If this narrative account of how our dyke survey developed has any message at all, it is that research designs can develop slowly, and should be encouraged to grow, to change and improve. A small team working in a given area (the boundaries of which should change as the research changes), for a long period of time, often becomes totally immersed in the area's past and present. One's interest of necessity becomes diachronic and one trades the discipline of geographical restriction for the greatest freedom of all, that only archaeology can provide, namely, the license to move through great expanses of time. Provided that the research team is able to keep abreast of modern archaeological developments (and this is not always easy), the process of immersion somehow filters out archaeological irrelevance. Real problems, i.e. those that stand some chance of being examined against real archaeological data, come to the fore seemingly of their own accord. I cannot explain this process and do not intend to try; but it happens.

In short, parish-level archaeology need not be parochial, although sadly it often is. As we pass along our dykes, do we progress from the particular to the general, deducing, as we go, successive law-like generalisations? I suppose we do, after a fashion, but I would rather not think about it too closely. After all, when something is thought to be explained, it loses much of its mystery and thereby its fascination. Perhaps this is why, on reflection, I found New Archaeology (with its obsessive concern with explicating everything) most worthy and commendable (in a very self-conscious way), but intrinsically tedious. However, having said that, it did force one to re-examine accepted explanations -- the conventional wisdom -- from the data upwards, and thereby provided the stimulus that led me to the Fens. And I have never been bored since.

References

Crowther, D.R., French, C.A.I. and Pryor, F.M.M. n.d. Approaching the Fens the flexible way. In Millet, M. and Haselgrove, C. (eds) Proceedings of the 1982 (Durham) Theoretical Archaeology Group Conference. Forthcoming.

de Bakker, H. and van den Berg, M.W. 1982. Proceedings of the Symposium on Peat Lands below Sea Level. Wageningen, International Institute for Land Reclamation and Improvement.

Hall, D.N. n.d. Regional fieldwork on the Wash Fenlands of England. In Coles, J.M. and Lawson, A.J. (eds) European Wetlands in Prehistory. Oxford University Press. Forthcoming.

Pryor, F.F.M. 1982. Problems of survival: Later prehistoric settlement on the southern East Anglian Fen. Analecta Praehistorica Leidensia 15, 125-143.

Pryor, F.F.M. 1983. South-west Fen-edge survey, 1982-83. Northamptonshire Archaeology 18, 165-168.

Pryor, F.F.M., French, C.A.I. and Taylor, M. n.d. Flag Fen, Peterborough: Discovery and Reconnaissance. Antiquity 59. Forthcoming.

Pryor, F.F.M. and Kinnes, I.A. 1982. A waterlogged causewayed enclosure in the Cambridgeshire Fens. Antiquity 56, 124-126.

TOPSOIL AND THE ARCHAEOLOGY OF THE SOLWAY PLAIN 1981-84

R.H. Bewley

ARC Volume 1:2 published a short article on the approach to the study of the archaeology of the Solway Plain, Cumbria (Bewley 1982). Three years later, with the research finished, the author is now able to offer a portion of that work and show how it relates to 'topsoil studies'.

There are different ways in which archaeologists can use the topsoil to obtain information about the occupation of a site or the settlement of a region. For my research I divided the fieldwork into site specific and regional studies (Bewley 1984, 100-133). In this article I will report only on the topsoil aspect of the work, as a full report of the fieldwork and excavations will be published in 1986 (probably in the Transactions of Cumberland and Westmorland Antiquarian and Archaeological Society, hereafter T.C.W.A.A.S).

Site Specific Fieldwork

Three sites were chosen for this work, mainly because of their 'availability'; although many more were fieldwalked by a local team of volunteers (see T.C.W.A.A.S. 1985). The site specific approach can be summarised most effectively by a diagram, see Figure 1. In this instance Aerial Survey was the starting point, but obviously this is not always the case. The important part of the process is the Fieldwalking-Geophysical-Soil survey stage, and it is this aspect which I will explain here and the results achieved by this process.

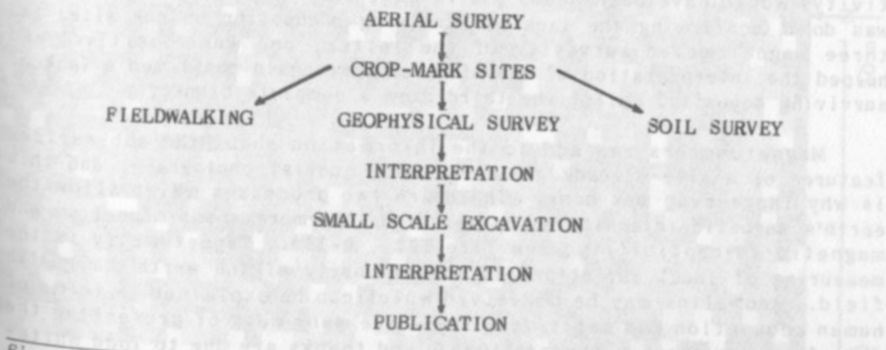

Figure 1: An approach to site specific fieldwork.

