"Archaeology By Experiment

A Research Tool for Tomorrow"

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New Approaches to our past - an archaeological forum. T. Darvill et al (Eds) Southampton University.

SUMMARY

This paper seeks to present archaeology by experiment as evidenced by the work at the Butser Ancient Farm Research Project and its Demonstration Area as a fundamental 'new approach'. The project is, in fact, a unique open air research laboratory devoted to prehistoric agriculture and archaeology, specialising in the Iron Age period. The Demonstration Area, divorced from the research site, is designed to present both research programmes and demonstrations to all levels of the public. The general thesis adopted is that postulated interpretations or hypotheses should be validated by experimental testing before their popular acceptance. Results from experimental programmes are reported by way of example. In addition the large number of variable factors associated with the results revealed by such testing should be thoroughly recognised as significant aids to improved excavation techniques and increased multiplicity of interpretation for archaeological features. Experiment is also argued as an important element in the assessment of the degradation of archaeological field monuments, in particular in terms of establishing the destruction rate of modern ploughing.

A further function provided by the experimental approach is the provision of an interpretational/educational 'bridge' to the public. The Demosstration Area of the Butser Ancient Farm Research Project shows not a reconstruction of an Iron Age settlement but rather the annexe to a working laboratory.

Archaeology over the last twenty years has progressed considerably in almsot every area. Gradually it is becoming a science embracing a great number of different disciplines as aids to understanding the raw data of excavation. Indeed as we have seen a chemical revolution in agriculture since the last World War so there has been an 'environmental revolution' in archaeology over the last two decades. With refined excavation techniques more and more environmental material is being recovered and analysed. The subsequent analyses are beginning to clothe the bare 'post-hole data' with a greater appreciation of the ecosystems involved. There is, however, a great danger of incipient complacency. Just as in the past specialist reports have formed mere appendices to excavation reports with little correlation of specialist results with the overall site interpretations, there is an inclination now towards the reverse case. It is vitally important when employing other sciences as interpretational aids to be aware of the limitations both of the environmental data and of the scientific discipline in which range they occur. A small number of beetle wings can hardly indicate an environment; the carbonised seed from a pit is unlikely to indicate an agricultural system. In the former case a minimum sample of a thousand individuals is scientifically persuasive (Dr. C. Nield - report forthcoming), in the latter the most generous assessment would allow some observations of isolated crop treatment but more properly presence and absence evaluations. Similarly the evidence from pollen rich samples are necessarily localised by their very nature and can give only generalised partial pictures. The combined results of these and all the other contributory sciences undeniably indicate the way forward but invariably require greater qualification and appreciation of sample bias.

The impact of rescue and salvage archaeology in recent years has been enormous. Indeed it has been this movement which has allowed archaeology to mature in almost every aspect. Certainly the great interest engendered publicly and academically has unquestionably improved the subject. The culmination of this approach has been the formation of 'archaeology units' to deal with threats posed by motorway and pipeline developments, urban redevelopment schemes and encroaching arable agriculture. Such units have been built ideally to cope with the increasingly multi-disciplinary nature of archaeology. The initial and most easily comprehensible contribution that has been made by their activity is the number of new sites of all periods whose presence was previously unsuspected. Period distribution maps have been radically altered. So much is this so that there would seem to be a fundamental need to re-assess much of the accepted material. The detailed results of a great deal of recent rescue excavation are only now beginning to emerge. Their publication in turn raises enormous difficulties. Because of the mass of data involved and the prohibitive cost of publication there is a serious doubt that much of it will ever be readily available. This problem has received considerable attention already and despite the proposals of different publication levels no clear national decisions have been reached, far less implemented. Further, the urgent need to publish as soon as possible is itself exacerbating any judicious interpretations of excavated sites where the basic data is integrated with the specialist reports. Since the whole development of rescue and salvage work has happened so quickly there is a real doubt that techniques have not been allowed to keep pace. Indeed when the final analysis is made there is a distinct possibility that the mass of the information will be but a quantitative increase of what was known before.

