Peter J. Reynolds

2. BUTSER ANCIENT FARM RESEARCH PROJECT. A UNIQUE EXPERIMENT IN WORLD ARCHAEOLOGY

The Butser Ancient Farm Research Project is unique in British and in World Archaeology in that its purpose is to reconstruct and operate a farm dating to approximately 300 B.C. In reality it is a vast open-air scientific research laboratory devoted to prehistoric agriculture and archaeology. The reason for its being brought into creation as a research tool is directly related to the immense problems of understanding posed by the prehistoric period. The distinction between history and prehistory is largely understood by the presence or absence of documentary material. History, dependant in many instances upon very doubtful source material, is concerned via the written word, chronicles, registers and other documents, with specific individuals, places and events. Prehistory, on the other hand, is concerned with culture periods, landscapes and settlements. Archaeology is in effect the handmaiden of prehistory. The archaeologist conducts excavations into the physical remains of the remote past and provides the basic evidence. This evidence comprises on the one hand structural remains like post-holes, pits, gulleys, banks, ditches and hearths, on the other artifactual remains like potsherds, brooches, pins, fragments of tools and implements and within this category one also includes ecological evidence like that provided by bone fragments, carbonised or waterlogged seeds and timber, pollen grains, mollusca and beetle wings.

This evidence is the data base upon which general theories are mounted, explanations posed, peoples isolated, trade routes plotted, landscapes reconstructed and agricultural economies postulated. It is important to realise that however grand a theory may be, however plausible the arguments which support it, nonetheless it is founded in the crude simple data recovered from excavations. The direct analysis of this data for whatever period of prehistory one may choose does not inspire great confidence in the theories which are mounted upon it. Indeed as excavation techniques improve, as methods of data recovery are refined, so the majority of those data which have been previously acquired become progressively less satisfactory and often the theories mounted upon them become incredible.

It is in this context that the concept of the Butser Ancient Farm Research Project is to be understood. Naturally, of the three broad periods of prehistory, the most recent, the Iron Age or Celtic period, is the one which is evidenced by the most data. There is such a wealth of data available, in fact, that quite detailed analyses and interpretations of the period, the landscape, settlement patterns and economy are regularly made. However, since the material evidence by its very nature is selective and hardly representational, there is inevitable conflict to be found among the interpretations of the period. There is an undeniable need to re-examine much of the data, not so much from the point of view of the broad implications but rather the immediate implications. For example, the carbonised seed recovered from excavations indicate the kind of crops which were probably grown but this information is not enough. One needs to know how they were grown, the problems posed by this or that process, the yield factors — in brief one needs to discover the implications and range of potential of each piece of evidence. Only when this kind of information is available can the broader implications, the overview have any kind of credibility. It may prove that some generalisations already made are supported in due course but such an event will be fortuitous. Generalisations should be substantiated as far as possible by real data rather than assumptions.

Even so there is little doubt that the basic economy of the Iron Age in Southern England and indeed in large areas of France was based upon agriculture. Therefore, in order to examine the data upon which that economy is based, the most logical approach to adopt is the empirical one. This approach led to the construction of a farm dating to the mainstream period of the Iron Age where not only the data but also the processes implied by those data can be physically tested.

The farm, started in 1972, is located on a spur to the north of Butser Hill some 24 kilometers north of Portsmouth in the County of Hampshire. The land area selected is ideal for the purpose since it is difficult of access and consequently interference by the public is at a minimum. In addition it was actually occupied in the prehistoric period. Excavations and field work on the site have yielded evidence of occupation dating to the late Bronze Age and throughout the Iron Age period. The most significant features are an unfinished ditch and bank and a dished platform subsequently interpreted as the foundations of a house. The purpose, to construct a farm with farstead and ancillary buildings, paddocks and fields, appropriate livestock and crops, is necessarily one which is long term. Indeed any activity or process directly concerned with agriculture gains greater validity the more seasons through which it is conducted.

The major single factor which dominates the agricultural process is the weather. All the available evidence points to a marked similarity between the weather pattern of today, including all its violent eccentricities, to that which obtained in the Iron Age period. Not only does the British weather, because of its variability, dominate most Englishmen's conversation, it also moved Tacitus, the Roman historian and political commentator, to describe it as *foedum*, the most polite translation of which is foul. This basic factor, the similarity of weather pattern, validates the project and provides a « constant » element against which the results of the farming process can be measured.