Fieldwalking

The fieldwalking was aimed at answering two basic questions. The first being 'what do crop-mark sites in this area produce in terms of artefacts?', and the other 'will fieldwalking help us to obtain a date for the sites?' To answer these questions a broad approach was necessary to enable the field-by-field walking to be done either by 'line' walking or 'grid' walking (Fasham et al. 1980, 13). Some line walking was undertaken, but a 30m grid system has proved to be the most efficient. In all, twelve sites were walked; three produced evidence to suggest a Romano-British date although this does not preclude either earlier or later occupation. However the finds from the other sites do not give a conclusive date, and this suggests that the occupation of the sites may have been either pre- or post-Roman. The most surprising feature of these sites is the amount of flint that has been discovered. To my knowledge there is no natural flint in the area, and it is usually beach pebble-flint which is used. At two sites, Cummersdale and Brownelson, a number of flints (c. 20) were discovered, including a leaf arrow head; at another site, Sandy Brow, a single neolithic petit tranchet derivative arrowhead was discovered. As yet these finds are not in sufficient quantities to be classified as proper 'flint scatter sites', but their discovery is beginning to change our understanding of the prehistoric settlement of the area. (Bewley 1984).

Fortunately these fieldwalking surveys will continue for some time to come as they are being undertaken by locally organised volunteers with professional guidance. Somewhat more complicated to organise are the geophysical and soil surveys.

Magnetometer and Resistivity surveys

There is not space here to digress into the relative merits of these techniques, suffice to say that they are complementary and, had time allowed both types of geophysical survey (magnetometer and resistivity) would have been used. As it was, only one resistivity survey was done (confirming the lack of surviving occupation on one site) and three magnetometer surveys. Of the latter, one was 'positive' and helped the interpretation of the site, another again confirmed a lack of surviving deposits, whilst the third drew a complete blank.

Magnetometers can add to the information about the sub-surface features of a site already gleaned from an aerial photograph, and this is why the survey was done. There are two processes which allow the earth's magnetic intensity to be measured (thermoremanent magnetism and magnetic susceptibility, see Tite 1972, 9-11). Magnetometry is the measuring of local variations in the intensity of the earth's magnetic field. Anomalies may be perceived which can be explained in terms of human occupation and activity. There are many ways of presenting the data from the surveys (Pocock 1983), and thanks are due to Todd Whitelaw's wizardry for Figure 2 and the 'Oughterby' survey, which reveals a number of interesting features. The ditch and entrance are visible both