This may well be the time to propose a moratorium on all excavation in order to evaluate the present state of knowledge and to define exactly the outstanding probelms. There is a vast range of material, especially for the prehistoric period in general and the Iron Age in particular which defies any interpretation. It is hardly acceptable to observe that a pattern recurs without being able to ascribe a function or functions for that pattern. The problem of the pit, ubiquitous on a great number of Iron Age sites, is one such pattern (see below). The parlous state of financial support for archaeology both from the government and independent sources itself urges a change in direction, a new approach. It is increasingly unwise to continue to recover more and more of the same material without seeking specific answers to specific problems. One example of this process has been the concentration upon settlements especially of the Iron Age. There is little doubt that the basic economy of the Iron Age was agriculture. Yet not one 'celtic field' has been totally excavated. Very few lynchets have been deliberately examined as a function of cultivation. Such ard marks that have been examined are invariably the accidentaly result of a settlement excavation. Such information is fundamental to any interpretation or understanding of an agricultural economy. Farming essentially comprises fields, fences and faeces. The farmstead and farmyard will only make appreciable sense once the function of the fields have been comprehended. Rather than excavate one more settlement site a research programme to examine fields, their boundaries and manuring evidence needs to be devised and implemented. Further, such a programme inevitably needs to be closely allied with direct functional experiments since in this way the specific questions may be framed against a series of testable hypotheses. Similar programmes can readily be designed for all periods with little difficulty.

The philosophy of experimental archaeology has been dealt with elsewhere (Coles 1973 , Reynolds 1977) but it is useful to reiterate briefly the basic approach. This philosophy is specifically orientated to prehistory where documentary evidence is either absent or subject to some suspicion. There is, for example, need for some reservation in accepting the statements made by Classical writers which refer to Britain particularly in the Iron Age. By virtue of the past six years research at the Ancient Farm, however, a number of these references have become more credible. The yield figures, for example, from the experimental fields lend credence to a surplus production and subsequent export of grain to the continent. The implications raised by acceptance of the validity of this reference alone are considerable. On the other hand many of Caesar's comments are woefully inaccurate and occasionally contradicted in his own commentaries.

The philosophy is most simply explained as a cyclical formula (Figure 1). The most important element of the formula is the prime data. These are the archaeological features and artifacts upon which any hypothesis is based. The term '<u>hypothesis</u>' is deliberately employed since it allows for re-assessment to take place. Interpretation, on the other hand, suggests total comprehension. Further, the experimental process is designed to test the validity or othereise 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 experimental 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 factually correct.

This presentation of the formula as cyclical also underlines how it can be commenced at different points (Reynolds 1977 ). An hypothesis can be mounted without the presence of any prime data simply because a structure or process must logically have existed in order to provide a specific artifact. Charcoal production for smelting ore and clamps or kilns for making pottery are obvious examples. Experimental data which were unexpected within the context of the experiment can occur. These occasionally have an excavated counterpart which has previously defied comprehension or even recognition. One particular example which illustrates this point is the effect of burning on chalk rock. In pottery firing experiments using a simple clamp or contained fire repeatedly in one place, a shallow scoop has been turned into an appreciable pit a metre deep and a metre and a half in diameter (Reynolds 1977). A logical extension of this effect,unproven as yet by experiment, is the creation of a 'working hollow many of which contain clear evidence of burning on excavation. This 'side effect' of experimentation either indicates the need for further hypothesis formation or provides a valid hypotheses for extant prime data.

Ome major result of building experiments is the concentration upon the minutiae of excavation and the realisation that so much of the available information is inadequate. The examination of a function as a working entity focusses attention upon evidence which should be there but is not recorded. This may be because it was not there or that it was but remained either unrecognised or dismissed as of no significance. Thus a valuable contribution which experimentation makes is the requirement for further specific excavation. Such excavation will have defined problems for which answers are to be sought.

