The Ploughzone

by Peter J. Reynolds

In recent years the topsoil or ploughzone in the rural context has received increasing attention and today, because of the escalating costs of excavation and the dwindling resources provided for archaeology, that attention is being further intensified. Financial constraint, however, is not the only motivation. The results of aerial survey and organised field walking have shown that excavation can only examine a minimal percentage of the known sites, a percentage which rapidly decreases as modern surveys reveal more and more evidence. Surveys are by their very nature inconclusive, each having significant problems and requiring constant checks one against another and none of them replace the yield of actual excavation. Today there is a degree of urgency in the identification of strategies to be employed to extract the maximum amount of evidence from surveys in order to isolate problem oriented excavation on the minor and cost-effective scale.

For example, the largest part of Britain's and, indeed, Europe's archaeological data-base in the countryside is evidenced by aerial photography. Yet this data-base has scarcely been tested and nowhere has it been examined scientifically. It is well known that different soil situations radically affect the photographic evidence, in some cases substantiated by excavation a very small percentage of a site is observable (e.g. Mucking, Essex), in others almost one hundred percent (e.g. Long Wittenham). There is a clear need for some qualifications dependent upon soil type to be applied to aerial photography *per se* before any integration is considered with surveys of other kinds.

Field walking is the second major source of evidence both for the location of previously unknown sites and the positive checking of information gained from aerial photography. Concentration upon this archaeological technique has increased but needs to increase dramatically if it is to achieve any kind of parity with the aerial evidence. Subsequent surveys include geophysical prospection and geochemical soil analysis. All surveys are necessarily to be followed by highly selective excavation in order first to correlate the various forms of data into exemplars and second to establish particular and local sequences, for example, by examining ditch intersections.

The overall strategy is one of integration, combining documentary sources where relevant with air reconnaissance with field walking and other surveys to measure the achievement or non-achievement of each discipline and their cross-fertilization potential. Against this background the following trials or experiments perhaps deepen rather than lighten the gloom. Since all such strategies are relevant to the topsoil, the hypothesis that the topsoil should be regarded as archaeologically significant is beyond question. It is the degree of significance which is subjected to question. As with all aspects of empiricism in archaeology the level of enquiry is geared towards the basic data and specific cases are examined in detail. The observations offered below are similarly specific, contained by the restrictions of the trials themselves and are necessarily to be viewed as interim trends requiring more extensive testing in widely divergent zones.

Fieldworks whether it is dedicated to elucidating aerial photographic phenomena and is valuating aerial photographic evidence against the reality on and in the ground or it is carried out with other objectives, includes as a major discipline, excavation apart, the practice of field walking. In simple terms field walking involves the examination on foot of the rural landscape. Degrees of intensitivity and frequency, of deliberate or random sampling are matters for some debate. The first aspect considered is one of urgency.

Field walking has been a traditional activity in Britain since the turn of the century. Given the large numbers of amateur archaeological societies spread countrywide, aside from the annual summer excavation, the major activity of these societies usually in the winter has been to walk areas within their regions fairly regularly if not systematically. It is normal, for example, to have special areas where sites are known and rewards will be commensurately

high. Such sites, therefore, become celebrated and often the focus of sumer excavation. There is no doubt but that the archaeological data base of Britain has been greatly increased by these activities especially in those areas which are unsympathetic to aerial photography. Very occasionally, on the other hand, a region is subjected to organised and systematic field walking and the resultant picture achieved over a period of years is dramatic. Such an example is provided at Chalton Manor Farm in Hampshire (Cunliffe 1973) where the evolution of a landscape is postulated primarily from data achieved from interim field walking by the owner and by organised groups. It is from one of the sites discovered by field walking and which has not been excavated that the following analysis is based upon.
A Bronze Age hillbrow site was located by pottery distribution on Camel Down in Hampshire (O.S. 739180) in 1968. Despite the intensity of occupation of this general region through all periods, on this particular site there were virtually no other intrusive pottery sherds at all. Nonetheless the concentration and quantity of material recovered indicated either a long term or very large Bronze Age settlement.
The field area of Camel Down was brought into cultivation in 1951 when the scrub and small trees were cleared with a bulldozer. Originally it was a typical stretch of unimproved downland devoted to sheep and cattle grazing. From 1951 to 1968 it was cultivated for cereals, root crops and regrassed at intervals, approximately one third of the time under cultivation and two thirds under intensive grazing. The cultivation machinery was relatively light. In 1968, however, it was brought into continuous and intensive cultivation and the basic economy of Manor Farm changed to an arable régime. The agricultural history of the area for the decade 1968-78 is presented in Table I below.

Table I.