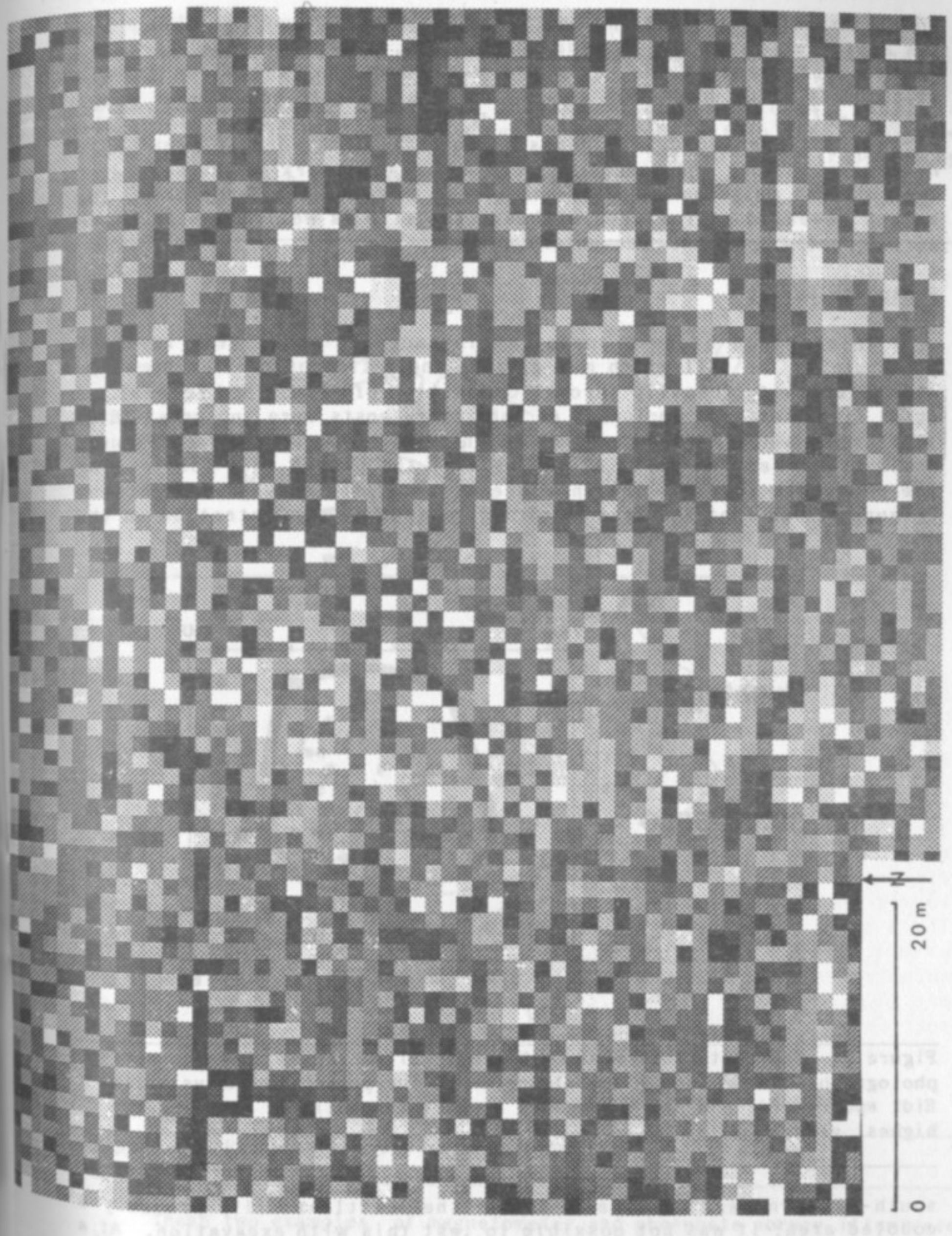

Figure 2: Magnetometer survey at Oughterby.

on the aerial photograph and on the magnetometer survey; it also shows (as a lighter mark) the internal bank. The darker (diagonal) area in the top-left part of the enclosure was shown, on excavation to be a stone built structure. This survey, using a fluxgate gradiometer shows the potential for examining these 'ditched enclosures' to assess the survival of archaeological deposits on a site. A word of caution is necessary in that the technique does not always work as the nature of the soil can mask the magnetic anomalies; at one site, Sandy Brow, the survey revealed no features although the site is well known from the aerial photographs and documentary sources.

Phosphate Survey

This method of soil survey is intended to assess the level of phosphate in the soil which may give an indication of earlier human or animal activity (usually through deposition of refuse and faeces). A quick field test was employed, as laboratory costs were too great (Eidt 1973). The sites were augered at 5m intervals over a grid (see Figures 3 and 4) and samples taken at the base of the plough soil for testing the phosphate levels. The interpretation of the survey at Oughterby (Figure 3) was that the area in of high phosphate concentration in the

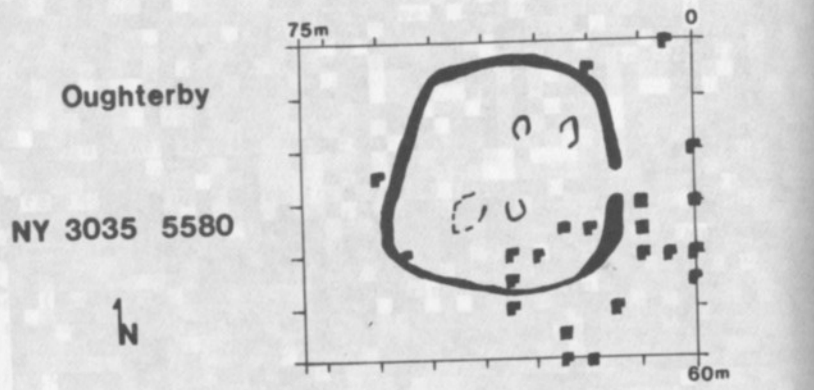

Figure 3: Phosphate survey at Oughterby. Site plan as shown on aerial photograph. The ▀ and ■ symbols refer to the phosphate analysis (the Eidt spot test), and are the grades 3 and 4 respectively (5 being the highest grade).

south-western part of the site was the 'cattle-stall', probably a cobbled area; it was not possible to test this with excavation. At a similar site, Crosshill, an area of cobbling was discovered with a high

quantity of decayed manure in betwen the cobbles (as well as a horse-shoe) suggesting an animal-stalling area (Higham and Jones 1983). Figure 4, (Boustead Hill) shows a blank area in the center of the site, with an increasing amount of phosphate in the ditches. This is indicative of sparse occupation debris surviving within the site. The excavations showed that most of the internal features were truncated by ploughing, as the site occupies the crest of a hillock.