In this connection the research into the storage of grain in underground silos is of considerable importance. The problem posed by the mass of pits on Iron Age sites is referred to elsewhere in this paper. However, one hypothesis which has received great attention since it was proposed after the excavation of Little Woodbury (Bersu 1940) is that some of the pits were used for the storage of grain. Several experiments examining this hypothesis have been conducted during the last twenty years (Bowen and Wood 1968, Reynolds 1967 & 1969 & 1974). The fundamentally significant result of these experiments has been that grain stored in this way need not necessarily be consumption grain but could well be seed grain. Indeed the latter case is the most likely simply because of the grain mass required to fill an average sized Iron Age pit (approximately one tonne). Such pits, bearing in mind their abundance, may well represent bulk storage of grain prior to export. The point at issue, however, is the effect of the function upon the structure of the pit. Replication of experiment is, of course, a basic requirement. By repeating the process of grain storage in the same unlined pit on an annual basis for a number of years, the nature of the pit wall has undergone a radical change. Initially a new pit is cut into the rock and the walls, however regular the pit, are themselves rough textured and the blocks of chalk rock are sharp edged at the interstices and faulting planes. The change has been brought about by three basic causes, the cleaning from the pit walls of the grain which has germinated providing the carbon dioxide so vital for successful storage; the roots of the germinating seeds which cling to the rough texture but on removal take with them tiny particles of chalk; thirdly during the summer when the pit is open the algae (Chlorella vulgaris and Chlorella elipsoida) grow on the pit walls and similarly smooths down the rough texture. The actual insertion and removal of the grain has least effect. The pit wall ultimately becomes quite smooth (Plate I). Although the author has observed this wall state in Iron Age pits it has yet to be recorded as significant data in an excavation report. Indeed when dealing with the archaeological features of the pit there is a disproportionate amount of attention paid to the fill and its artifacts. Since a pit is no less a structure than a standing building it at least deserves the same attention as a building and should have its walls fully recorded and, in many cases, drawn. Indeed several pits should be now excavated in the light of the results from the grain storage research programme.

One further observation which must be recorded is the dramatic effect of disparate weathering of the walls of a pit left open to the elements. A rapid breakdown of the wall surface of a pit is experienced on the northern arc while the process is considerably slower on the southern arc. During the winter especially when frost is a common occurrence the nature of the northern wall arc can be altered within a few days. The damage is caused by the heating differential vis à vis the sun's track. The implications of this for the excavator are obvious. Implications for hypothesis formation are, however, somewhat more complex. It may, for example, prove possible to determine which season of the year a pit was left open to the elements, if a pit was covered at all times whether full or empty, if a pit was deliberately backfilled in the space of one season or over a number of seasons.

The contribution from this one aspect of this research programme argues for a different technique of excavation simply because it focusses attention upon the problems and effects of function. It would be unwise to assume that this is an isolated case.

One further important issue which has emerged from recent excavations and the virtual impossibility of total site excavation has been the principle of sampling. In the statistical sense sampling can be a swift and provable method of reaching an accurate solution. The solution thus provided can always be checked by appraisal of all the data. However, sampling in an archaeological situation is somewhat different. Since so few sites and arguably no sites at all have been totally excavated there is no adequate 'data-bank' against which a sample procedure can be adequately tested for potential bias. Blind sampling, therefore, of an archaeological site is statistically unacceptable. Experiment on the other hand, can supply a real 'data-bank' against which a sampling procedure and bias assessment might be reached. For example, the cultivation of a 'celtic field' with prehistoric type cereals and concomitant weed flora provides as accurate a 'data-bank' as could be achieved. One result of this experiment at the Ancient Farm, replicated some six times, gives a yield figure in seeds of emmer wheat of over 32,000,000 per hectare. Sampling of relative numbers of carbonised seeds from pits in this context bearing in mind the number of variables involved in their carbonisation and ultimate deposition in the pit gives some idea of the unacceptable bias. Further assessment of the frequency, stand heights and fruiting times of arable weeds whose seeds are found in the carbonised deposits also underlines the danger of sample bias. Hares Ear or Thorow-wax (Bupleurum rotundifolium) now virtually extinct as an arable weed but whose carbonised seed occurs commonly in the Iron Age contexts, has a stand height of approximately 0.45 m. Emmer wheat (Tr. dicoccum), in one replicated experiment involving no nutrient additives to the soil, has an average stand height of some 0.95 m. If the documentary evidence of reaping only the ear is accepted, any admixture of thorow-wax seeds and emmer seeds can only come about in the harvesting of the straw where the emmer seeds are subjected to most unfavourable conditions low down in the crop where their development is significantly restricted. The seed deposition in the pit becomes increasingly unreal as a reflection of the true functional state of a crop as to deny the value of sampling other than to determine quantitative presence and absence. However, sampling of the field situation will provide a data background against which subsequent feature sampling and bias can be assessed. The experimental approach here provides the acceptable reality and focusses attention upon the observable variables of function against which sampling procedures may be developed. More importantly the experiment itself focusses attention upon the paucity of the data and clearly indicates the need for improved data collection and further suggests the specifics to be examined.