At the outset I described the project as a vast open-air scientific research laboratory since this is a much more accurate description. It consists of a large number of specific research experiments which ultimately may be integrated together in such a way that simulates an actual farm. Given the concept of such a research laboratory it has been of prime importance to establish a basic philosophy of procedure. Since the experiments themselves are diverse, ranging from crop yield experiments to the reconstruction of buildings, from mycology to thermodynamics, the requirements of each individual scientific discipline which a specific experiment employs must be satisfied. One seeks not simply to persuade an archaeologist or prehistorian, one seeks to fulfil the demands of the scientist.

That philosophy is best presented as a cyclical formula (figure 1). The most important element of the formula is the

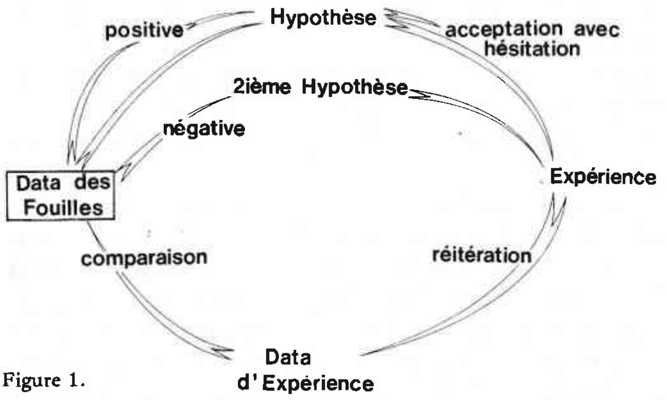

Figure 1.

prime data. These are the archaeological features and artifacts upon which any hypothesis is based. The term « hypothesis » is deliberately employed since it allows for reassessment to take place. Interpretation, on the other hand, suggests total comprehension. Further, the experimental process is designed to test the validity or otherwise of an hypothesis. It must be clearly understood that more than one hypothesis can be mounted from a particular set of data and that of these hypotheses more than one may be proven valid. The experiment, whether it is designed to test a structure or a process, yields its own data. Because the experimental process is conducted within rigorous and known constraints the data yield is scientifically acceptable and provable. The test for validity lies in the comparison between the experiment data and the archaeological or prime data. With negative correlation a second hypothesis is necessary. Positive correlation allows the tentative acceptance of the hypothesis as valid. Yet validity does not indicate that the hypothesis is historically correct.

The element of the cyclical formula that should be stressed is the replication of experiment. It is essential that the experiment itself is validated and that the results are beyond question within the context of the experiment.

One immediate effect of the experimental approach is the recognition of the number of variables regularly involved within any hypothesis. Close scrutiny of the minutiae inevitably raises alternative approaches and the execution of an experiment throws up further variables which had previously escaped recognition. Consequently experiment regularly involves the necessity for the « multiplicity of hypothesis formation », an uncomfortable but accurate phrase. Several hypotheses can be proved to be valid, though none are necessarily true and in any attempt to understand an excavation of a site, all such hypotheses should be initially integral to the thinking stage and subsequently, in terms of their relationship with other material evidence, the most unlikely should be rejected. It is an error of judgement to accept without due consideration the hypotheses raised from other excavations on the basis of tenuous similarity.

The greatest contribution of experiment in archaeology is the establishment of the boundaries of probability. Indeed this is the contribution of experiment in any field. It is of value here to present an analysis of experiment as recognised in the scientific world. The process of accumulating scientific knowledge involves the formulation of rational, logical, deductive theories, the establishment of « rules of correspondence » between the theories and the real world, and testing whether the observations of the real world confirm or disprove a theory. In the most rigorous sense, no theory can be proven true or validated. It can, however, through proper experimentation be invalidated. A theory can be considered valid only after repeated conduct of experiments which by their design appear capable of proving the theory invalid. If such invalidation constantly fails to occur, then the theory may be tentatively accepted as valid.

When most people think of experimental archaeology their immediate reaction is to think of the reconstruction of buildings. Although this area of research is important and has by far the greatest visual impact, nonetheless it represents less than ten percent of the projects undertakings. Farming of any period is necessarily about fields, fences, crops and stock. Buildings are to a large extent ancillary features and generally the nature of the archaeological evidence is so ephemeral that it is extremely difficult to hypothesise a real three-dimensional structure. This is particularly the case with regard to rectangular structures since the variables are virtually infinite.