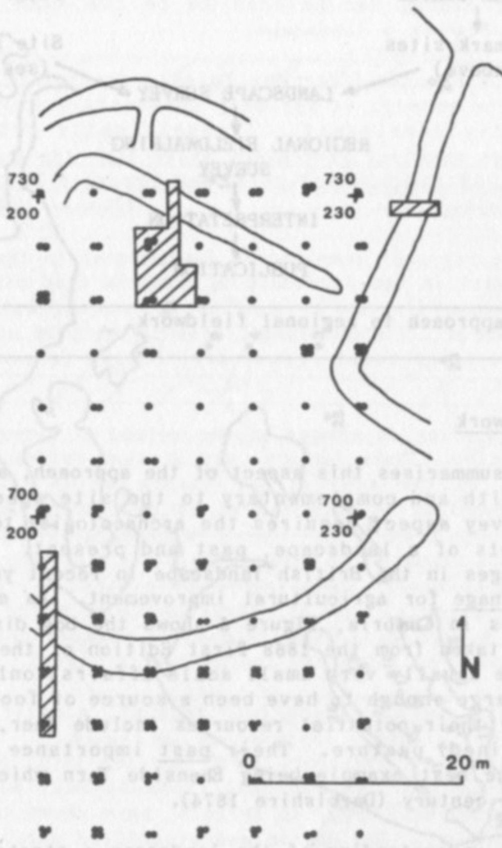

Figure 4: Phosphate Survey at Boustead Hill.

These two examples of magnetometer and phosphate survey illustrate the potential of the approach for crop-mark sites. They are relatively quick and cheap in comparison with excavation and they provide insight into the state of preservation of the sites; this is an important point when archaeologists have to consider the protection and preservation of sites. Small scale excavations can help to clarify the information about a site (especially a crop-mark site) and the approach as presented in Figure 1 is one way of achieving a greater understanding of the on-site archaeology in any region. The results so obtained can then be used during the formulation of a regional approach.

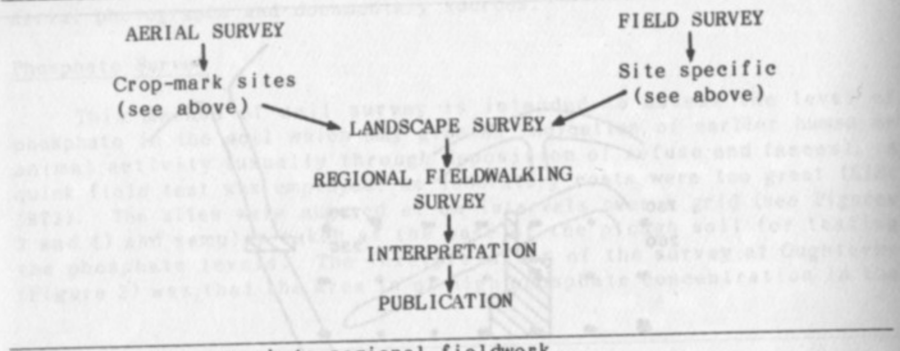

Figure 5: An approach to regional fieldwork.

Regional Fieldwork

Figure 5 summarises this aspect of the approach, and it can be seen as integral with and complementary to the site specific work. The landscape survey aspect requires the archaeologist to become familiar with all facets of a landscape, past and present. One of the most important changes in the British landscape in recent years has been the extent of drainage for agricultural improvement. As an example of the effects of this in Cumbria, Figure 6 shows the bog distribution in the Solway Plain, taken from the 1868 First Edition of the Ordnance Survey. These bogs are usually very small scale affairs, only a few acres in extent, yet large enough to have been a source of food for humans and animals; today their potential resources include deer, wild-fowl, fish and (when drained) pasture. Their past importance was as foci for settlement; the best example being Ehenside Tarn which was drained in the nineteenth century (Darbishire 1874).