Experiment, of course, is not limited solely to the techniques of production whether of fields or structures. Some most notable experiments both here and on the continent have examined the natural degradation and internal movement of deliberately constructed earthworks (Jewell et al, ~~1960, 1968~~ 1963 Liining 1972, Reynolds 1972). The results of these experiments, in a sense artificial since no animal or human activity monitored or otherwise is admitted, are invaluable in assessing the natural effects of weathering. In association with observed degradation of actual earthworks some assessment of plough damage can be achieved and recommendations made for suitable conservation. There is, however, a much more serious threat that is to a certain extent not fully recognised and even complacently ignored. This is the threat to earthworks evidenced only by aerial photography as soil or crop marks. Such earthworks are nonetheless real and there is a need, the urgency of which is directly proportional to the increasing acreage being taken into arable and the intensity of cultivation to assess the rate of plough damage to these features. An experimental 'subterranean earthwork' has been proposed to assess this damage (Reynolds & Schadla-Hall 1978). Briefly the proposed earthwork consists of a 'V' section ditch, octagonal in plan, which has been allowed to weather for one winter and subsequently backfilled. Thereafter the area is to be subjected to normal agricultural activity, the effects of which can be examined by excavation on an annual basis. The great advantage of such a proposal is that of an accurately recorded starting point against which ensuing damage can be precisely measured. In addition the assessment will be achieved in a relatively short time. It is quite impossible to assess damage to actual sites since the process of assessment requires a clearly defined start point as a standard for comparison.

Similarly the rate of degradation of potsherds in ploughsoil requires immediate attention especially as it is now being realised that the sole evidence for a settlement site can be ploughsoil finds (Schadla-Hall personal communication ~~1977~~). Observational experiment here will also provide invaluable standards for comparison (Reynolds & Schadla-Hall 1978). An initial assessment of actual degradation of Bronze Age sherds under modern cultivation has recently been carried out (Reynolds ~~1979~~ report forthcoming). The results, presented graphically in Figure 2 show an average decrease in sherd size of approximately 60%. In ten years of arable agriculture it is not yet known whether this is an exponential function. Less well fired pottery of the Iron Age is suspected to disintegrate after only one winters exposure in the surface of ploughsoil (personal observation).

Surface pottery distribution as indicative of archaeological features has for some time been suspected and precise plotting of such finds has been undertaken on some excavations (e.g. Fowler, Gardner & Rhatz 1980). There is, however, no clear model of how pottery distributions under modern or even prehistoric ploughing conditions are affected. If, as has been suggested above, pottery distributions are the only remanent evidence of an occupation site, there is a clear requirement for the implementation of a programme to examine the effect of ploughing both ancient and modern on potsherd movement (Reynolds & Schadla-Hall 1978). The results of such a programme allied with the evidence from excavations could provide an interpretative framework for such ephemeral sites.

Finally within the overall theme of this conference, 'New Approaches to Archaeology' it would be quite wrong to omit discussion of the presentation of archaeology to the public for whom the subject holds an undeniable fascination. The success of many and varied television and radio programmes are indeed adequate testimony. In addition the plethora of popular modern books and the anxiety of publishers to produce yet more argue the willingness of the public to buy the subject. Yet it is necessary to ask whether the best face of archaeology is being presented. Inevitably, as the multi-disciplinary nature of archaeology gains greater acceptance and understanding, so the results have become increasingly complex and couched, quite properly, in scientific language. This very movement has lead to an incipient gulf between the researcher and the populariser. There is a clear danger of the re-establishment of the 'ivory-tower', incomprehensible except to the initiates, which 'Rescue' has done so much to destroy. Archaeologists have a direct responsibility to the public not least because in the vast majority of cases they are directly funded by the public. The professionals need to be very much more aware of their obligations not only in the dissemination of information but also in their relationships with land-owners, state organisations and corporate bodies. It is of singularly little value to be misunderstood and even obstructed by those very people whose permission and compliance is vital. The most obvious example to quote is the reluctance of most farmers to co-operate since objectives are poorly defined and adequate liaison, except on personal bases, relatively rare.

