0	0 0	0 0
9S	1 0	1 0	2 0	4 1	0 0	0 1	5 0	2 0
10S	4 0	2 0	2 2	1 2	0 0	1 0	0 0	2 0
11S	0 1	3 3	3 1	2 2	1 0	2 0	0 0	0 0
12S	1 1	1 1	3 0	1 2	0 1	4 0	0 0	0 0
13S	1 2	3 0	7 5	2 0	0 0	0 0	0 0	0 0

proximal segments and 15 medial segments. In cross-section, about one-half of the blades are triangular in shape and the other half trapezoidal. Intentional retouch is rare and, when present, takes the form of marginal retouch along a lateral edge. Only four definite cases of retouch are observed among the blades (TABLE 5). The blades have a mean width of 1.2 cm; three-quarters of the values fall in the range between 0.8 and 1.5 cm. Again, it is worth noting that all of these characteristics are in keeping with what is seen in other Stentinello contexts at Acconia (e.g., Diamond and Ammerman 1985). As shown in Figure 10, the blades are widely dispersed over the area. Some of them occur within the structure, eight of which, as we shall see below, show traces of use wear. The part of the area that has the largest number of blades is that located just outside of the south wall. It will be recalled that several features are present on this side of the house. There is also a small cluster of blades that is found along the southern edge of the area (i.e., in a place where other classes of lithic material also show a local concentration). Some comment should also be made here on what is not seen in Figure 10: that is, the occurrence of well-defined clusters that contain large numbers of blades. The distribution for blades offers little support for the notion that space around the structure was organized in terms of discrete, well-defined activity areas.

Figure 10. Map showing the distribution of obsidian blades recovered in Area H at Piana di Curinga. Blades with traces of microwear or evidence of intentional retouch are identified by letters which correspond to those used in Table 5.



The study of microwear traces, which was conducted by Hartmann, involved the examination of 50 pieces of obsidian from the area. This sample included all of the blades and also a certain number of pieces of core-trim, which in terms of their shapes and sizes seemed to offer good potential cutting edges. With regard to methodology, the study was based primarily on the identification of striations and other forms of edge damage as observed under the microscope.[16] In contrast with what is seen on chert and flint tools, polishes are not generally observed on obsidian tools, including those "worked" under experimental conditions.[17] Before turning to the results of the

16. The microwear study was conducted at the Museum Applied Science Center for Archaeology of the University of Pennsylvania. We would like to thank Dr. S. Fleming, Scientific Director of the Center, for allowing Hartmann to use MASCA's facilities. Each piece of obsidian was inspected both with a low power (10×–50×) stereomicroscope and a high-power (100×–400×) reflected-light metallographic microscope. For bibliographies on microwear studies, especially those pertaining to chert and flint, see Keeley (1980) and Vaughan (1985). For previous studies concerned with obsidian, see Hay (1977) and Lewenstein (1981). For previous microwear studies done by Diamond on obsidian from Neolithic sites at Acconia, see Diamond and Ammerman (1985).

17. As part of his study, Hartmann carried out a series of experiments in which pieces of obsidian were used to "work" different materials. Some of the experiments were done in relation to a previous study, see Hartmann (1980). No traces of polishes were recognized on these experimentally-worked pieces. The one exception in this regard would seem

Table 5. Obsidian blades (*a* through *v*) with evidence of microscopic wear patterns or intentional retouch recovered in Area H at Piana di Curinga.