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Ploughed	x1	x1	x1	x1	x1	x1	x1	x1	x1	x1
Cultivated		x2	x2	x2	x3	x2	x2	x2	x2	x2
Rolled	x2	x2	x2	x2	x2	x2	x2	x2	x2	x1
Harrowed	x1	x2	x1	x1	x1	x1	x1	x1	x1	x1
Cereal (Barley)	*	*		*	*		*	*	*	*
Roots (Kals)			*			*				

Ploughing normally took place in September with a multi-shared turn-over plough to an average depth of 200 mm. The creation of fairly deep furrows necessarily increased the surface area of the land and exposed any pottery brought to the surface to frost action and general weathering during the ensuing winter period. Spring cultivation was carried out with the standard multi-tined chizel plough which brought the soil into a levelled seed bed. The depth of tine penetration into the soil averaged 150 mm. The spike harrow completed the process and after sowing the heavy roller compressed the seed bed and thus increased tillering of the crop. The roller used weighed two tonnes across a 5.0 m width. The agricultural processes to which the greater pressure per square metre of the tractor itself must be added is undoubtedly severe both in terms of friction and pressure. Ironically in terms of survival of pottery sherds all the agricultural processes take place at critical times of the year. Autumn ploughing brings the sherds to the surface and spring cultivation strikes them immediately after the ravages of frost action. In the case of the very coarse pottery of the Iron Age with its high percentage of inclusive material like calcined flint, a winter's exposure is enough to break down the fabric to the point where any movement will bring about immediate disintegration. Simple trials carried out by the author have shown that even the tougher fabrics of Bronze Age pottery will readily laminate when exposed to severe night frosts and mild days. The damage is caused by the extreme variability of temperature. Given slow and steady change little damage occurs.
With the discovery of the sherd scatter on Camel Down in 1968 a group of experienced field walkers were brought in to walk the area in the late autumn. Several kilos of pottery sherds were collected from the surface. These were the typical late Bronze Age pottery of the area. The clay fabric, probably from the local "clay with flints" cappings to be found on top of many of the chalk Downs, with flint inclusions had been fired light red at a temperature of