It is against this background that the Butser Ancient Farm Demonstration Area (BAFDA) was conceived. The over-riding philosophy was and is to present to the public at every level not only the results of research programmes at the Ancient Farm as demonstrations but also to present actual research programmes themselves. In effect the demonstration area was specifically designed as an annexe to the main research laboratory. The major focus of BAFDA is the reconstruction of the house excavated at Pimperne Down in Dorset (Harding 1974). This reconstruction was excavated as a full scale research programme and resulted in the largest round-house reconstruction ever achieved. Apart from the remarkable scale of the structure, the most significant factor to emerge from the programme was the ability to distinguish between structural and constructional features evidenced in the archaeological ground plan (Reynolds - report forthcoming). This distinction which proved impossible to isolate on paper, justified the programme entirely.

There are inevitably further significant implications raised by the structure. Indeed, since the structure is an entity and in a real sense a working entity further archaeological and academic implications will be forthcoming. Yet its major contribution may well be non-academic since it provides for the general public, schoolchildren, students and even professional archaeologists, a new appreciation of the Iron Age. Even if the detail of the structure is in error, the space it confines and the materials with which that space is confined are accurate. The realisation that structures within which an expensive modern house could be placed existed over two millennia ago is arresting for the vast majority of people. In addition the structure adds a new dimension to the normal view of archaeological excavations where the 'find' is of seemingly tantamount importance. It is rewarding to rebuff the 'treasure seeker image' with the determination that archaeology is about people and that archaeological objects and features are really aids to discovering more about the people of the past.

The other elements of BAFDA comprise an earthwork, a ditch and bank surmounted by a palisade fence, two 'celtic fields' in which emmer wheat (Tr. dicoccum), spelt wheat (Tr. spelta), einkorn (Tr. monococcum) and other Iron Age cereals and plants are grown, paddocks for the livestock, four post structures, a museum of tools and shortly the reconstruction of Romano-British grain driers. The majority of these elements are unashamedly research projects in themselves and are explained as such. The fields, on a different soil type to the main research farm are used for crop yield experiments, earth movement assessment and arable weed propagation. The earthwork is an experiment designed to observe erosion patterns. Even the modern meteorological station blends into the whole project.

Naturally enough, since the creation of BAFDA was designed to admit the public and at the same time earn money for the continued existence of the total research project, demonstrations of processes like smelting, pottery making and firing, weaving, cooking, boat building and charcoal production are mounted at weekends. Again all these demonstrations spring from direct research programmes. It has been the authors experience that the public are more than prepared to accept the presence of scientific monitoring devices like thermocouples and metres attached to a shaft furnace or a thermistor net spread across the interior of the house. There is a greater appreciation in being invited to observe a research programme in operation than in being fobbed off with inadequate answers. The workings of an environmental laboratory of this kind are comprehensible to the great majority of people.

As an educational tool BAFDA is quite unique. Since it was first began in January 1976 over twelve thousand schoolchildren have visited the site in organised parties. Many schools have incorporated such visits into their curricula. Because of itspresence perhaps the Iron Age will no longer be dismissed as a twenty minute interval between the Egyptians and the Romans.

BAFDA, therefore, is designed to be a bridge to the public. Compromise is essentially at a minimum. It is a required function of research to present its findings to as wide an audience as possible. BAFDA is just a small beginning, a minor bridgehead established by an independent research project.

In conclusion this paper has sought to present archaeology by experiment as a fundamental 'new approach' to archaeology. The examples quoted to support the thesis argue for a re-appraisal of the archaeology of today. There is an urgent need to isolate problem areas and to design specific programmes to answer those problems. Some answers may be achieved by building experiments, establishing other research projects like the Ancient Farm, specific excavations carried out at the highest levels of technical skill. Other answers may be achieved by public ownership and conservation of certain land areas and sites and maintaining them until improved excavation techniques have been developed. Of prime importance is the cessation of indiscriminate excavation for its own sake. The moratorium urged above would allow such an assessment to be made and would persuade all interested parties, funding agencies, developers and landowners that an integrated and flexible reseach design for all archaeological periods existed and was in train. In addition there is an increasing obligation to explain to the public at large the results of archaeological investigation. Whether the means is by way of demonstration areas or utilising more simple and readily available ways, it is the contention of the author that compromise should be avoided. Complex results do not necessarily require complex, still less, abstruse presentations. The role of the amateur in the field of archaeological research is of vital importance. Given the great general interest in the subject and the nature of the problem it faces the educational obligation should be discharged in such a way as to recruit the resources to help solve that problem.

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