For circular structures, on the other hand, it is possible to make an attempt. This example is based upon the excavations carried out at Maiden Castle, an Iron Age hill town in Dorset by the late Sir Mortimer Wheeler (figure 2). There

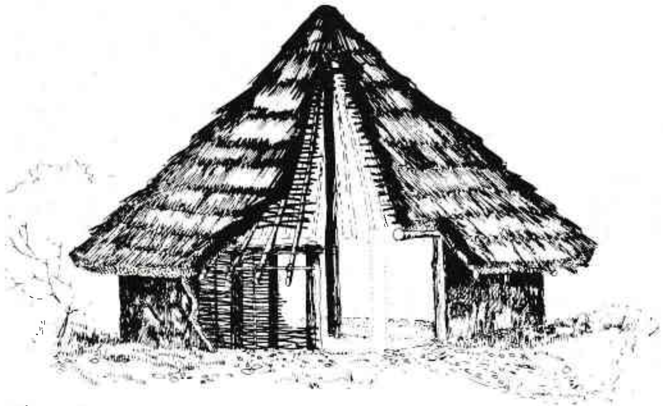

Figure 2.
Ancient Farm-Maiden Castle Round-House.

he discovered a circle of post-holes encompassing an area of crushed chalk in the middle of which was a solitary post-hole. In addition he found fragments of daub, a mixture of earth, clay, animal hair, straw and grass. Daub is a traditional walling material. He interpreted the structure as a house. This reconstruction is based upon an exactly similar ground plan. The juxtaposition of the upright posts and the discovery of the daub implies a wattle or interwoven hazel-rod wall. From as early as the Neolithic period in the South West of England, there is clear evidence of coppicing hazel trees to obtain the rods for building, fencing, hurdles, baskets and other structures. The completed wall of interwoven hazel rods is extremely strong. The doorway is the weak link in the structure and is fitted with a solid wooden lintel. The central post-hole was taken to imply a vertical post to support the apex of the roof.

The roof inevitably is a matter of conjecture. Pytheas describes the houses in southern Britain about 350 B.C. as circular with thatched rooves. The pitch of the roof, therefore, must be at an angle of 45°-50° to the horizontal. If at a lower angle the rainwater will penetrate into the straw and the roof will leak. The central post acts as a support for the main rafters. However, because the apex of the roof needs to be carefully shaped in order to be waterproof, it becomes necessary to provide a subsidiary support called a ring-beam. This is a traditional building device to be seen in many of the extant round-houses especially in Africa. In this case a rectilinear ring-beam is attached to the roof. All the other rafters are attached to the outside of this ring-beam and to the protruding uprights of the wall. The rafters are also interwoven with hazel rods to provide a base for the thatch. The completed timber work of the house demonstrates not only its strength but also the subtlety of the design.

The completed roof required one tonne of straw. From other crop-growing experiments this suggests the harvested straw from three celtic fields. Celtic fields range in area from 1/6 to 1/4 of a hectare. The wall has approximately seven tonnes of daub in its construction. The ingredients of the daub are mixed with water to a plastic consistency and then plastered onto the wattled walls from both inside and outside. As it dries so the daub contracts and cracks. However, once these cracks are filled, in contrast to modern buildings, they remain filled. The house was completed in 1973 and has received virtually no attention since that time.

While the construction process itself is interesting, its real value is appreciated as one studies its life history. Every detail is carefully monitored especially with regard to the effect of the weather upon it and to its effect on the ground surface. Its design is aerodynamically perfect since at no point does it offer a large flat surface opposed to the elements. In addition the daub as long as it is kept in good condition, the work perhaps of two days a year, provides the real strength of the wall and it is not particularly important if the wall posts actually rot away in the post-holes. During the winter the house is used for storage of grain and hay and naturally attracts rats. These have made their home inside the cavity wall and have burrowed under the wall itself producing around a third of the circumference a clear gulley. The archaeological evidence of this house has consequently been changed quite radically. Also it is generally thought that under the eaves of the roof, the constant dripping of water would produce a further gulley called a drip trench. In fact the opposite has occurred. The eave has provided a protected habitat which has been colonised by plants and the resultant deposition of humus has produced a build-up of material. At the doorway the opposite effect has been observed where the passage of feet has produced a shallow depression. In wet weather this becomes a puddle and the splash action only serves to deepen it. This observation allowed the isolation of doorways in an excavation of an Iron Age settlement in Yorkshire.