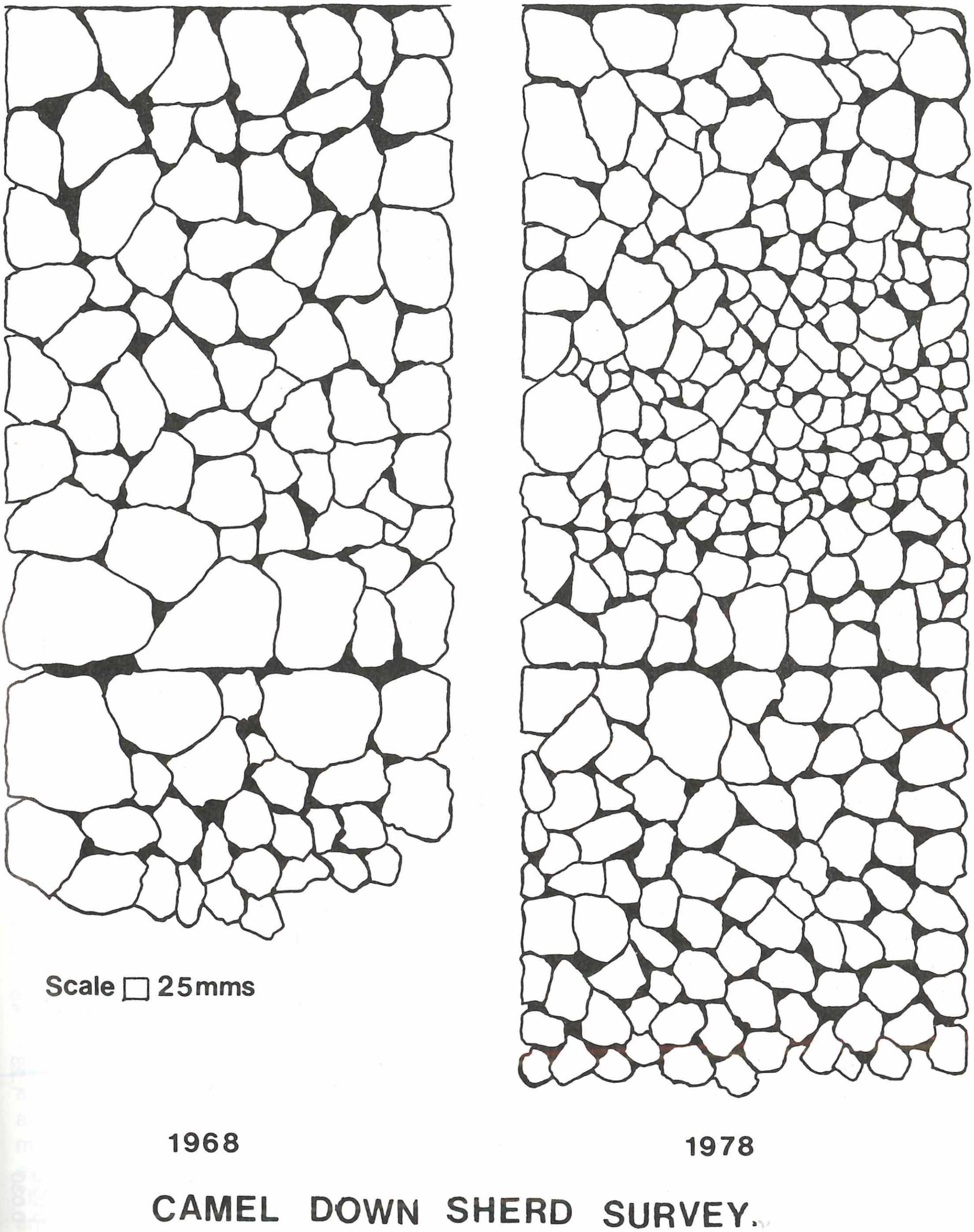

Fig. 1 Bronze Age Sherds from Camel Down

Table 3

1968

Weight in gms	Area mm²	Weight per mm²	Weight in gms	Area mm²	Weight per mm	Weight in gms	Area mm²	Weight per mm²	Weight in gms	Area mm²	Weight per mm²	Weight in gms	Area mm²	Weight per mm²
28.89	663	0.044	24.40	341	0.072	3.14	78	0.040	43.48	445	0.039	11.10	263	0.042
2.36	82	0.029	9.41	218	0.043	1.37	36	0.038	4.79	110	0.044	4.14	130	0.032
8.34	202	0.041	10.29	251	0.041	7.09	131	0.053	1.34	67	0.020	2.70	71	0.038
2.93	80	0.037	5.44	94	0.058	3.34	75	0.045	5.26	62	0.085	1.92	53	0.036
19.84	497	0.040	4.96	123	0.040	15.68	177	0.089	9.36	106	0.050	8.17	149	0.055
6.75	127	0.053	12.68	203	0.063	9.90	185	0.054	4.83	108	0.045	8.00	149	0.054
38.92	362	0.108	4.06	86	0.052	2.61	60	0.044	6.62	161	0.041	9.23	194	0.048
6.21	85	0.073	7.93	103	0.077	7.55	145	0.052	14.69	215	0.068	3.18	76	0.042
10.47	216	0.048	1.68	47	0.036	2.60	67	0.038	28.82	318	0.091	11.66	183	0.064
7.77	141	0.055	5.49	104	0.053	4.22	112	0.038	2.62	55	0.048	7.58	119	0.042
2.27	56	0.041	3.64	89	0.041	2.49	59	0.042	1.98	136	0.035	9.72	162	0.060
8.34	165	0.050	9.30	167	0.056	8.89	169	0.053	8.07	132	0.061	8.19	101	0.081
10.33	228	0.045	4.25	109	0.039	9.74	158	0.062	15.49	283	0.055	6.04	129	0.047
4.30	86	0.050	10.27	215	0.048	5.82	129	0.045	20.80	345	0.060	11.82	209	0.057
10.15	182	0.056	15.83	278	0.057	17.41	270	0.065	4.12	111	0.037	10.88	188	0.058
2.14	61	0.035	11.87	224	0.053	7.80	134	0.058	7.72	174	0.044	2.82	51	0.055
2.94	81	0.036	1.45	17	0.085	15.24	180	0.085	14.02	227	0.062	8.20	170	0.043
34.87	597	0.058	10.53	255	0.041	13.99	233	0.060	1.85	75	0.031	8.97	175	0.051
10.25	195	0.053	3.17	87	0.036	24.19	250	0.097	2.40	62	0.039	9.39	193	0.048