From this understanding of the landscape a strategy for fieldwork on the regional scale has been devised. Some off-site fieldwalking has been done (in March 1984). Thirty-eight fields were walked, producing twnety-three flints and a rough-out Group VI axe. The axe was found on the very edge of one of the drained bogs; these bogs, when ploughed, are visible as dark areas and contrast with the surrounding sandy loam soils. The purpose of this initial field-walking survey was to assess

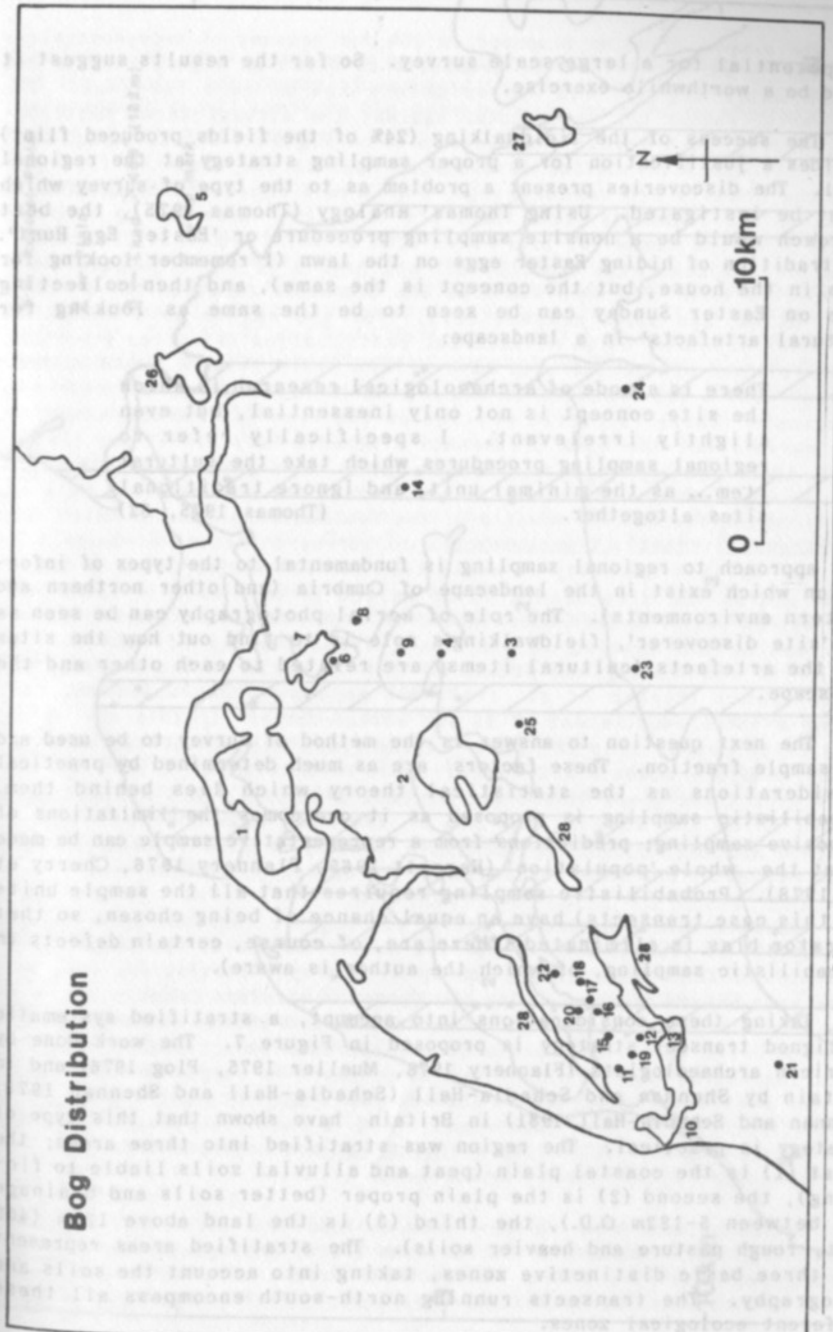

Figure 6: Bog distribution in the Solway Plain.

the potential for a large scale survey. So far the results suggest it would be a worthwhile exercise.

The success of the fieldwalking (24% of the fields produced flint) provides a justification for a proper sampling strategy at the regional level. The discoveries present a problem as to the type of survey which might be instigated. Using Thomas' analogy (Thomas 1975), the best approach would be a nonsite sampling procedure or 'Easter Egg Hunt'. The tradition of hiding Easter eggs on the lawn (I remember looking for them in the house, but the concept is the same), and then collecting them on Easter Sunday can be seen to be the same as looking for 'cultural artefacts' in a landscape:

> There is a mode of archaeological research in which the site concept is not only inessential, but even slightly irrelevant. I specifically refer to regional sampling procedures which take the cultural item... as the minimal unit, and ignore traditional sites altogether. (Thomas 1975, 62)

This approach to regional sampling is fundamental to the types of information which exist in the landscape of Cumbria (and other northern and western environments). The role of aerial photography can be seen as the 'site discoverer', fieldwalking's role is to find out how the sites and the artefacts (cultural items) are related to each other and the landscape.