The largest reconstruction of a prehistoric house ever undertaken has been built at the Demonstration Area of the Butser Ancient Farm. The ground plan is taken from a first-class excavation at Pimperne Down in Dorset (figure 3). It

Figure 3.

comprises an outer ring of stake-holes, an inner ring of post-holes with a series of massive post-holes for the porch. Beyond the outer ring of stake-holes a series of six regularly spaced shallow slots were recovered. The excavation indicated one rebuilding of this structure utilising the same porch post-holes. The time span of the site is some 450 years. That fact alone argues for the construction of houses not only for the present generation but for a large number of generations.

The reconstruction process moves through specific stages. The first stage involves the exact simulation of the ground plan, the construction and recording the stake and post-holes and the insertion of stakes and posts. The initial conjecture is the specific height of the stakes and posts. Because the roof is to be thatched the pitch must be at 45°. At first the wall height was postulated at 1.50 m but during the roof construction it became probable that this height was actually correct.

Round-houses depend upon the strength properties of the circle. For this construction the outer ring of stakes interwoven with hazel rods make up the first circle. The inner ring of posts, however, absorbs much more of the weight-thrust of the roof. Consequently a full ring of timber is set onto these posts with mortice and tenon joints and pegged scarf-joints. Its appearance and indeed the method of jointing is remarkably similar to that of Stonehenge. the major problem with the outer wall is posed by the break in the circle at the porch. The massive post-holes argue for major timbers. These provide a weight counterthrust to the break in the circle.

The positioning of the first rafter, each one had to be raised individually because of the weight involved, some 120 kilos per rafter, caused considerable difficulties. Although the house had been carefully designed the weight distribution of each rafter had been overlooked. The length of rafter beyond the inner ring proved heavier than the outer length. Re-examination of the excavation plan isolated the shallow curved slots set at regular intervals around the structure. By extending the 45° angle from the inner ring to the top of the outer wall and on to the ground surface these curving slots fitted exactly into place as the positions for the base of the major rafters. The wall height of 1.50 m, therefore, initially conjecture, now was supported by physical evidence. Six slots indicated six major rafters. These were duly positioned, jointed to the outer wall and pegged with oak pegs to the inner ring. The ring beam in the roof was attached to these major rafters a third down the slant height. In this case the majority actually formed the apex of the roof. Finally the purlins, split hazel rods, were attached to the outside of the rafters, and the structure was thatched. The last stage of the construction was the daubing of the walls.

The statistical details of the structure are fascinating and have considerable implications for the Iron Age. Over 200 trees, primarily oak for the upright timbers and ash and elm for the rafters as well as 20 hazel trees for the rods, were used in the structure. Some 15 tonnes of daub were applied to the walls. Approximately 5 tonnes of straw were used to thatch the roof. The roof weighs over 12 tonnes and has a free span of over 9 meters.

The trees needed for the structure were straight and close grained, the kind of trees normally found in managed woodland. The hazel rods are the product of coppicing, itself a seven-year programme. Such a house clearly implies the careful management of woodland. The straw similarly implies a considerable number of arable hectares and careful harvesting and storage.

The construction of houses despite their fascination and undeniable visual impact, represent only a minor element within the overall research project. One point must be made, however, concerning the reconstruction of structures, is that it would be quite wrong to consider these to be Iron Age houses. They are specifically and only reconstructions based upon archaeological evidence. The fabric of the structure may be accurate, indeed the space it confines may also be accurate but the detailed manufacture may be quite inaccurate.

The major research programmes at the Ancient Farm necessarily have been devoted to the agricultural cycle itself. Unfortunately within the confines of a simple lecture it is quite impossible to deal with all the aspects of the research and consequently I propose now to deal with a brief selection of the most important.

Our evidence for the livestock of Iron Age farms is drawn principally from the bones recovered from excavations. Unfortunately *bos longifrons*, the Celtic shorthorn is extinct. Consequently we have had to obtain the nearest equivalent animal to provide the traction element particularly for ploughing experiments. The Dexter cattle originally bred from the Kerry cattle of Ireland sometime in the last century, are ideally suited. Properly the Dexters are very small cattle but occasionally the breed reverts back to the Kerry and produces « long-legged animals ». These longer legged animals are equivalent to the extinct *bos longifrons* in shoulder height, body weight and general appearance and presumably in pulling power. A pair have been trained to the yoke and form the « power-unit » of the farm. Another breed of cattle, the Highland, is similar to the Dexters and would also be suitable as an unimproved breed. To date we have not yet trained a pair to the yoke although the project has a small herd.