1978

8.35	215	0.038	19.55	205	0.095	4.04	119	0.037	4.55	80	0.056	3.63	68	0.053
2.39	47	0.051	10.60	178	0.060	11.31	172	0.066	2.06	46	0.045	3.10	78	0.040
7.33	149	0.049	6.00	113	0.050	2.55	65	0.039	5.65	96	0.059	11.00	90	0.122
1.79	52	0.034	1.62	45	0.036	1.46	35	0.042	3.02	78	0.039	5.28	82	0.064
7.27	117	0.062	2.39	50	0.047	1.07	27	0.039	1.15	53	0.036	1.87	41	0.045
1.01	27	0.037	1.06	31	0.034	0.99	33	0.030	3.27	64	0.051	4.85	105	0.046
1.86	49	0.038	1.15	36	0.031	0.48	19	0.025	2.02	58	0.034	2.23	70	0.031
11.31	203	0.055	2.75	70	0.039	2.28	55	0.041	5.03	80	0.062	10.97	176	0.062
2.80	66	0.052	14.61	284	0.050	3.40	77	0.044	1.64	31	0.053	3.16	66	0.048
5.48	149	0.037	6.66	113	0.059	1.92	47	0.041	1.24	38	0.033	1.08	35	0.031
7.15	94	0.076	2.93	75	0.039	1.46	39	0.037	1.46	26	0.056	4.00	68	0.058
7.63	155	0.049	2.10	42	0.050	4.55	79	0.057	4.33	52	0.082	1.39	21	0.066
2.35	51	0.046	0.44	11	0.040	2.39	59	0.040	9.91	117	0.084	4.22	91	0.046
0.81	29	0.027	1.18	32	0.036	0.97	29	0.033	0.58	24	0.022	1.59	42	0.037
1.43	70	0.027	0.40	21	0.019	0.66	26	0.025	0.35	16	0.021	3.45	71	0.048
0.62	23	0.026	1.31	37	0.035	1.46	24	0.060	0.99	49	0.020	0.87	30	0.029
1.62	54	0.030	1.23	48	0.025	0.98	26	0.037	1.88	31	0.060	2.71	74	0.034

While both fragmentation and erosion are demonstrably happening to the sherds in the ploughsoil, it is impossible to build a predictive model on these data for the stage at which these processes render the sherd size imperceptible in the soil. In due course after another field walking programme sheduled for late autumn 1983 a clearer picture may emerge. Nonetheless, a clear trend is present and especially obvious in Figure 1. If nothing else this trend is entirely persuasive of the need for urgency in implementing major field walking programmes especially in those areas under intensive arable régimes.

Thus pottery fragmentation in the ploughsoil is clearly a major focus in that the potential identification of sites is a seemingly disappearing resource. In terms of sites contained only in the ploughsoil it is a matter requiring urgent attention. The process of fragmentation, however, is the direct result of plough action and soil movement as shown above. The normal view is simply that such movement has been so severe, whether under present or past agricultural régimes, that while the sherds in the ploughsoil doubtless originate from a site and indicate its presence, their relationship to that site is now remote. That view has been challenged in recent years regarding Roman sites (Saunders 1973) and it has been subjected to initial analysis by excavation (Hinchcliffe 1979). A clear correlation was discovered in the weight of tile fragments and sherds in the ploughsoil, to the underlying walls of Roman buildins in excavations, at the Roman city of Verulamium. Interestingly enough the initial damage to the walls in this instance was not modern, a layer of disturbance lay between the base of the present ploughsoil and the surviving tops of the walls. The conclusion drawn from this analysis is that an undispersed spread is not necessarily the result of recent plough damage to a site. This view had been mooted by the author as an hypothesis some time previously in advocating the need to examine the topsoil as an archaeological layer subsequent to the black plastic experiment described below (Reynolds 1978).

Essentially the problem was to assess the movement of sherds in the ploughsoil under prehistoric, historic and modern agricultural conditions. The reason for examining these three distinct periods is the clear evidence that each succeeding new technology had disturbed occupation sites of the preceding era but in different ways. Principally the ard, the single turnover plough and the multiple turnover plough represent this technological change. Thus the initial phase, to examine sherd movement under prehistoric ploughing conditions, began in 1976 based upon two specific areas within the confines of the Ancient Farm.

The method was to lay out on a specified rectilinear grid, at 1.00 m or 0.50 m centres, a fixed number of known sherds and subsequently to monitor their movements once in each full agricultural cycle. After a number of such cycles the analysis of the results is designed to give a number of conclusions, the most basic being the average movement of a sherd from its original point of deposition in each cycle, the most complex the intimate life history of each individual sherd, allowing an insight into the basic turbulence of ploughsoil. From this latter a significant product would be the number of sherds appearing on the surface of the ploughsoil at any one time. Further, the results should either substantiate or deny the inferences of Saunders and the findings of Hinchcliffe in terms of the different ploughs and soil types under examination. One further objective, perhaps of greatest importance, is to attempt to ascertain if there is any way of inferring original deposition patterns of sherds in that, given archaeological features beneath the ploughsoil layer, there can be a correlation, albeit a mathematical one, between their distribution (Fig. 2). These principles, should they prove to exist, could subsequently be applied to sites whose totality is bound only in the topsoil.