The next question to answer is the method of survey to be used and the sample fraction. These factors are as much determined by practical considerations as the statistical theory which lies behind them. Probabilistic sampling is proposed as it overcomes the limitations of purposive sampling; predictions from a representative sample can be made about the whole 'population' (Haggett 1965, Flannery 1976, Cherry et al. 1978). Probabilistic sampling requires that all the sample units (in this case transects) have an equal chance of being chosen, so that operator bias is eliminated (there are, of course, certain defects in probabilistic sampling, of which the author is aware).

Taking these considerations into account, a stratified systematic unaligned transect strategy is proposed in Figure 7. The work done by American archaeologists (Flannery 1976, Mueller 1975, Plog 1976) and in Britain by Shennan and Schadla-Hall (Schadla-Hall and Shennan 1978; Shennan and Schadla-Hall 1981) in Britain have shown that this type of strategy is practical. The region was stratified into three areas; the first (1) is the coastal plain (peat and alluvial soils liable to flooding), the second (2) is the plain proper (better soils and drainage and between 5-122m O.D.), the third (3) is the land above 122m (400 feet, rough pasture and heavier soils). The stratified areas represent the three basic distinctive zones, taking into account the soils and topography. The transects running north-south encompass all these different ecological zones.

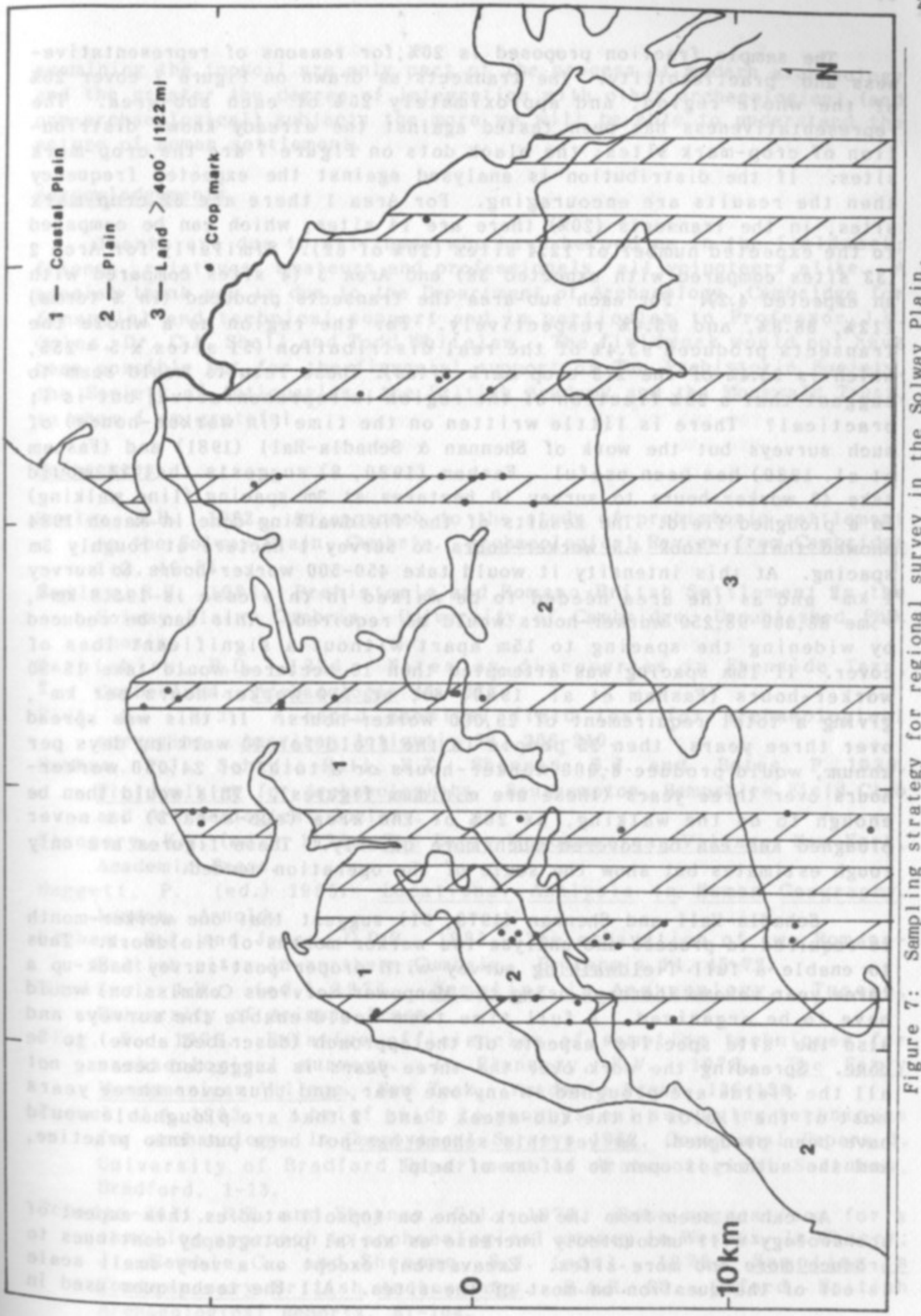

Figure 7: Sampling strategy for regional survey in the Solway Plain.

