

# an experiment in iron age economy

BY P. J. REYNOLDS

REPLICAS OF IRON AGE HUTS  
CONSTRUCTED AT THE AVON -  
CROFT MUSEUM OF BUILDINGS



Plate One.



Plate Two.

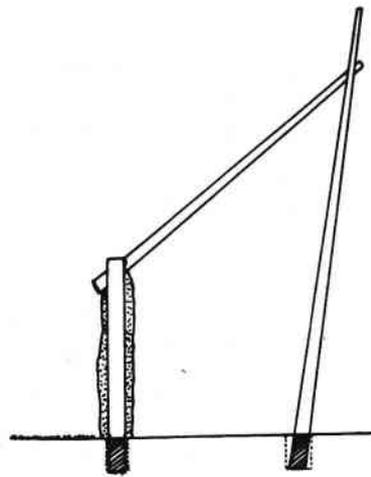
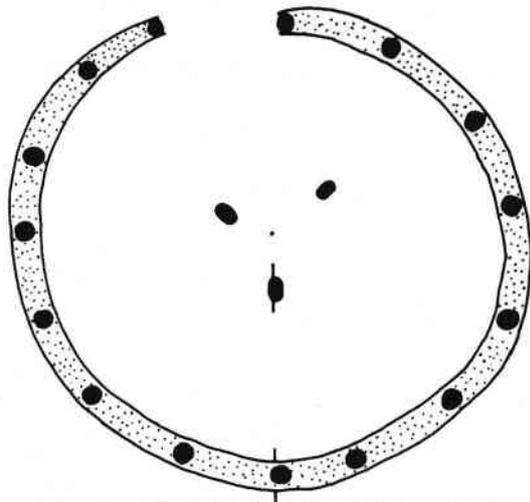
The Trustees of the Avoncroft Museum of Buildings, Stoke Prior, Nr. Bromsgrove, Worcestershire, set aside a rectangular area of approximately one sixth of an acre of their museum site and in 1969 invited the author to continue his research into certain aspects of the economy of the Iron Age on a protected site. This research is basically concerned with the reconstruction of at least two huts of different types and further experimentation into grain storage in underground pits. The previous site of these experiments had been effectively destroyed by vandals (1). At the outset it is necessary to record that the soil type of this site is fundamentally keuper marl, red/grey clay and sandy earth, since the results of many of the experiments will only be relevant to this particular soil type.

The first phase of the programme was to reconstruct a hut of the post-hole variety described below and to build a ditch and bank to delineate the site, which is bounded on two adjacent sides by hedgerows, from the surrounding area. The ditch, completed in July of this year, is specifically modelled on the ditch of Tollard Royal, Dorset, (2) an enclosure which contained pits and a hut. A brushwood fence was built into the top of the bank and a silt indicator was positioned in the ditch. Regular readings from this indicator will furnish valuable evidence of silt rate on keuper marl. During the first two months, August and September, a mere centimetre of silt has accumulated.

In the immediate vicinity of the ditch and bank it is planned to cultivate about a sixth of an acre and grow emmer and spelt for pit storage experiments. It is also hoped to obtain some limited information about the yield from these primitive grains, since the area intended for cultivation has lain fallow for at least a decade and therefore has not been subjected to modern concentrated fertilizers and chemical feeding. Woad (*Isatis tinctoria*) has already been introduced onto the site and experiments in extracting indican dye will be conducted at various stages in its growth.

The first hut to be built on the site was a general reconstruction of the post-hole type of structure based to a large extent on evidence drawn from the Glastonbury excavations (3). The dimensions of this hut, which can be seen in Plate 1, correspond to those of the smaller Glastonbury type. The structure is essentially quite simple. A circle of upright posts six feet long was set in post-holes one foot in depth and, leaving a doorway, willow withes were woven in and out of the posts making what was, in effect, a large basket-work frame. A tripod of long poles, lashed together with leather thongs, was erected in the centre and