The difficulties of building such an experiment can be readily observed once the parameters are drawn. For the results to have any consistent validity the sherds selected had to be relocatable. Thus it was impossible to use real sherds in the trials. Experiments with sieving techniques have regularly demonstrated the difficulty of recovering sherds by excavation in ploughsoil (Payne 1973). Similarly since prehistoric sherds are invariably manufactured from a coarse fabric, often with as much as 20 % inclusive material, disintegration by frost action compounds the difficulty. It would be quite impossible, apart from these factors, to envisage a regular re-excavation of the area of ploughsoil in order to relocate the sherds after each agricultural process.

c. 900°C. Kilns of this period have so far not been isolated but in all probability they were of the simple updraught variety. Their very absence suggests the kilns may have been of the Sévrier type (Bocquet and Cowen 1975; Andrieux 1976).
In the late autumn of 1978 the same area was again walked with another group of experienced field walkers and several more kilos of sherds of the same type were collected. Both collections were, of course, kept separate but surface examination indicated considerable differences between them. So different were they that it was decided to carry out a very simple, even simplistic, analysis.
Such an exercise is inevitably fraught with difficulties of standardisation. The basic problem lies in the initial collection of the sherds from the ploughed ground surface. Were the two surveys comparable? Was the earlier survey as painstaking as the later one? Such questions are virtually impossible to answer and while comparability in field walking may be regarded as a necessity, both from site to site and time to time, it is also an impossibility. There are far too many variables, both human and physical, which will affect such an exercise.
To obviate undue bias roughly equal samples were taken from both collections. The collections were placed inside large cloth bags. A scoop was inserted into the bag which was then shaken gently, laid flat on a table and the scoop removed. The sample used was weighed on household scales to obtain rough parity and no additions were made to the basic samples. The 1968 collection was significantly greater in weight than the 1978 sample but no accurate records of total weight were made. Such figures do not necessarily affect the analysis given the statistics of central tendency and dispersion.
Subsequently both samples were weighed, each individual sherd was weighed to three decimal places and its area calculated in square millimetres. Exact shapes were recorded and the results are presented in Figure I. This visual presentation dramatically underlines the differences between the samples occasioned by agricultural activity. The results from numerical analysis are given in Table 2 below. The basic data for each sherd is given in Table 3.

Table 2

	1968	1978
No. of sherds	95	280
Total sample weight	887.75 gms	885.63 gms
Mean weight	9.35 gms	3.16 gms
Total area	15.805 mm^2	19.567 mm^2
Mean area	166.37 mm^2	69.88 mm^2
Median area	145.00 mm^2	60.00 mm^2
Standard Deviation	±64.72 mm^2	±47.20 mm^2
Weight/mm^2 mean	0.052 gms	0.041 gms
Standard Deviation	±0.016 gms	±0.013 gms

The object of the analysis was to determine the effect of modern agricultural methods upon the sherds and should a significant effect be observed to indicate the rate at which such evidence may be disappearing from the landscape. The analysis is potentially distorted by the human factor in that larger thicker sherds being more visible may have been collected in the earlier survey or that sherds of a genuinely lower density were recovered on the second occasion. Setting aside this hazard, the results are surprisingly significant. Clearly fracturing and fragmentation is the major effect but there is also a significant surface erosion of sherds caused both by abrasion in the soil surface and by lamination brought about by frost action. The distributions are, as one would expect, positively skewed which inevitably drags the mean away from the main clustering of the sample. The provision of the median value allows clearer understanding of the distributions. Examination of weight/surface area data shows that the actual distribution of the values are different. The means, especially in the 1968 sample, have been severely affected by the presence of a few very high values. The median value and main clusters have shifted significantly from the range 35-60 gm/mm^2 to the range 25-50 gm/mm^2. In fact, the difference between the sample means is 0.011 gm/mm^2 and the standard error of difference is 0.0018. Thus the difference in means is of the order of ten times the standard error of difference, which is highly significant of a difference in the samples.

Table 3 (Cont.)