Keeping cattle, of course, underlines the problems of the farmer of any period of time. The provision of food and water for livestock and cattle in particular is regularly overlooked by the archaeologist and prehistorian and yet it is a major farming problem. The months of May and June are largely given over to the production and stacking of hay. Perhaps in prehistory leaves, particularly of elm, oak and ash trees, were collected, dried and stacked as well. It is of interest to record that both the Dexters and Highland cattle will happily browse on leaves during the summer and early autumn. The major problem, of course, is the winter itself, the months of December to April. It is nonsense to believe that the majority of animals were deliberately killed in the autumn of each year. The breeding cycle for cattle alone is at least two years which inevitably includes two winters. Despite the fact that provision of fodder is a vital necessity, so far no clear evidence of barns or haystacks has been isolated.

The bones of sheep and goat are notoriously difficult to distinguish. However, the sheep bones that have been identified especially from sites in Southern England are extremely similar to a breed which survives to this day. These are the Soay sheep from the St. Kilda Islands off the north-west coast of Scotland. As a breed they have survived virtually untouched on these remote islands. At the farm a flock of these sheep, the foundation stock was imported, from Hirta, one of the St. Kilda group of islands, is kept to study both the growth patterns and behaviour of the animals and the problems of their management in an arable landscape. Undoubtedly they have survived in the feral state and despite their physical structure remaining fairly constant, some genetic changes may have taken place. A major difficulty is their re-domestication. They are impervious to dog control. They run like deer and can leap fences nearly two meters high with relative ease. The wool is basically soft but does have some kempy fibres and makes into splendid garments. It is plucked and not sheared in June of each year. Approximately two kilos of wool is taken from each animal. Lambing takes place in April and early May. In the late Iron Age a different kind of sheep makes its appearance. In addition, sheep shears have been recovered from excavations of late Iron Age sites. In all probability this animal is very similar to the Shetland sheep, another breed which still survives today. This animal is much heavier and yields considerably more wool.

With regard to other domestic livestock the evidence is extremely slight. The goat was probably small and similar in appearance to the Soay sheep. The Old English goat is the nearest modern equivalent but this too is virtually extinct. Caesar tells us that the Celts kept chickens and geese – *animi causa* for the sake of pleasure but thought it wrong to eat them. Very few bird bones have survived but those that have suggest that the geese were the « Grey lag », *anser anser.* Geese, while not necessarily agreeable birds, can be faithful to their owners and excellent guards. Indeed they have been kept domestically for this very purpose for thousands of years.

The chicken is probably *gallus gallus*, the Indian Red Jungle Fowl. The element of pleasure undoubtedly lies in the main reason for their original domestication in the Indian sub-continent and China, cock-fighting. This had spread certainly throughout the mediterranean in the first millennium B.C. There is little doubt that it was also introduced to the Celtic world long before the Roman expansion in the first century B.C. Bronze spurs have occasionally been recovered from excavations which further supports this theory. Their maintenance on the other hand provides a source of considerable interest. Even exotic breeds of fowl scratch around in search of food and make for themselves dust baths sometimes to considerable depths of 30-40 centimeters. Regularly they dig holes around posts converting a neat purpose-built post-hole into a formless pit. Further, observation has shown that when kept in a pen the chickens tend to dig around only one of four posts. Archaeologically this is of great importance as a potential variable.

Apart from the obvious reasons for maintaining animals within the context of a farm, the most important purpose is to focus attention upon the minutiae, those apparently minor aspects of day-to-day animal control which archaeologically assume critical importance. The sheer mechanics of animal husbandry give far greater insight not only into the problems of excavation interpretation but also into the isolation of features which were previously unrecognised.

Plant husbandry similarly focusses attention upon the minute details. Our basic evidence is drawn principally from three sources, carbonised seeds, seed impressions fired into pottery and pollen evidence. The present state of knowledge allows us only to make statements concerning the presence and absence of plants and cereals. As techniques improve and the contribution of experiments increases more information may be gained in the future. The aims of the research programmes are to examine the behaviour patterns, sowing and germination characteristics and probable yield factors, of the evidenced plants to provide a framework for assessment of prehistoric agricultural economies.

The major wheat cereals of the Iron Age were Emmer wheat, *Tr. dicoccum* and Spelt wheat, *Tr. spelta.* Other crops were certainly grown, notably barley and probably oats.

The vegetable crops are particularly intersting. The most dominant of the seeds recovered are those of *Vicia faba minor*, the Celtic bean. This has been cultivated through the millennia to the present day. It has a high food value but its greatest virtue is its nitrogen fixing properties. It may have been used as a break crop in a simple form of crop rotation. Thus it would replenish the nitrogen used by a cereal crop.