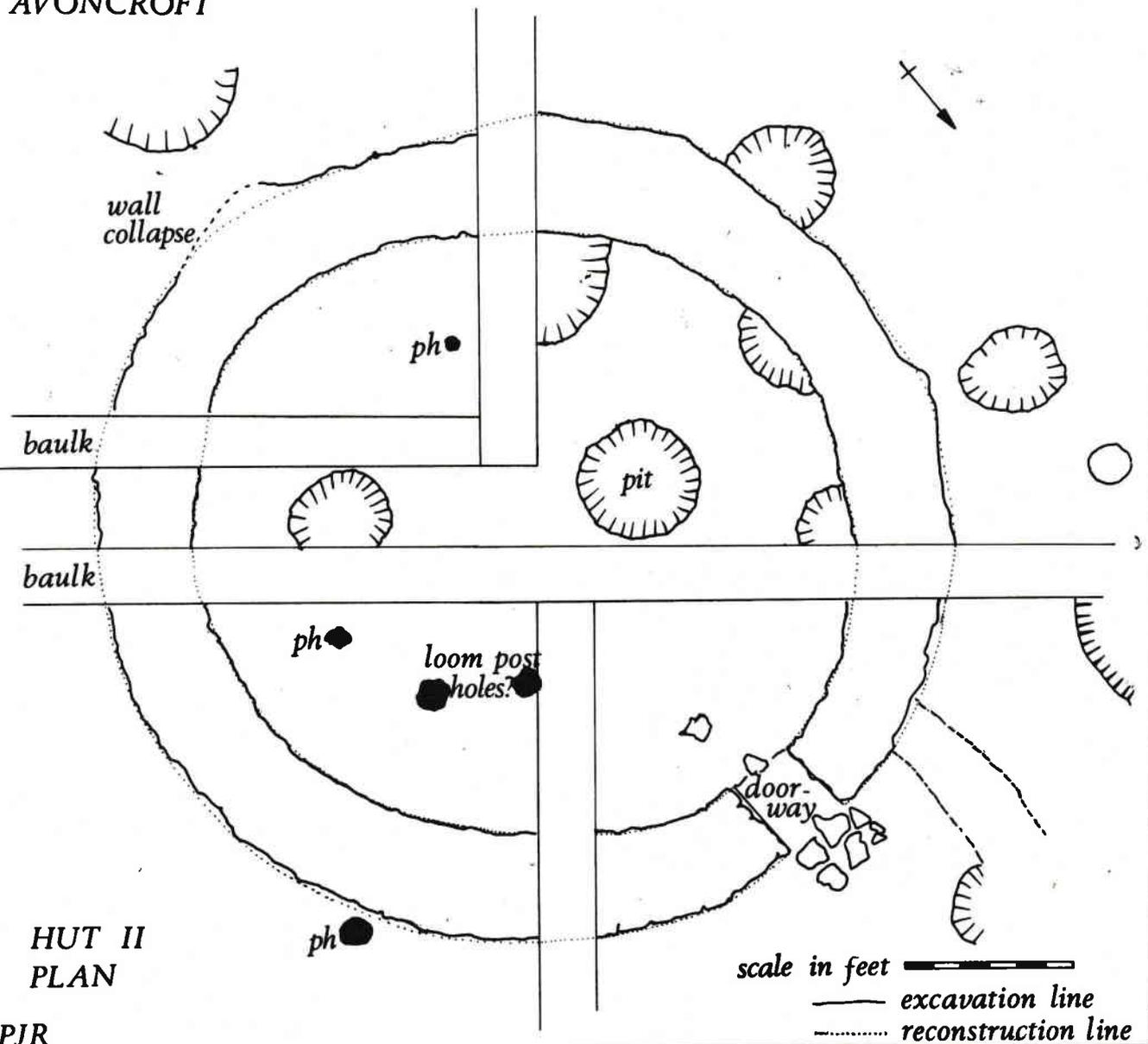
AVONCROFT HUT I PLAN & ELEVATION



● post hole  
 ▨ wattle & daub  
 ━━━ scale in feet

PJR

AVONCROFT



HUT II  
 PLAN

scale in feet ━━━  
 ━━━ excavation line  
 ····· reconstruction line

PJR

the roof poles were tied to the apex of the tripod and to each upright pole around the circumference of the hut; a further roof pole was fastened to a lintel above the doorway. Consequently there were fifteen wall poles and sixteen roof poles. The exact dimensions can be clearly seen in Figure 1, the plan and elevation drawing for Hut 1.

At this point it must be understood that this roof structure, while possibly accurate, is conjectural. Furthermore, the system of thatching presented grave difficulties. The first stage was to weave withes in between the roof poles to act as rafters to support the straw. The straw itself was drawn in yealms and secured to the roof by means of a withe placed two-thirds down the length of the yealm and tied with twine through the straw onto the roof poles. A simple wooden needle with an open eye was used to pass the twine through the straw. A careful examination of Plate 1 will show how this system operated, since the photograph was taken prior to the completion of the roof. Each subsequent layer of straw, working from the bottom of the roof, was positioned in such a way as to conceal the withe locking the previous layer in place. There was no hole left at the apex of the roof. Finally the walls were plastered with clay mixed with straw and animal hair.