Weight in gms	Area mm^2	Weight per mm^2	Weight in gms	Area mm^2	Weight per mm^2	Weight in gms	Area mm^2	Weight per mm^2	Weight in gms	Area mm^2	Weight per mm^2	Weight in gms	Area mm^2	Weight per mm^2
1.05	38	0.027	0.72	26	0.027	0.82	32	0.025	0.56	20	0.028	1.16	32	0.036
1.86	35	0.053	1.29	30	0.043	0.81	21	0.038	0.88	33	0.026	0.89	22	0.040
2.27	59	0.038	3.04	71	0.042	1.67	58	0.028	1.42	42	0.033	0.79	29	0.027
0.88	25	0.035	1.87	36	0.052	1.44	29	0.049	0.79	29	0.027	0.68	25	0.027
5.66	120	0.047	0.26	15	0.017	0.33	14	0.023	5.81	98	0.059	0.69	25	0.027
2.55	54	0.047	0.81	29	0.027	1.54	47	0.032	1.91	62	0.030	1.36	31	0.025
0.40	14	0.028	0.93	22	0.042	1.55	25	0.062	19.58	281	0.069	0.83	38	0.021
1.87	60	0.031	3.00	85	0.035	2.13	62	0.034	2.43	58	0.041	1.66	35	0.047
1.04	34	0.030	0.44	17	0.025	0.97	27	0.035	0.79	31	0.025	0.70	22	0.031
1.32	43	0.031	0.81	35	0.023	2.06	66	0.031	0.82	32	0.025	1.42	39	0.036
1.42	22	0.064	0.92	34	0.027	0.81	22	0.036	0.77	22	0.035	0.92	24	0.038
1.46	40	0.036	1.17	38	0.038	1.06	28	0.036	1.25	41	0.030	1.31	41	0.031
1.92	42	0.045	1.19	30	0.039	0.43	21	0.020	0.67	27	0.024	1.67	46	0.036
2.39	60	0.039	7.29	153	0.057	2.02	49	0.041	1.53	42	0.036	2.20	50	0.044
3.47	93	0.037	1.74	54	0.032	3.09	66	0.046	4.91	107	0.045	1.89	47	0.040
1.11	29	0.038	1.43	39	0.036	2.00	44	0.045	0.62	22	0.028	7.15	125	0.057
4.19	105	0.037	4.94	107	0.046	8.29	129	0.067	7.46	179	0.041	5.45	120	0.045
5.41	113	0.047	2.67	74	0.036	2.54	93	0.027	5.11	100	0.051	3.22	88	0.036
5.31	103	0.051	1.03	27	0.038	2.15	45	0.047	0.40	17	0.023	0.91	39	0.023
0.56	26	0.021	0.62	21	0.029	0.78	31	0.025	0.45	22	0.020	0.86	26	0.033
4.33	89	0.048	2.06	41	0.050	0.08	26	0.031	1.49	53	0.028	1.01	33	0.031
1.61	43	0.037	3.32	92	0.036	2.67	80	0.033	2.81	72	0.039	2.70	86	0.031
4.25	82	0.051	1.88	50	0.037	1.31	32	0.040	12.41	190	0.065	3.90	88	0.044
10.31	170	0.060	3.42	80	0.042	4.41	90	0.049	4.89	121	0.040	5.15	105	0.049
3.58	128	0.027	7.51	134	0.056	21.27	350	0.060	6.57	126	0.052	3.21	80	0.040
8.05	154	0.052	5.23	112	0.046	5.02	136	0.036	6.17	114	0.054	4.56	118	0.038
2.08	60	0.034	3.19	85	0.037	6.07	129	0.047	3.56	78	0.045	1.02	34	0.030
2.33	61	0.038	3.49	79	0.044	2.11	64	0.032	3.85	66	0.058	6.96	135	0.051
3.30	83	0.039	2.49	72	0.034	3.33	79	0.042	3.34	84	0.039	3.63	87	0.041
5.36	96	0.055	0.95	40	0.023	3.46	88	0.039	3.91	103	0.037	2.30	65	0.035
1.26	40	0.031	3.33	75	0.044	2.84	68	0.041	2.88	70	0.041	1.30	42	0.030
1.69	42	0.036	2.03	72	0.028	2.34	64	0.036	0.64	27	0.024	2.36	67	0.035
1.54	42	0.034	4.01	108	0.037	6.26	115	0.054	0.89	118	0.007	4.89	117	0.041
6.55	140	0.046	5.34	123	0.043	5.19	100	0.051	2.85	73	0.039	6.44	114	0.056
1.59	47	0.033	4.49	75	0.059	7.80	138	0.056	3.17	63	0.050	2.90	93	0.031
3.64	91	0.040	2.33	70	0.033	5.04	89	0.056	2.50	58	0.043	4.58	90	0.050
4.79	97	0.049	1.81	71	0.025	1.78	73	0.024	3.12	97	0.032	2.46	85	0.028
3.20	85	0.037	2.65	80	0.033	4.20	78	0.055	2.73	69	0.039	1.16	46	0.025
3.45	62	0.055	3.19	67	0.047	1.15	58	0.019						