Vetch, *Vicia sativa*, similarly is considered to be a potential vegetable crop. It is particularly sensitive to frost action and can only be planted in the late spring when the threat of severe frost has passed.

Linum usitatissimum, Flax, was certainly grown not for food but rather for the linen thread which is made from the stalk fibres of the plant and for the oil which can be crushed from its seeds. The oil would have been an important product for a variety of purposes including lighting, leather work and cooking. Another plant, the crushed seeds of which produce oil is *Calamina sativa*, Gold of Pleasure. Seeds of this plant are also found in deposits of carbonised seed.

There is no doubt that a range of wild plants, especially the soft fruits, provided further foods in due season and which then were not specifically cultivated. They were certainly exploited. In addition one must consider the probability that certain plants, whole not a farm crop, were specially grown for domestic purposes. The seed evidence suggests a considerable number of which two can be cited here. First *Papaver somniferum*, the opium poppy, whose seeds could have been valued as food and the latex as a medicine. Second, seemingly a vital crop, *Carum carvi*, caraway, whose seeds were added as flavouring to the ale of the Celtic period ! Perhaps it is not too far-fetched to postulate the cultivated garden, even the herb garden in the prehistoric period. There is, apart from the carbonised seed, evidence of ard marks so close to a house or structure that they must have been made by a human-drawn ard.

A major area of research at the Ancient Farm has been devoted to the phenomenum of the pit. Evidence from both excavation and field work clearly shows that the pit is the most widespread and characteristic vestige of the Iron Age occupation of lowland Britain and in France, though apparently absent on some settlement sites, and consequently represents a way of thinking current over a very large part of the country involving all the major soil types. A very large number of the pits, despite the considerable variety of shape, size and detail, were probably used for storage and most of these were probably used expressly for storing grain.

The principle of grain storage in a pit is essentially quite simple. In a sealed container, grain will continue its respiration cycle using up the oxygen in the intergranular atmosphere and giving out carbon dioxide. Once the atmosphere is sufficiently anaerobic the grain reaches a state of dormancy. Provided that the anaerobic atmosphere is maintained, the moisture content remains unaltered and a consistent low temperature which inhibits microflora activity prevails, the grain will store successfully for a considerable period.

The principles of grain storage in underground pits is certainly not exclusively prehistoric nor does it belong to specifically primitive cultures. The modern method of hermetic storage of grain in above-ground silos owes much to the principles of pit storage. In the nineteenth century in France grain was successfully stored for a period of five years in hermetically sealed metal lined concrete underground silos. A similar system of concrete storage pits designed to be impermeable to gases and water vapour is in use today in Africa and South America. In Argentina alone, storage capacity in underground silos exists for about 2,000,000 tons. However, in all the above situations the dominant factors are the impermeability of the pit lining and dryness of the grain at storage, the highest admissible level of moisture content being 13 per cent. This figure is also recommended for the grain storage fossae in Malta, the shape of which is reminiscent of the beehive-shaped pits of the Iron Age period. Constructed by the Knights of St. John under the Grand Magistracy of de Redin (1657-1660), the Maltese fossae have capacities ranging from 50-500 tons. In contrast, the largest of the excavated single pits on Maiden Castle has a capacity of between four and five tons.

A further modern parallel can be seen in the beehive-shaped storage pits of the Chibi district in Rhodesia. In the same country, the grain storage pits of the Matabele tribe have a similar size range to the excavated examples of the Iron Age and the principle of sealing them with cattle dung accords well with Tacitus' description. This last point also offers an indication that an area dovoted to pits does not necessarily have a single function since they are commonly positioned within the cattle compound.

The interim results of this long-term experiment show that it is perfectly feasible to store grain not only for consumption but also for seed in underground pits event in the inimical climate of southern Britain. The implications for the understanding of the agricultural economy of the Iron Age are considerable. Certainly they indicate a regular and maintained surplus production of cereals suggesting that by this time farming was both complex and very successful. Further one can hypothesise that the society contained the basic elements of service and production industries.

In conclusion I would like to take this opportunity of expressing my gratitude to M. Olivier Büchsenschütz for inviting me to address this conference at Levroux and for allowing the text of that address to be published, in the proceedings of that conference. May I also express my gratitude to all those people at Levroux who made my visit so acceptable with warm generosity and enthusiasm.