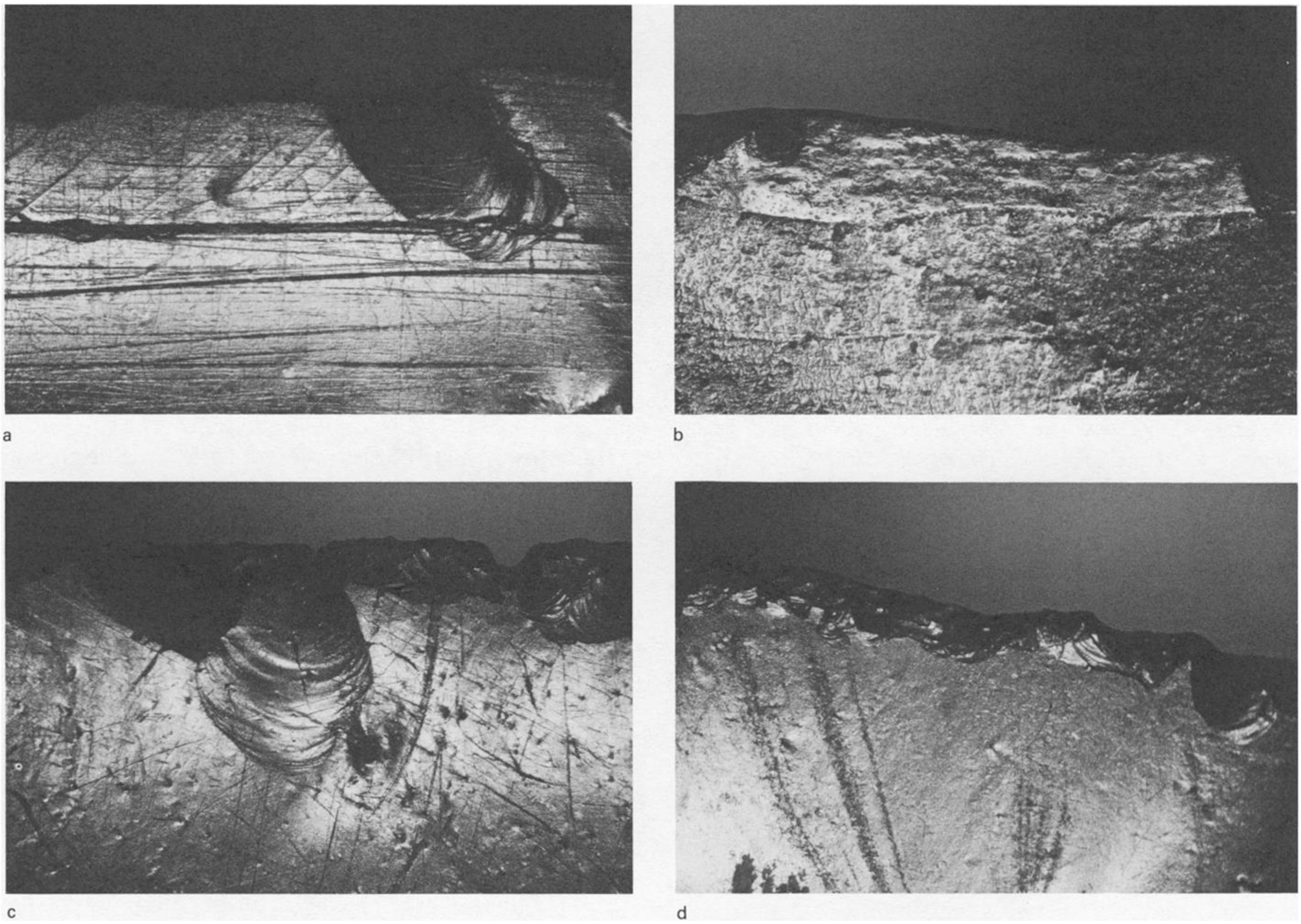
	Heavy Wear	Parallel Striations	Oblique Striations	Large Flat	Steep Rounding	General Scraping	Sickle Gloss	Intentional Retouch
a		▲		△				
b	△	▲		△				
c	◭					△		
d				◭	▲			
e				◭	△			△
f		◭		◭				
g	◭					△		
h						◭		
i			◭					
j		◭						
k							▲	
l		◭						◭
m		▲						
n		△	△					◭
o	◭					◭		
p		△	▲					
q		◭						
r					◭			
s		△						▲
t								◭
u		◭		◭				
v	△	◭						

Attribute Observation: △ Possibly Present; ◭ Present; ▲ Predominant

to be that of sickle gloss observed on Neolithic pieces in the present study and previously by Diamond and Ammerman (1985: 71–80). It is worth noting that the conclusions reached in the present study are similar in many respects to those reached by Diamond in his earlier and entirely independent study.

study, which are presented in Table 5, it is worth discussing briefly the categories of microwear identified on the edges of tools.

Striations, the most frequent type of wear observed, commonly occur parallel to the working edge of a tool



a b c d

Figure 11. Macrophotographs of use-wear observed on the edges of obsidian blades from Area H at Piana di Curinga: A) dense, deep striations running parallel to the working edge of blade ***a*** (scale 21×, note that the surface has been so densely scratched near the edge that it has an overall matte appearance); B) sickle gloss on blade ***k*** (scale 18×); C) blade ***u*** showing an isolated large flat microscar (scale 11×); and D) blade ***d*** showing steep rounding scars or an edge row (scale 14×).

(FIG. 11, A). The density and depth of the striations are correlated with the hardness of the material being worked, the pressure exerted on the tool, and also the length of time that the tool was used for a particular operation. While it is not possible to disentangle these three variables at the present time, this type and orientation of wear invariably corresponds to a slicing or sawing motion, ranging in intensity from light whittling to operations such as notch-cutting.[18] The striations observed on the tools from Area H are usually light to moderate in density and depth, which would imply the cutting of soft or thin materials (such as sinews, thin hides, or vegetable products). The second category includes two forms of edge damage: large, flat scars (0.1–0.3 mm in width) distributed discontinuously along the edge and small steep scars that often form a continuous bevel or what is sometimes called an "edge row".[19] Both are connected with the scraping of a

18. Vaughan (personal communication) has observed no direct correlation between striation depth and the hardness of the material being worked in his own experiments. He thinks that striations are caused by chips of the obsidian, which break off and become lodged between the blade and the material being worked. The hardness of the worked material would consequently affect the occurrence of striations only insofar as it influences the degree to which microchips are detached from the edge of the tools.