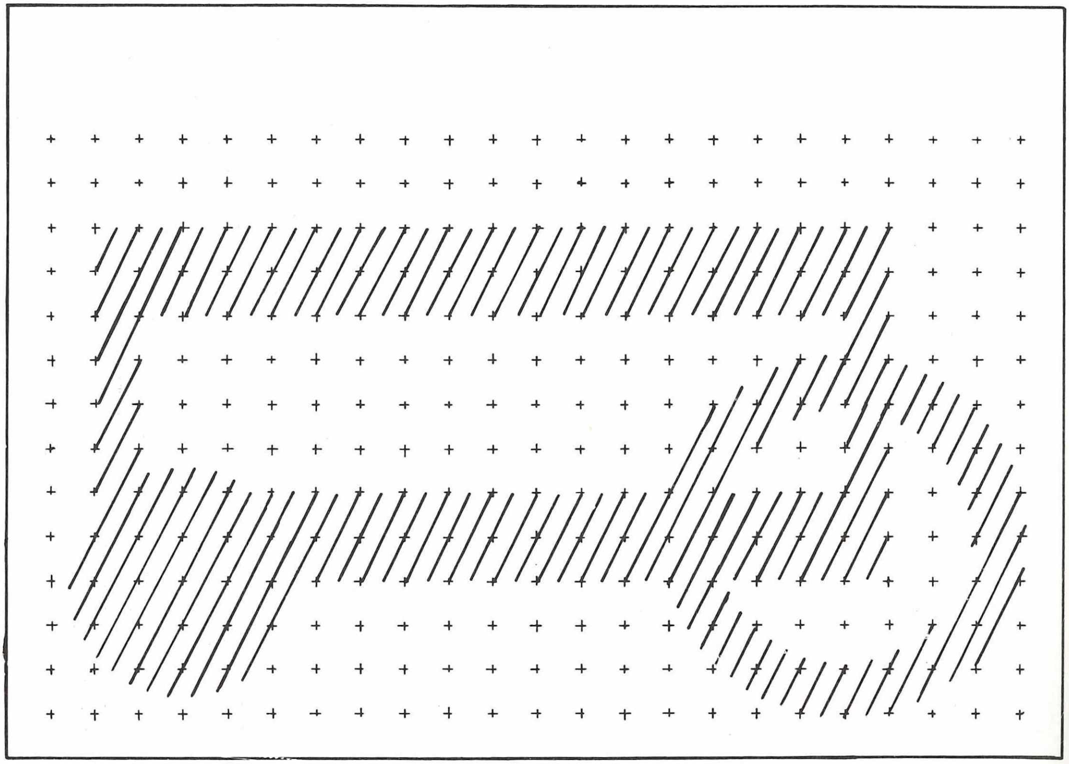

Fig. 2 Potential imposed patterns on sherd distribution

The problem was one of Platonic proportions, to determine the essence of sherdhood. Although early trials in 1975 included the use of luminous paint on actual sherds, in order to relocate by radioactivity, this system was rejected by virtue of expensive geiger counters and potential, though probably unreal, danger. Thus the decision to create an artificial relocatable sherd was taken. One could replicate the exact shape of original sherds in another material but this denies any strict comparison between individual performance. The end product seems to satisfy all the criteria and comes from the analysis of the Bronze Age sherds from Camel Down discussed above. This appears to be rectilinear, essentially a diamond shape, with two narrow angles and two wide angles. The same condition obtains broadly for both the surveys of 1968 and 1978 (see Fig. 1) although the initial decision was taken from the 1968 sample. The artificial material ultimately selected was a plastic resin which could either be used to manufacture sheets or poured into specific moulds to replicate original sherds. To obtain standardisation of sherd and hence remove one experimental variable in the preliminary phase, it was decided to adopt the "Platonic ideal" of a diamond shaped sherd which in surface area and total weight simulated typical Bronze Age sherds of the same size. The relocation device, a simple tiny bar magnet, was encased in the plastic resin during manufacture which gave the added advantage of making the replica sherd the correct weight. Individual sherd identification was achieved by including within the sherd a three figure number. Each artificial diamond shaped sherd measured 50 mm along the longest axis by 30 mm along the shortest axis by 7 mm in thickness.
A fluxgate gradiometer (Clarke 1982) which is most sensitive to magnetic anomalies in the soil structure has been used to date as the relocation instrument. For these purposes it is ideal in that it not only relocates each sherd with unerring accuracy but is also quite capable of isolating the north and south poles of each individual magnet. Should the sherd be vertical in the soil only one pole is "seen" by the machine.