The sample fraction proposed is 20% for reasons of representativeness and practicability. The transects as drawn on Figure 7 cover 20% of the whole region, and approximately 20% of each sub-area. The representativeness has been tested against the already known distribution of crop-mark sites; the black dots on Figure 7 are the crop-mark sites. If the distribution is analysed against the expected frequency then the results are encouraging. For Area 1 there are 62 crop-mark sites, in the transects (20%) there are 14 sites, which can be compared to the expected number of 12.4 sites (20% of 62). Similarly for Area 2 (33 sites compared with expected 38) and Area 3 (4 sites compared with an expected 4.2). For each sub-area the transects produced (in % terms) 112%, 86.8%, and 95.4% respectively. For the region as a whole the transects produced 93.4% of the real distribution (51 sites x 5 = 255, which is 93.4% of the 273 crop-mark sites). These results would seem to suggest that a 20% fraction of the region is representative, but is it practical? There is little written on the time (in worker-hours) of such surveys but the work of Shennan & Schadla-Hall (1981) and (Fasham et al. 1980) has been useful. Fasham (1980, 8) suggests that it would take 40 worker-hours to survey 10 hectares at 3m spacing (line walking) in a ploughed field. The results of the fieldwalking done in March 1984 showed that it took 4.5 worker-hours to survey 1 hectare at roughly 3m spacing. At this intensity it would take 450-500 worker-hours to survey 1 km^2 and as the area needed to be walked in this case is 195.6 km^2, some 88,000-98,250 worker-hours would be required. This can be reduced by widening the spacing to 15m apart without a significant loss of cover. If 15m spacing was attempted then 10 hectares would take 15-30 worker-hours (Fasham et al. 1980, 8), or 150 worker-hours per km^2, giving a total requirement of 29,000 worker-hours. If this was spread over three years, then 25 people in the field for 40 working days per annum, would produce 8,000 worker-hours or a total of 24,000 worker-hours over three years (these are minimum figures). This would then be enough to do the walking, as 20% of the area (sub-area 3) is never ploughed and can be covered much more quickly. These figures are only rough estimates but show the scale of the operation needed.

Schadla-Hall and Shennan (1978, 91) suggest that one worker-month is required to process and analyse two worker-months of fieldwork. Thus to enable a full fieldwalking survey with proper post-survey back-up a three year scheme (perhaps using the Manpower Services Commission) would have to be organised. A full time team would enable the surveys and also the 'site specific' aspects of the approach (described above) to be done. Spreading the work over the three years is suggested because not all the fields are ploughed in any one year, and thus over three years most of the fields in the sub-areas 1 and 2 that are ploughable would have been ploughed. As yet this scheme has not been put into practice, and the author is open to offers of help!

As can be seen from the work done on topsoil studies this aspect of archaeology will undoubtedly increase as aerial photography continues to produce more and more sites. Excavation, except on a very small scale is out of the question on most of the sites. All the techniques used in

examining the topsoil are only part of the process of modern archaeology and the greater the degree of integration with other archaeological (and non-archaeological) subjects the more we will be able to understand the nature of human settlement.

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References

Bewley, R.H. 1982. An approach to the study of prehistoric settlement in the Solway Plain, Cumbria. Archaeological Review from Cambridge 1:2, 46-51.

Bewley, R.H. 1984. Prehistoric and Romano-Britsh Settlement in the Solway Plain, Cumbria. University of Cambridge, Unpublished PhD. thesis.

Darbishire, R.D. 1874. Notes on discoveries in Ehenside Tarn, Cumberland. Archaeologia 44, 273.

Eidt, R. 1973. A rapid chemical field test for archaeological surveying. American Antiqutiy 39, 206-210.

Fasham, P.J., Schadla-Hall, R.T., Shennan, S.J. and Bates, P. 1980. Fieldwalking for Archaeologists. Southampton, Hampshire Field Club and Archaeological Society.

Flannery, K.V. (ed.) 1976. The Early Mesoamerican Village. New York, Academic Press.

Haggett, P. (ed.) 1965. Locational Analysis in Human Geography. London, Arnold.