19. On the formation of an "edge row", see Vaughan (1985: 22). Scraping with the blade held almost perpendicular to the worked surface would correspond to what Diamond calls "upright scraping" and Keeley simple "scraping" as defined for flint. The brittle obsidian edge is unsuited to the alternative scraping orientation in which the blade would be used as a plane or chisel to gouge into the worked material. Such an operation would involve extreme stress on the edge and correspondingly rapid and heavy wear; it would almost immediately have ruined the cutting edge, especially in the case of comparatively thin blades such as those found in Area H.

blade along a worked surface in a direction perpendicular to the long axis of the blade. In view of the brittle nature of an obsidian edge, it is to be expected that blades used for scraping were normally held almost perpendicular to the surface being worked (in the manner of a cabinet-maker's scraper) and that a repeated one-way action was employed. Only the extreme edge of the tool rather than any appreciable portion of the bevel of the blade came in contact with the material being scraped. In order to achieve a smooth finish, only small amounts of material would have been removed with each stroke.[20] The third category of microwear consists of a highly lustrous deposit on the extreme edge of a tool (FIG. 11, B). It is more commonly observed on chert blades where it is often referred to as sickle gloss. This wear pattern appears to result from the repeated cutting or slashing of certain kinds of plants that deposit a thin coating of silica on the tool's edge.[21]

As can be seen in Table 5, definite microwear is observed on a total of 19 blades. In addition, two other blades (*n* and *s*) show possible wear traces. This means that evidence for use-wear is observed on only about half of the blades recovered in Area H. Also, traces of microwear are seen on four of the nine pieces of core-trim examined. One of these has wear traces characteristic of cutting and three of scraping. There is thus good evidence that pieces of obsidian other than blades were used to perform cutting and scraping operations. Incidentally, none of the four pieces of core-trim with traces of microwear shows the presence of intentional retouch. Likewise, there seems to be only a weak relationship between microwear and intentional retouch in the case of obsidian blades: one (*t*) of the four blades definitely with retouch shows no signs of use-wear, while two others (*n* and *s*) have only possible traces of microwear.

The most common kind of wear observed is that of striations that run parallel to an edge. Nine definite and three possible cases of this wear pattern are present among the blades in Area H. Blades with oblique striations, which perhaps derive from operations such as whittling, are less common. There are only two definite cases (*i* and *p*) of this wear pattern. In all, striations are observed on more than half of the blades with definite evidence of use-wear. Such blades were employed in operations that involved cutting, slicing, and whittling. To this group should also be added blade *k* (with gloss along one edge) that was used for plant cutting. Table 5 reveals that scraping was also an activity performed with some frequency. There are six definite and four possible cases in which blades exhibit wear patterns associated with scraping. There is also evidence that a given blade could be used for more than one kind of operation: blades *f* and *u*, for example, show traces of microwear for both cutting and scraping. The implication here is that a blade could readily serve as a multipurpose tool.[22]

In terms of spatial distribution, a fairly wide dispersion of blades with definite and possible traces of microwear is seen in Figure 10. No one location shows a dense concentration of such blades. Nor does there seem to be any indication of a clear pattern of segregation between blades used for cutting and those used for scraping. Both categories of microwear are observed on the north and south sides of the house as well as inside it. The various kinds of microwear are broadly distributed over the area. Nor is there any evidence that blades with heavy patterns of wear all tend to occur as a distinct cluster in any one part of Area H. In fact, one of the striking aspects of the set of blades as a whole is the low proportion that shows signs of heavy wear. Only five of a total of 41 blades exhibit a high degree of edge damage. Very few of the blades in Area H seem to have reached that stage in their life histories where they could be described as exhausted. Indeed, as mentioned earlier, almost half of the blades appear to show no traces of use-wear whatsoever.

In addition to chert and obsidian, the lithic remains in Area H include 12 hand-stones. It is useful to consider this material in terms of three main groups: small hand-stones (pebbles used for burnishing, polishing, or fine percussion), large hand-stones (cobbles used as hammer stones or for pounding), and grinding stones (pieces of rock with either concave or flat surfaces, which were used for grinding or sharpening). Table 6 shows the kinds of rocks exploited for the respective groups. All of them except sandstone occur naturally in the immediate vicinity

20. Under such a scraping motion, micro-chips are removed, in effect, from the trailing side of the edge. It is worth adding that both types of edge damage from scraping (i.e., large flat scars and small, steep scars forming an "edge row") normally occur only on a single side of a given edge. In experiments done by Hartmann, such scars can be observed even after only 100 strokes of perpendicular scraping.

21. Such gloss seems to be the only polish commonly recognized on obsidian so far (see note 17). In the microwear study of the lithic material from the Acconia Survey, only five out of 13 cases of "plant cutting" wear were observed on obsidian blades (Diamond and Ammerman 1985: 80).

22. For evidence for multiple modes of use among obsidian blades from the Acconia Survey, see Diamond and Ammerman (1985: 72–80). In terms of basic blank morphology, the blades used for cutting operations are much the same as those used for scraping ones. It is possible in this regard that an obsidian blade was considered to be an all-purpose implement, much like a disposable pocket knife, to be use for whatever task was at hand. It only developed a recognizable and consistent wear pattern when it happened to be used for an extended period of time (i.e., more than a few minutes) in a given operation.

Table 6. Hand-stones recovered from the occupation surface associated with the structure in Area H at Piana di Curinga. FGG is fine-grained gneiss. The spatial distribution of the handstones is given in Figure 12.

	Quartzite	*FGG*	*Gneiss*	*Gabbro*	*Sandstone*	*Total*
Small hand-stone	1	1	1	0	0	3
Large hand-stone	2	2	0	0	0	4
Grinding stone	0	0	2	1	2	5
Total	3	3	3	1	2	12

of Piana di Curinga.[23] Three of the hand-stones in the first group (*f*, *g*, and *h*) have local areas of fine abrasion on one face; they were probably used for either burnishing or polishing. The fourth small hand-stone (*e*) has a smaller area of abrasion and may have served as a fine percussion tool (perhaps for the knapping of obsidian). Two of the larger ones have localized areas of pecking on either one end (*i*) or opposite ends (*j*) of a cobble; they were probably used as hammer stones. The third large hand-stone (*k*) has extensive abrasion over the v-shaped end of a broken cobble. It is likely to have been employed as a pestle or rubber. Three of the grinding stones (*a*, *b*, and *d*) have a concave or slightly hollow surface. Given the size and thickness of the stone, it is likely that *b* once formed part of a quern. The remaining two grinding stones (*c* and *l*) have flat working surfaces. In the case of *l*, the surface is both hard and very flat, suggesting that the stone may have been used for the sharpening of other tools.