Discussion

Y. de Kisch : Si cela n'est pas indiscret, quel est le coût global d'une telle opération ?

P.J. Reynolds : Il s'agit d'un projet indépendant. Nous avons une subvention de la fondation Leverhulme, une petite subvention du County Council, et enfin de l'argent versé par les visiteurs, puisque l'une des maisons est accessible au public. Le tout réuni atteint la somme moyenne de 12 000 livres par an, ce qui est insuffisant.

N. Freidin : Quelle quantité de temps et de travail sont nécessaires pour construire un ensemble pareil ?

P.J. Reynolds : Le travail et le temps sont les éléments les plus difficiles à estimer dans une expérience de ce genre, parce qu'ils posent le problème de l'habileté (du savoir-faire). Nous pouvons reconstituer les objets et les processus, mais nous n'avons le moyen d'appréhender ni les connaissances techniques, ni l'habileté des hommes de l'Age du Fer. Si donc le temps est pris en considération dans ce genre d'expérience, il n'est cependant jamais publié.

A. Villes : Vous avez travaillé avec combien de personnes, et pendant combien de temps, pour construire la grande maison ?

P.J. Reynolds : J'ai travaillé avec deux personnes, et la construction a duré un an, mais les deux personnes n'ont pas travaillé continuellement. Pour couvrir le toit, il a fallu six semaines de travail, soit le temps normal pour une couverture de chaume actuelle, au dire des techniciens que nous avons interrogés ; ils ont ajouté que cela coûterait 2 500 livres pour les heures de travail, plus 100 livres pour le chaume. Nous l'avons réalisée pour 500 livres.

A. Deyber : Pouvez-vous préciser quelles essences de bois ont été utilisées dans la construction ?

P.J. Reynolds : Nous avons utilisé exclusivement le bois disponible dans les environs : le chêne pour les poteaux verticaux, le hêtre et l'aulne, le noisetier enfin pour le clayonnage.

A. Ferdière : Je crois savoir que vous n'avez utilisé que des outils qui étaient en usage à cette époque. Est-ce que pour le choix des essences d'arbres, vous vous êtes basés sur des identifications faites au cours de fouilles archéologiques ?

P.J. Reynolds : Oui, en effet, nous avons utilisé l'équivalent actuel des outils de l'Age du Fer : la scie, la hache, les ciseaux, la masse. Nous avons basé le choix des essences sur des données pollyniques ainsi que sur des vestiges ligneux conservés dans des sites de tourbières, comme Glastonbury, par exemple.

D. Muller : Quelles sont les données archéologiques qui vous ont amené à penser que les mottes de gazon étaient utilisées dans la construction des maisons, et particulièrement des toitures ?

P.J. Reynolds : J'ai moi-même trouvé des traces semblables dans une fouille. Ce type de couverture est connu dans les tumulus de l'Age du Bronze, ou sur des remparts en terre. Au siècle dernier encore, en Islande et en Norvège, on a construit des maisons de ce type qui sont toujours debout. Dans le Middle West, les Américains ont utilisé également cette technique.

A. Villes : Comment vos expériences ont-elles été ressenties par les agriculteurs qui habitent actuellement les régions où vous avez travaillé ?

P.J. Reynolds : Au début, les gens ont pensé que j'étais fou. Maintenant, ils en sont persuadés, mais ils sont fascinés !

J.-F. Baratin : Vous dites, à propos de deux maisons superposées, qu'elles ont duré quatre cents ans. Sur quelles preuves basez-vous cette affirmation ? D'autre part, à propos des céréales, vous nous avez parlé d'abord de céréales carbonisées puis, quand vous avez abordé la question des silos, vous avez dit qu'elles étaient stockées telles quelles, sans traitement. Au Moyen Age, il semble au contraire qu'on ait pratiqué une carbonisation partielle pour éviter la germination.

P.J. Reynolds : Le Pr Harding, qui a fouillé ces deux maisons, a prouvé que l'occupation était continue — le porche est commun aux deux périodes et il n'y a pas d'interruption dans la couche archéologique — et l'analyse de la céramique indique une durée de 450 ans au total. On ne peut pas connaître la durée de chaque phase.