The wall structure of the hut, including the wattle and daub, is well attested from a multitude of sites; the roof structure and the method of thatching, while logical, is conjectural. It was quite a deliberate step to thatch the roof completely and not leave a 'smoke-hole' at the apex. From preliminary experiments carried out in a prior reconstruction (4) it was found that the smoke either percolated through the thatch, incidentally acting as an insecticide, or curled out of the doorway after gathering above head height inside the roof. Certainly there was insufficient smoke within the hut to cause physical discomfort. In addition, it would seem from the archaeological evidence that hearths were to be found more often just outside huts rather than actually inside. Further experiments, however, are planned to examine the thermodynamics of such structures. Finally it is intended not to maintain this hut but to observe the process of deterioration in order to determine, within the limitations of its construction, how long it will remain a functional building.

The second hut on the Avoncroft site is a reconstruction of a stone hut excavated by Mr. Nicholas Thomas, Director of Bristol Museum, on Conderton Camp, Bredon Hill in Worcestershire (5). The approximate date for this camp is the first century B.C. The excavation revealed the first few courses of a dry-stone walled circular building, its greatest diameter being thirty one feet and the greatest width of the wall being four feet. There was no evidence of post-holes beneath or within the wall. From the few extant courses the wall appeared to be of careful stone construction throughout rather than two facing walls filled with rubble. An experiment on site indicated that the height of the wall was in excess of two feet. In

the doorway of the hut a few large stones had been laid as a threshold. At one point on the circumference of the wall there had been a collapse. There were no post-holes within the hut that would suggest a support for a roof structure.

The plan of the reconstruction, therefore, is virtually an exact reproduction of the excavated ground plan. A dry-stone wall was built to an average height of two feet nine inches to compensate for a slightly greater area of stone scatter than the excavation had encompassed. The comparative building lines can be seen in Figure 2. The doorway was built up to a height of four feet, this height being chosen as a parallel to the doorways of the brochs of North West Scotland, the only extant Iron Age doorways in this country.

The structure of the roof presented a complex problem since it had to span approximately twenty six feet without a central support of any kind. The angle of the roof was also critical. In practice an angle of forty five degrees to the horizontal seems to be typical of thatched roofs and this angle is supported mathematically in so far as it affords the least lateral thrust. Therefore the roof poles needed to be an average length of eighteen feet from the top of the wall to the apex. The method of securing the roof poles to the wall provided some negative evidence. It was found that a tripod of roof poles exerted enough lateral pressure to force the wall outwards. Consequently the pressure had to be spread along the wall so that its considerable width could fulfill its real function as a continuous buttress. The solution offered was a series of six foot poles, half-lapped together around the inside edge of the wall and locked into position with stonework to act as a ring-beam. The six foot length was selected, not only because it was eminently suitable for this particular circumference, but also because the collapsed area of the original wall was this length. The ring-beam was then notched at approximately three foot intervals and each roof pole was correspondingly jointed to the ring-beam. The roof poles were erected in three distinct phases. Initially a tripod was placed in position, the apex being lashed together with leather thongs. After that three further roof poles were attached to this tripod and lastly a ring-beam made of willow was secured to these six main roof poles some six feet from the apex. The remainder of the roof poles were in turn attached to this ring-beam. The use of such a ring-beam is well supported by primitive building techniques throughout the world. In fact it is quite a logical, if not a vital step since there is certainly a limit to the number of poles that can be tied together at the apex of such a structure. The final phase prior to thatching was to weave withes in and out of the roof poles, incidentally making a multiple ring-beam, to act as a support and anchorage for the thatch.

The building also offers a most interesting point with regard to the thatching style. Since the roof is secured to the inner edge of the wall, there is a considerable width of wall that must be covered

to protect it from the weather. So the straw was laid flat on top of the wall leaving only the ends of the stalks exposed. It can be suggested, therefore, that the type of thatching one might see on a hut of this nature would not be dissimilar to that of the sophisticated thatching of the present day. This early stage of thatching can be seen in Plate 2. Ultimately the yealms will be pegged in position, layer by layer, with the inner ends of each yealm secured to the framework of the roof.