With regard to spatial distribution (FIG. 12), there are almost no hand-stones found inside of the structure. A cluster of three grinding stones is seen on the north side of the house. This is the same side where most of the coarse-ware pottery in Area H was recovered (Ammerman and Bonardi in press). It is tempting to interpret the combination of such pottery and the grinding stones as pointing to activities that involved the preparation or processing of food. There is also a cluster of three small hand-stones that occurs just at the east side of the structure. Two of them (*f* and *g*) were probably used as burnishers. It is worth recalling that the surfaces of Stentinello fine-ware vessels are often highly burnished (Ammerman 1983: 20). Both of the hammer stones, *i* and *j*, occur on the south side of the structure, where the reduction of obsidian is also best documented.

A final class of lithic remains that needs to be mentioned is that of pumice. What is involved are comparatively small pieces that have been rounded by wave action and that are found on the storm beaches west of the site.[24] A total of 20, measuring 1 cm or more in their longest dimension, was recovered in Area H. The largest piece is ca. 8 cm long; two-thirds of the pumice remains measure at least 3 cm in length. The spatial distribution for pumice, which was presumably used as an abrasive material (one of the pieces shows definite signs of such use), is given in Table 7. Again, most of the material is seen outside of the structure and, with the exception of the SE corner, the

23. All rocks, cobbles, and pebbles recovered in Area H were screened for evidence of pecking, polishing, and other forms of abrasion. For the distribution of natural lithic resources at Acconia, see Ammerman and Andrefsky (1982: 167–171).

24. The location of the storm beaches where pumice could be procured in Neolithic times is shown in Figure 1; see also Ammerman and Andrefsky (1982: fig. 7.10). Note that pumice floats on water; the Aeolian Islands are in all probability the original geological source of the pumice washed up on the beaches at Acconia.

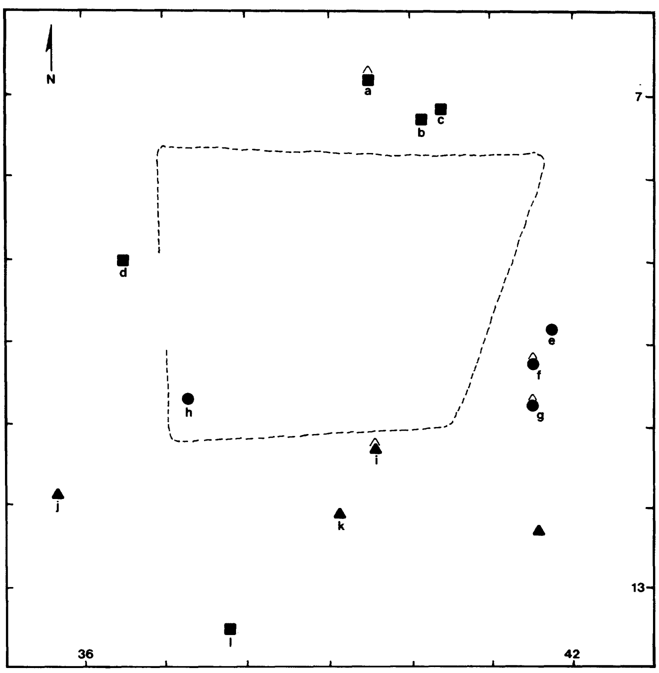


Figure 12. Map showing the distribution of the hand-stones recovered in Area H at Piana di Curinga: (circles) small hand-stones, (triangles) large hand-stones, and (squares) grinding stones. A caret indicates those tools recovered in 1.0 m × 0.5 m excavation units; such hand-stones are plotted in the center of their respective recovery units.

Table 7. Pieces of pumice (≥1 cm long) recovered per sq m in Area H at Piana di Curinga. The coordinates of the grid system are given along the top and left side of the table.

	35E	*36E*	*37E*	*38E*	*39E*	*40E*	*41E*	*42E*
6S	0	0	0	1	1	0	1	0
7S	0	0	3	1	1	0	0	0
8S	0	1	0	1	0	0	2	0
9S	0	0	0	0	0	2	0	0
10S	0	0	0	0	0	0	0	0
11S	1	0	0	2	0	0	0	0
12S	0	1	0	0	0	0	0	0
13S	0	0	2	0	0	0	0	0

pieces have a wide distribution. In closing this section, it is perhaps worth stressing the wide range of different materials (obsidian, chert, quartzite, gneiss, gabbro, sandstone, and pumice) and different actions (cutting, scraping, fine percussion, pounding, grinding, burnishing, and light abrasion) observed among the lithic remains in Area H. In other words, a wide range of domestic activities was once performed at or near the household.

Discussion

From the preceding sections, we begin to gain a useful sense of what an early Neolithic house at Piana di Curinga was like. With its robust timber framework and thick daub walls, the building in Area H was a substantial and durable construction. It represents a fitting material correlate for a sedentary way of life.