La réponse à la seconde question ne peut pas être simple, car nous travaillons sur ces problèmes depuis plus de dix ans. Quand on met des grains dans une fosse fermée, ils produisent du dyoxyde de carbone. Ce dyoxyde agit comme un agent protecteur et empêche la germination. Si l'on sèche ou si l'on carbonise les grains, il n'y a plus ce phénomène et de plus, la sécheresse ambiante attire l'eau dans la fosse. Les grains non carbonisés gardent un haut pouvoir de germination, ce qui est très important, parce que nous pensons qu'à cette époque ils étaient exportés comme semence vers le continent. Pour ce qui est des silos plus récents, ceux du XVIIe siècle et du XVIIIe siècle dans le Gers par exemple, ou encore ceux du XIXe siècle en Moravie, taillés dans le loess, les procédés de conservation sont différents. Il faut bien se garder d'utiliser des connaissances récentes pour expliquer des techniques plus anciennes. Enfin comme dernier argument, les silos de Grande-Bretagne étant creusés dans la craie, le calcaire, le sable et les graviers, si le blé contenu dans ces fosses avait été brûlé, la structure aurait été détruite.

G. Coulon : A propos des couvertures en mottes de gazon, pourriez-vous préciser pourquoi il faut maintenir un feu constant dans les maisons qu'elles abritent ?

P.J. Reynolds : La chaleur que dégage un feu continu crée une atmosphère de serre, qui permet à l'herbe des mottes de continuer à pousser ; or c'est précisément l'herbe qui maintient, quand elle reste vivante, la cohésion des mottes.

R. Agache : Comment étaient scellés ces silos ?

P.J. Reynolds : Les fosses étaient bouchées avec de l'argile recouverte d'une couche de terre destinée à maintenir l'humidité et la plasticité de ce bouchon. J'aurais pu vous parler plus longuement du problème du stockage des grains ou de l'agriculture, mais ce soir, nous avions choisi de parler des maisons.

A. Ferdière : Pensez-vous qu'il existait à côté des silos à cette époque des greniers surélevés ?

P.J. Reynolds : Oui, il y a eu d'autres systèmes de stockage. Mais il faut toujours se rappeler que les céréales exercent une pression égale aux 2/3 de leur poids. C'est pourquoi toutes les structures de stockage doivent être des constructions massives. Dans les greniers romains, ou dans ceux de la Moravie ou de la Pologne par exemple, on trouve des parois en argile épaisses de 35 à 50 cm !

A. Dautant : Quelles données archéologiques vous permettent de dater des sillons de l'Age du Fer ?

P.J. Reynolds : Dans le site que j'ai montré, ces traces de sillons sont scellées par des couches de sable éolien stériles, puis par des couches de l'Age du Fer et d'autres plus récentes : ils sont donc ici bien datés, mais ce n'est pas toujours aussi facile.

A. Villes : Les maisons que vous avez montrées n'ont pas de fenêtres, si j'ai bien fait attention. Donc, il devait y avoir un éclairage artificiel. Avez-vous pu retrouver, quoique cela soit bien entendu très difficile à savoir, des traces indiquant des mesures de protection contre le feu ?

P.J. Reynolds : En effet, il n'y avait pas de fenêtres, et il devait y avoir un éclairage artificiel. Nous n'avons pas de traces évidentes de prévention contre l'incendie, mais en Angleterre, il y a vingt siècles de tradition d'utilisation des toitures en chaume, qui n'ont pas brûlé parce qu'on a simplement fait très attention au risque d'incendie.

O. Büchsenschütz : En ce qui concerne les problèmes de stockage des grains, il faut signaler deux colloques organisés par des ethnologues, le premier à Aix-en-Provence, le second à Pau-Arudy cette année. Celui d'Aix sera bientôt publié avec une communication de P. Reynolds sur ce sujet. Les auditeurs non spécialistes auront peut-être remarqué qu'à l'Age du Fer, les maisons sont généralement rectangulaires sur le continent, contrairement à ce que nous avons appris à l'école, et rondes uniquement sur les îles Britanniques. Vous avez pu constater qu'au-delà des fouilles de sauvetage, effectuées trop vite derrière la pelle mécanique, au-delà même des fouilles programmées, qui sont en France le *nec plus ultra*, P. Reynolds a pu aller jusqu'à l'expérimentation et à la vérification des hypothèses, qui constituent une phase indispensable de la démarche scientifique. On sort ainsi du domaine un peu étriqué des spécialistes des fosses et des trous de poteau pour aborder les véritables problèmes de l'habitat. Enfin j'attire votre attention sur un détail qui montre déjà une liaison entre les deux thèmes de notre colloque : R. Pêcherat nous parlera dimanche du rôle symbolique des porches de grange en Berry, et cela nous rappellera les propos de P. Reynolds sur les porches des plus grandes maisons rondes de l'Age du Fer britannique, qui étaient également porteurs de signes, annonciateurs de la fonction du personnage qui habitait la maison.