A final comment that must be made concerning both of these huts is that all the tools employed in the reconstruction, although modern, were available to Iron Age man. The wood working, however, in comparison to that of the lake villages of Glastonbury and Meare, while functional, falls rather short of the Iron Age standard.

The problems of the storage of grain in pits represent another important field of research that is being conducted on this site at Avoncroft. From the wealth of evidence from excavation reports of Iron Age sites, it would seem that, apart from the great variability of the size of storage pits, there are several possible types of pit linings. These linings fall into four major categories, the largest category being that of pits which provide no evidence for any lining whatsoever, the other three categories being respectively clay, basket-work and stone linings. In addition there is the further aspect of the location of storage pits, whether they were inside a dwelling, the most logical place, or alternatively outside, specifically, as Tacitus suggests, in order to conceal their exact location from an enemy. The chemistry of the storage of grain is quite straightforward: the natural respiration or growing cycle of grain requires the absorption of oxygen and gives off carbon dioxide as the waste product. If the grain is placed in a sealed container, such as a storage pit, it will respire until all the oxygen is used up. Thereafter, because of the predominance of carbon dioxide, respiration ceases, a state of dormancy ensues, and the growing cycle is arrested until oxygen is reintroduced.

Some research into grain storage in pits on other soil types has already been conducted (7) and the evidence from these and subsequent experiments, combined with the results from Avoncroft, should begin to build up a body of extremely useful information for archaeological interpretation. Five experimental pits, which embrace the above four categories of lining types, have been put down this winter. From previous research conducted by the author on a limestone subsoil, the evidence suggested that the variability of the size of the pits was of minimal account. The experimental pits, therefore, are fairly small, the average dimensions being three feet in depth by two feet three inches in diameter, in comparison to excavated examples of a mean average of four feet six inches in depth by four feet in diameter. Four of the pits are outside, clay lined, basket-work lined, stone lined and unlined, and one pit, unlined, is inside Hut 1. Each pit is furnished with an aspiration tube, to allow gas samples to be drawn from

it to determine the concentration of carbon dioxide, thermistors to establish the internal temperatures and a maximum-minimum thermometer to record the extremes of temperature. All the pits were filled with approximately three hundred-weights of modern threshed barley at the same moisture content and then sealed with clay. Therefore the results will all be in parallel and the effects of the different linings on the grain will be directly comparable. The findings from this pilot scheme will determine the pattern of future experiments and the establishment of further control pits to account for the variability of preparation of pits that have already been used. Throughout, the principle problem is to limit, as far as possible, the number of variables in order to provide valid results. This present sequence of experiments in grain storage is expected to continue for five years.

The above experiments represent the major work accomplished over the past two years but many other projects are in hand and planned for subsequent seasons. These include the growing of emmer and spelt under controlled conditions, ultimately for storing in grain pits, further experiments with primitive ploughs including a beam ard, the setting up of a simple loom inside Hut 2 and obtaining data of the effects of limited light on efficiency, and many other allied projects. Such a site affords a multitude of research opportunities. Finally it is the wish of the author to be able, in due course, to offer to other archaeologists the facility to carry out practical experimentation in Iron Age practices on this site.

## REFERENCES

1. P.J. Reynolds, 'Iron Age Hut: A Reconstruction', *Vale of Evesham Historical Society Research Papers*, Volume 1, 1967, pp 5-10.
  2. G.J. Wainwright, 'The Excavation of a Durotrigian Farmstead near Tollard Royal in Cranbourne Chase; Southern England', *Proceedings of the Prehistoric Society*, Volume XXXIV, 1968, pp 102-147.
  3. A. Bulleid, 'The Lake Villages of Somerset', *The Glastonbury Antiquarian Society*, Fifth Edition, 1958.
  4. *Ibid*, 1.
  5. Information given personally to the author.
  6. Tacitus, *Germania*, 16,4.
  7. H.C. Bowen and P. Wood, 'Experimental Storage of Corn Underground and its Implications for Iron Age Settlement', *Institute of Archaeology, Bulletin No. 7*, 1968, pp 1-14.
- and  
P.J. Reynolds, 'Experiment in Iron Age Agriculture', *Transactions of the Bristol and Gloucestershire Archaeological Society*, Volume LXXXVI, 1967, pp 60-73 and Volume LXXXVIII, 1969, pp 29-33.