One of the contributions of this report in terms of methodology is to show how daub remains can yield valuable information on such things as the plan of a structure, the materials used in building its walls, and even the season when a house was constructed. The study of daub—a class of material that archaeologists have tended to neglect—warrants our closer attention. At the same time, it should be noted that we have taken a cautious position with regard to the actual reconstruction of prehistoric buildings (see Shaffer 1983). It is common in the literature on prehistory to find drawings of houses reconstructed with roof and all, even though the available evidence in most cases is quite limited and ambiguous (Shaffer 1981). What is at issue here is the practice or habit of over-reconstruction. Part of our caution at Piana di Curinga stems from work that we have done along the lines of experimental archaeology: the building of wattle and daub structures out of local materials at Acconia, the firing of these structures, and the recording of their subsequent appearance in collapsed form (Shaffer 1981). It is a chastening experience for the archaeologist to realize that the reconstruction of the former (a standing house) from the latter (its remains in collapsed form), when the two are both well known as in the case of experimental archaeology, represents no simple undertaking.

A question of major interest concerns the use and organization of space as seen at the household level in Area H. The house itself is comparatively small; it has an interior area of only about 14 sq m. In its size, it is similar to the other wattle-and-daub structures that have been excavated at Piana di Curinga to date. No features as such and few lithic and ceramic remains are observed inside of the structure in Area H, which made use of the leveled surface of the dune for its floor. The suggestion is either that the interior was kept free of refuse, tools, and other equipment due to housekeeping or, alternatively, that only a rather narrow range of activities was actually performed within the structure. In any event, it is reasonable to think that one of the main functions of the house was to provide shelter from the elements and a place to sleep.

The vast majority of the artifactual remains recovered in Area H occurs outside of the wattle-and-daub-structure. There is little evidence, on the basis of the spatial distributions that are available, that the lithic remains belonging to a given class are distributed in terms of discrete, well-defined clusters. Nor is there evidence for the occurrence of midden deposits in the immediate vicinity of the structure. What is seen instead are spatial distributions that usually take a broader and more diffuse form; the overall impression is one of a more fluid use of space around the house.

At the same time, there are some basic patterns of association that can be recognized among different classes of material. Grinding stones and coarse-ware pottery, for example, are seen for the most part on the north side of the structure. The working of obsidian as reflected by the distributions for cores, core rejuvenation flakes, core-trim, and shatter is best documented in areas on the south and west sides of the structure. In contrast, the SE corner shows almost no evidence for the reduction of obsidian; even shatter is rarely observed there. In terms of overall spatial patterns, it is also worth recalling the rock feature (315) and the three fine-ware vessels associated with it that are found near the south wall of the house. Thus, in the case of Area H, we appear to be dealing neither with a series of discrete, well-defined activity loci (at least as reflected in the distributions of lithic and ceramic remains) nor with a situation in which there is a complete lack of spatial order. There are clear differences between what is seen inside and outside of the structure and also between what is observed on different sides of the house. On the other hand, in carrying out the many different activities that were performed in and around the structure, space seems to have been used in a flexible and multipurpose way.

One aspect of the spatial question that deserves some further comment is that of housekeeping. The best evidence for this practice comes from the study of pottery, which shows that at least 21 different fine-ware vessels are represented in Area H (Ammerman 1983: table 1). Two quite different things are seen with respect to the number of sherds that belong to a given vessel. On the one hand, there are a few whole pots, each consisting of a large number of sherds. On the other hand, most of the vessels are represented by only one or a few sherds. It is likely that the former are vessels that were in use at the time of the structure's collapse, while the latter comprise vessels in prior circulation that had broken near the structure and some of whose sherds managed to escape being swept up in housekeeping. The lithic remains recovered in Area H may also provide indirect evidence for housekeeping. It is worth recalling that two-thirds of the total weight of obsidian is incorporated in three cores (TABLE 3). The actual products and by-products of obsidian reduction recovered in the area turn out to weigh less than those that potentially could be generated by the working of the cores at hand. There are two important implications of the practice of housekeeping: 1) that the material actually found on the occupation surface constitutes only a fraction of what was once in use there, and 2) that spatial distributions are, in effect, to be viewed as composites in the sense that they contain material in circulation at the time of the structure's abandonment and also material in previous circulation, some of which ended up evading efforts at housekeeping.

The other general question that we want to consider here concerns the exploitation of natural resources. Most of the things recovered in Area H can be linked with sources of raw material that occur locally at Acconia. The major exception to this is obsidian that comes from the island of Lipari. As we have seen, almost exclusive reliance was placed upon obsidian for chipped stone tools and cutting edges. One of the common features of the obsidian tools from Area H, as well as from other Stentinello contexts at Acconia, is their lack of morphological elaboration.[25] Intentional retouch is seldom observed on obsidian blades; patterns of microwear indicate that an obsidian blade, as a sort of all-purpose tool, could readily be used for cutting, whittling, and scraping. What is intriguing is that greater attention was apparently not paid to the efficient and intensive exploitation of obsidian. As we have seen, the blades in Area H seldom show signs of either heavy use wear or resharpening.[26] There is almost the sense—one seemingly at odds with modern economic notions about strategies of maximization with regard to the exploitation of scarce resources—that obsidian was exploited in a rather casual way at Piana di Curinga. There is the suggestion that even though its nearest source was located at a distance of more than 100 km from the site, obsidian may not have been perceived at Piana di Curinga as a particularly scarce or valuable commodity.