Higham, N.J. and Jones, G.D.B. 1983. The excavation of two Romano-British sites in northern Cumbria. Britannia 14, 45-72.

Mueller, J.W. (ed.) 1975. Sampling in Archaeology. Tuscon, University of Arizona Press.

Plog, S. 1976. Relative efficiencies of sampling techniques for archaeological surveys. In Flannery, K.V. 1976. The Early Mesoamerican Village. New York, Academic Press, 136-158.

Pocock, J.A. 1983. A brief guide to geophysical surveying techniques for archaeology. In Geophysical Surveys 1982, Occasional Papers 3. University of Bradford Department of Archaeological Sciences, Bradford, 1-13.

Schadla-Hall, R.T. and Shennan, S.J. 1978. Some suggestions for a sampling approach to archaeological survey in Wessex. In Cherry, J., Gamble C., and Shennan, S.J. (eds). 1978. Sampling in Contemporary British Archaeology. B.A.R. 50. Oxford, British Archaeological Reports, 87-104.

Shennan, S.J. and Schadla-Hall, R.T. 1981. The Archaeology of Hampshire: from the Palaeolithic to the Industrial Revolution. Southampton, Hampshire Field Club Monograph 1.

Thomas, D.H. 1975. Nonsite sampling in archaeology: up the creek without a site. In Mueller, J.W. (ed.) 1975. Sampling in Archaeology. Tuscon, University of Arizona Press, 61-81.

Tite, M.S. 1972. Methods of Physical Examination in Archaeology. London, Seminar Press.

Appendix: List of Bogs in the Solway Plain (see Figure 6)

NUMBER	GRID REFERENCE (NY)	NAME
1	200 600 TO 240 600	Bowness
2	220 530	Wedholme Flow
3	258 511	Martin Tarn, Oulton
4	258 538	Biglands Bog
5	430 635	Scaleby Moss
6	255 579	Fingland Moss
7	255 585	Drumburgh Moss
8	270 570	Little Bampton Moss
9	258 553	Eastholme Moss
10	085 450	Salta Moss
11	103 470	Holme Low
12	115 462	Hangingshaw Moss
13	117 452	Chapel Moss
14	320 552	Thurstonfield Lough
15	115 474	Tarns Dub
16	124 478	The Tarns
17	128 481	High Tarns
18	135 485	Raisehow
19	108 465	Goodyhills
20	124 485	East Hill Tarn
21	105 410	Hayton
22	138 494	Highlaws
23	253 465	Grainger Houses
24	358 470	Hawksdale Pasture
25	232 508	Colmire Sough
26	360 635	Rockliffe Moss
27	455 500	Wragmire
28	see Figure 6	Fen Peats

SCOURING THE SURFACE: APPROACHES TO THE PLOUGHZONE IN THE STONEHENGE ENVIRONS

Julian Richards

Introduction

Stonehenge lies at the centre of a prehistoric monumental complex of unparalleled diversity (RCHM 1979) yet little is known of contemporary domestic activity. In this, at least, the area cannot be regarded as atypical. The monuments in their present context, largely one of intensive arable cultivation, provide both cause for concern due to erosion, and the opportunity for extensive investigation of contemporary activity and landuse.

The Stonehenge Environs Project (SEP) was funded in the field between 1980 and 1984 by the Ancient Monuments branch of the DoE (now the HBMC[E]) with a brief to locate areas of prehistoric activity and to evaluate the areas for preservation. This, and the examination of specific monuments, would form the basis for the formulation by the HBMC(E) of overall policies of preservation and management for the area. The HBMC(E) funding provided a platform on which a number of specific research projects were founded, additional funding for these coming from the Society of Antiquaries, the British Academy and the Prehistoric Society.

The initial field survey carried out by the SEP, involving extensive surface sampling, developed over the seasons into a tiered method involving extensive and intensive collection, geophysical and geochemical survey and ploughsoil excavation utilising extensive sieving techniques. This paper will examine the changing approach to the ploughsoil as an archaeological resource and will then attempt to outline the development not only of the project's methods, but of our conception of the prehistoric past in the Stonehenge area.

Previous approaches to the ploughsoil

A marked change of attitude in the archaeological approach to the ploughsoil can be noted over the last decade. Previously it was removed as swiftly as possible (usually mechanically), in order to reveal the 'archaeology'. Major debate revolved not around sampling strategies but around the type of machine to be employed. Stratigraphy, except in subsoil features, was reserved for urbanists who, wielding their machinery with practised panache knew exactly when they had arrived at the end of the medieval period (whenever that was currently held to be). Life was simpler for the ruralists who stopped when they reached rock or a layer that had no finds in it.