Among the resources found locally at Acconia, the timber used for the framework of a house is one of major interest. As seen earlier, the impressions left in the daub by timbers, saplings, and wattles permit estimates to be made of the diameters of the trees that were used for this purpose. Figure 8 shows a wide range for such values; there is little indication that close attention was paid to the systematic cutting of trees with the same diameter or of those belonging to a given size-class. Instead, there appears to be a more heterogeneous pattern of exploitation with regard to this renewable resource. Of much greater economic interest is the practice of splitting timbers and saplings. This doubles, in effect, the board feet of framing material that can be obtained from a given tree. Some effort and skill are obviously called for in order to achieve the successful lengthwise splitting of timber. But this effort is probably well repaid, since fewer trees have to be felled, trimmed, and hauled to the building site in this way. Not only does such a strategy tend to reduce the overall effort required but, by reducing the total number of trees exploited, it also makes good sense in ecological terms.

25. There is a dramatic contrast between the high degree of elaborations that went into the decoration and finishing of fine-ware Stentinello vessels and the lack of elaboration when it came to the working of obsidian. The former appears to have been a major channel of stylistic expression and the latter not.

26. The resharpening of obsidian blades and the occurrence of "exhausted" edges (i.e., obsidian blades displaying heavy wear patterns) are likewise comparatively rare among the material from the Acconia Survey (Diamond and Ammerman 1985).

Besides timber, the other main resource that one needs in order to build a house is clayey sediment for daub. As mentioned above, sediments of this kind have to be sought in areas away from the dunes at Acconia. There is a distance of more than 100 m between Area H and the nearest potential source of such sediment. As we have also seen, an estimate on the order of 3 cu m, which is equivalent in terms of weight to roughly 5500 kg, can be made for the total amount of material needed for daubing the walls of the structure in Area H.[27] The quarrying of such a mass of clayey sediment and its transport to the building site clearly involved a good deal of work. Some comment is called for at this point on the question of why the dunes, and not the fluvial terraces where such sediments occur naturally, were chosen as places for site location at Acconia. Besides offering an elevated position with a good view over the surrounding landscape, the dunes have light and well-drained soils. In contrast with the terraces whose heavy clay soils are wet much of the winter, the dunes offer a much drier living surface. Moreover, while the heavy terrace soils would have been difficult to cultivate with a primitive technology, the light dune soils would have been quite easy to work (see Ammerman 1985b). Thus, there would appear to be good reasons for living on the dunes and for going to the effort of hauling masses of clayey sediment up to a building site such as the one in Area H.

In order to gain a fuller sense of the labor involved in the procurement of this resource, it is useful to consider the basic relationships between the work done per person and the number of people who live in a house and also the number of years that a house is occupied.[28] For example, an inverse relationship would hold between the number of people who inhabit a house and the effort per individual that is required: the fewer the inhabitants, the more work per person (on average) that one has to contribute to the task at hand. The same kind of relationship would hold between the life-span of a house (i.e., the number of years that it is occupied) and work effort: the shorter the life-span, the more often that a new structure has to be built and, in consequence, the more effort per person (on average per year) that one has to put into the procurement of daub sediment. Put in a more positive way, work tends to decline both as more people live in a house and as the structure has a longer life-span. From a heuristic point of view, it is of interest to consider the worst possible case: for example, a structure that is inhabited by only a single (adult) person and that has a life of only five years. Under such a regime of habitation, it would be necessary to put major amounts of time and work into the procurement of clayey sediments for house building.[29] It is probably more reasonable to imagine a situation in which a given house either has more inhabitants or the house has a longer life or some combination of the two. Otherwise, house building would have to rank as one of the main activities of those living at the site of Piana di Curinga. At the same time, even if we consider a more generous regime of habitation (e.g., two adults and a life-span of 15 years), substantial amounts of work would still have to be put into the activity of daub procurement.[30]

The suggestion has been made previously that one of the ways to cut down on the quantity of sediment to be procured would be the recycling of daub from abandoned structures at the settlement (Ammerman and Shaffer, 1981). The daub of a collapsed house may well have been fire-hardened intentionally so that the sediment would not be lost through weathering and erosion on the surface of the site. Instead, it could be preserved in the form of sintered daub fragments to be recycled eventually as filler in the walls of a new structure.[31] Such a strategy of re-

27. On the basis of experimental studies at Acconia, a cu m of clayey sediment would weigh approximately 1869 kg. Given a volume of 3 cu m (see note 10), this would yield a weight of 5607 kg. A somewhat larger figure, 7000 kg, is used by Shaffer (1985b) in a previous study. Obviously, such figures are approximate and would vary depending upon actual soil humidity. They do, however, give a tangible sense of the quantities of clayey sediment that are involved.

28. The discussion is developed here in terms of effort "on average" per person. In thinking about how a structure was actually built, it is entirely possible and even likely that there was reciprocal exchange of labor between households (or individual habitation units) and that, in the manner of a barn raising, more people took part in the construction of a particular structure than those who lived there once it was finished. Taking reciprocity into account (i.e., an overall balance between work "given" and work "received" with respect to any household), the basic relationships outlined here would still hold. For a discussion of house building in another early Neolithic context, that of the Bandkeramik culture in Central Europe, see Startin (1978).

29. Given a weight of sediment of 5500 kg (see note 27) and taking the number of inhabitants as one person and the life span as five years, this would mean that the person had to move on average more than 1000 kg of clayey sediment per year.

30. Given a weight of 5500 kg (see notes 27 and 29) and taking the number of inhabitants to be two adults and the life span to be 15 years, each person would have to quarry and move on average ca. 180 kg of clayey sediment per year. Taking into account dependents (e.g., young children) who were probably not able to make much of a contribution to this kind of activity, the actual composition of the household (or habitation unit) would be closer to three or four persons in this case. Note that if one considers that three or four people inhabited each of the wattle-and-daub structures at Piana di Curinga, it would suggest a fairly high level of local population density at Acconia.

31. The quantities of sintered daub recovered during the course of the excavation of various collapsed buildings at Piana di Curinga are regularly much greater than those that would be produced by accidental firing. The possibility of the ceremonial firing of structures at the time of their abandonment is one that deserves further exploration. In any event, the daub was subject to some form of intentional firing. The

source husbandry would reduce the volume of new clayey sediment that had to be procured away from the dune. In addition, it would have promoted continuity in terms of settlement patterns; decisions about where to build a new house would be influenced by the locations of structures previously built and abandoned at a settlement.

In closing, it is worth noting that all three of the examples of resource exploitation considered here relate to areas of economic life that do not directly concern subsistence. Major work effort and skillful strategies of resource exploitation are being put into such non-subsistence activities as house building and the exchange and reduction of obsidian. There is a contrast between the view of Neolithic economics that emerges from the close study of the remains associated with the household in Area H at Piana di Curinga and the view still common elsewhere in the literature that would equate Neolithic economics simply with the study of seeds, bones, and site territories (e.g., Higgs 1975; Jarman, Bailey, and Jarman 1982). The point here is not to argue that subsistence—or how one feeds oneself—is unimportant. It is obviously one of the main themes of Neolithic studies. But subsistence constitutes only one of the sectors of a Neolithic economy. A deeper understanding of Neolithic economics calls for the study of a much wider range of activities—tasks that involved different kinds of production, consumption and exchange—as they were performed within the context of basic units of social and economic life such as the household.

---

spatial distributions of daub fragments often seem to suggest that daub has been robbed in places from a collapsed structure (see Shaffer 1983). The erosion and recycling of sediment would be primarily responsible for the difference between the estimated mass of daub in the original building in Area H (5500 kg) and that actually recovered in the form of sintered fragments (1100 kg).

Albert J. Ammerman received his Ph.D. from the University of London in 1972 and is currently Visiting Professor at the Italian Center for Environmental Research, University of Parma, Italy. He has directed the Calabria survey and excavations at several sites in Italy, including Monte Leoni and Piana di Curinga. For the last three years he has conducted environmental studies at the Forum Romanum and other sites in central Rome. During the current academic year (1987–1988), he holds the Mellon Fellowship in Classical Studies at the American Academy in Rome. His address for correspondence is the Department of Anthropology, Colgate University, Hamilton, NY 13346.

Gary D. Shaffer earned his Ph.D. in Anthropology from SUNY Binghamton in 1983. He is currently working as an archaeologist for the international consulting firm of Louis Berger and Associates with headquarters in East Orange, New Jersey. In addition to his research on Neolithic sites in southern Italy, he has been involved in field projects in various regions of the United States and recently has compiled the computerized National Archaeological Database in 14 states for the National Park Service. He plans to continue his long term experimental work on wattle-and-daub buildings in southern Italy.

Nicholas Hartmann earned his doctorate in Classical Archaeology in 1982 from the University of Pennsylvania, where he was a Research Fellow at the Museum Applied Science Center for Archaeology (1977–81). He has studied microwear on stone tools from Crete and Belize as well as Calabria. He is currently a freelance technical and scientific translator specializing in the field of materials science.

Ammerman, A. J.
1979 "A Study of Obsidian Exchange Networks in Calabria," *World Archaeology* 11: 95–110.

1983 "Early Italian Pottery," *Expedition* 25 (2): 29–45.

1985a *The Acconia Survey: Neolithic Settlement and the Obsidian Trade. Institute of Archaeology, Occasional Publication* 10. London: University of London.

1985b "Modern Land Use versus the Past: A Case Study from Calabria," in C. Malone and S. Stoddart, eds., *Papers in Italian Archaeology IV. Part 1: The Human Landscape. British Archaeological Reports* 243 (International Series). Oxford: BAR, 27–40.

1987a "L'Habitation Stentinellienne en Calabre," in J. Guilaine, J. Courtin, J. L. Roudil, and J. L. Vernet, eds., *Premières Communautés Paysannes en Méditerranée Occidentale.* Paris: Editions du Centre National de la Recherche Scientifique, 407–411.

1987b "Recenti Contributi sul Neolitico della Calabria," in *Il Neolitico in Italia. Atti della XXVI Riunione Scientifica.* Florence: Istituto Italiano di Preistoria e Protostoria, 333–349.

Ammerman, A. J., and W. Andrefsky
1982 "Reduction Sequences and the Exchange of Obsidian in Neolithic Calabria," in J. E. Ericson and T. K. Earle, eds., *Contexts for Prehistoric Exchange.* New York: Academic Press, 149–172.

Ammerman, A. J., and S. Bonardi
in press "Ceramica Stentinelliana da una Struttura a Piana di Curinga (Catanzaro)," *Rivista di Scienze Preistoriche* 41.

Ammerman, A. J., Bonardi, S., and M. Carrara
1980 "Nota Preliminare sugli Scavi Neolitici a Piana di Curinga (Catanzaro)," *Origini* 10: 109–133.

Ammerman, A. J., and G. D. Shaffer
1981 "Neolithic Settlement Patterns in Calabria," *Current Anthropology* 22: 430–432.

Cassano, S. M., and A. Manfredini
1983 *Studi sul Neolitico del Tavoliere della Puglia. British Archaeological Reports* 160 (International Series). Oxford: BAR.

Crummett, J. G., and S. E. Warren
1985 "Appendix I: Chemical Analysis of Calabria Obsidian," in A. J. Ammerman, ed., *The Acconia Survey: Neolithic Settlement and the Obsidian Trade. Institute of Archaeology, Occasional Publication* 10. London: University of London, 107–114.

Diamond, G. P., and A. J. Ammerman
1985 "Lithic Material," in A. J. Ammerman, ed., *The Acconia Survey: Neolithic Settlement and the Obsidian Trade. Institute of Archaeology, Occasional Publication* 10. London: University of London, 60–82.

Evans, J. D.
1976 "Village, Town and City in the Aegean and Italy," in G. Sieveking, I. H. Longworth, and K. E. Wilson, eds., *Problems in Economic and Social Archaeology*. London: Duckworth, 501–512.

Geddes, D. W.
1986 "Neolithic, Chalcolithic, and Early Bronze in West Mediterranean Europe," *American Antiquity* 51: 763–778.

Guilaine, J.
1976 *La Préhistoire Française*, Tome II. Paris: Centre National de la Recherche Scientifique.

Guilaine, J., J. Courtin, J. L. Roudil, and J. L. Vernet
1987 *Premières Communautés Paysannes en Méditerranée Occidentale*. Paris: Editions du Centre National de la Recherche Scientifique.

Hallam, B. R., S. E. Warren, and C. Renfrew
1976 "Obsidian in the Western Mediterranean: Characterization by Neutron Activation Analysis and Optical Emission Spectroscopy," *Proceedings of the Prehistoric Society* 42: 85–110.

Hartmann, N.
1980 "A Preliminary Microwear Analysis of Obsidian from Santa Rita Corozal (Belize)," *MASCA Journal* 1 (5): 136–140.

Hay, C. A.
1977 "Use-Scratch Morphology: A Functionally Significant Aspect of Edge Damage on Obsidian Tools," *Journal of Field Archaeology* 4: 491–494.

Higgs, E. S., ed.
1975 *Palaeoeconomy*. Cambridge: Cambridge University Press.

Jarman, M. R., G.N. Bailey, and H. N. Jarman, eds.
1982 *Early European Agriculture: Its Foundations and Development*. Cambridge: Cambridge University Press.

Keeley, L. H.
1980 *Experimental Determination of Stone Tool Use*. Chicago: University of Chicago Press.

Klein, J., J. C. Lerman, P. E. Damon, and E. K. Ralph
1982 "Calibration of Radiocarbon Dates: Tables Based on the Consensus Data of the Workshop of Calibrating the Radiocarbon Time Scale," *Radiocarbon* 24: 103–150.

Lewenstein, S.
1981 "Mesoamerican Obsidian Blades: An Experimental Approach to Function," *Journal of Field Archaeology* 8: 175–188.

Phillips, P.
1975 *Early Farmers of West Mediterranean Europe*. London: Hutchinson.

Remmelzwaal, A.
1985 "Physiography and Soils," in A. J. Ammerman, ed., *The Acconia Survey: Neolithic Settlement and the Obsidian Trade. Institute of Archaeology, Occasional Publication* 10. London: University of London, 6–25.

Shaffer, G. D.
1981 "An Experimental Archaeology Study of Wattle and Daub Structures in Calabria, Italy," unpublished M.A. thesis, State University of New York at Binghamton.

1983 *Neolithic Building Technology in Calabria, Italy*. Ph.D. dissertation, State University of New York at Binghamton. Ann Arbor: University Microfilms.

1985a "A Study of Structural Stones in Calabria," *World Archaeology* 17: 76–89.

1985b "Architectural Resources and their Effect on Certain Neolithic Settlements in Southern Italy," in C. Malone and S. Stoddart, eds., *Papers in Italian Archaeology IV. Part 2: Prehistory. British Archaeological Reports* 244 (International Series). Oxford, BAR, 101–117.

Startin, W.
1978 "Linear Pottery Culture Houses: Reconstruction and Manpower," *Proceedings of the Prehistoric Society* 44: 143–159.

Stuiver, M., and R. S. Kra, eds.
1986 Radiocarbon Calibration Issue: Proceedings of the Twelfth International Radiocarbon Conference, June 24–28, 1985, Trondheim, Norway. *Radiocarbon* 28 (2B).

Tinè, S.
1983 *Passo di Corvo e la Civilità Neolitica del Tavoliere*. Genoa: Sagep.

Vaughan, P.
1985 *Use-Wear Analysis of Flaked Stone Tools*. Tucson: University of Arizona Press.

Vitruvius, *De architectura* (*The Ten Books of Architecture*. M. H. Morgan, trans. New York: Dover [1960]).