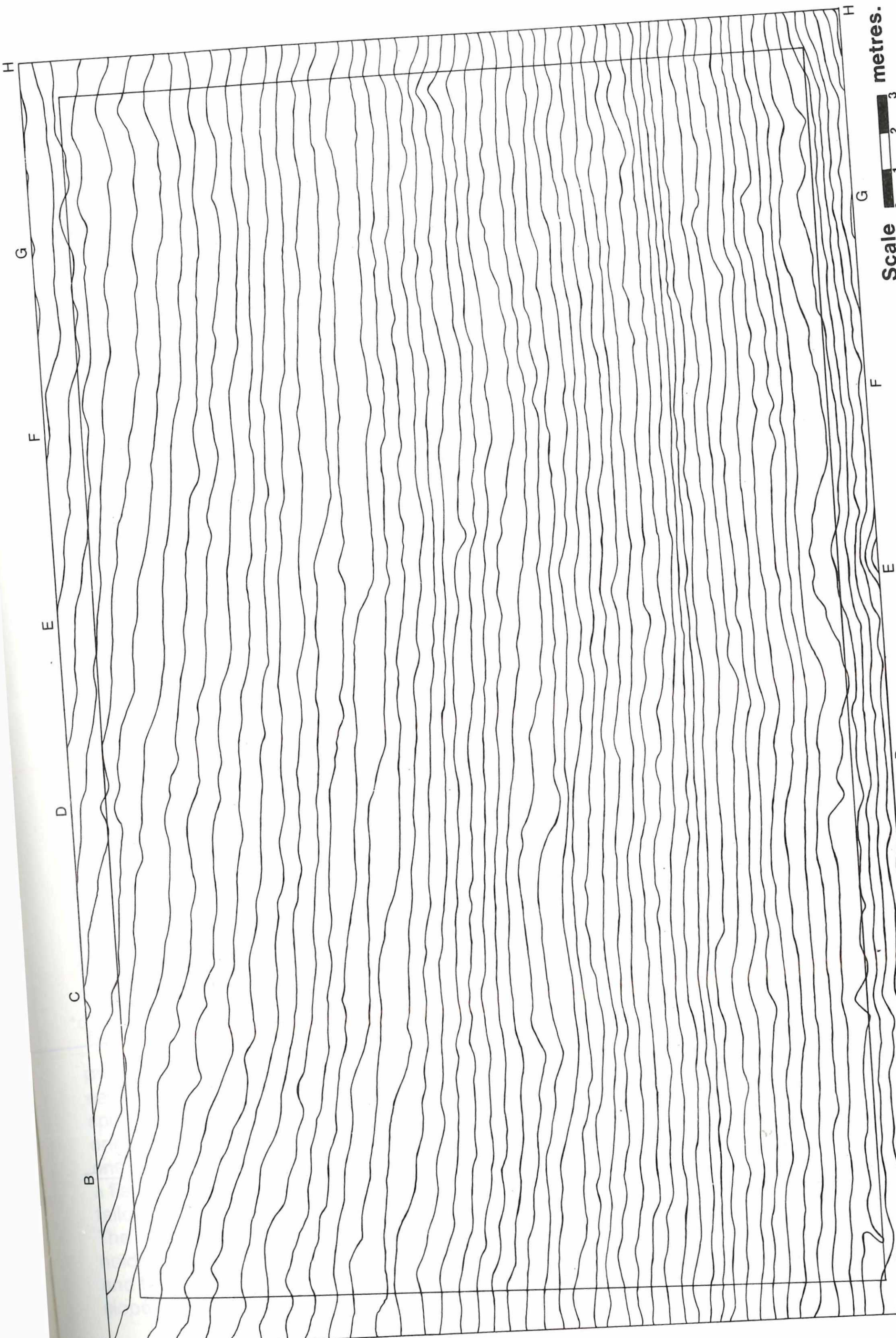

Fig. 3 Contour Site I. Field V

All the sherds are based upon the dominant archaeological sherd as recovered being a body sherd. In a random sample of over five hundred sherds from Camel Down only two rim sherds were included. In order to check that the principle of "sherdhood" was not false a number of moulds were taken from actual sherds and replicas made in plastic resin within which the standard magnet was inserted. These were scattered at random within the trials and have shown no anomalous behaviour in comparison with the selected standard sherd. The potential problem of using a magnet as the relocation device lies in the magnetic attraction between it and another sherd or the metal on the plough. This is solved by the use of low powered magnets. Once encased in plastic, the attraction factor only comes into affect in air when sherds are closer than 10 mm apart. In soil the attraction factor is nullified and to date, no sherd has been lost during ploughing. Thus this minimal attraction factor is of no significance to any movement through the soil.
Having solved the problems over the sherds, the design of the experiment is simplicity itself. Three sites have been selected. One on a slope of approximately 16° (Figs. 3 & 4) on a friable redzina soil averaging 100 mm in depth directly onto middle chalk (Site I), the second on virtually level land (Fig. 5) on hill-wash soil comprising a mixture of redzina, clay with flints and chalk averaging 300 mm in depth directly onto middle chalk (Site II). The third located on similar soil on virtually level land is the subject of modern agricultural activity and has run only for two seasons (Site III). Sites I and II are on the Ancient Farm, Site III is situated at Manor Farm, Chalton, Hampshire. The first two are devoted to looking at the effects of

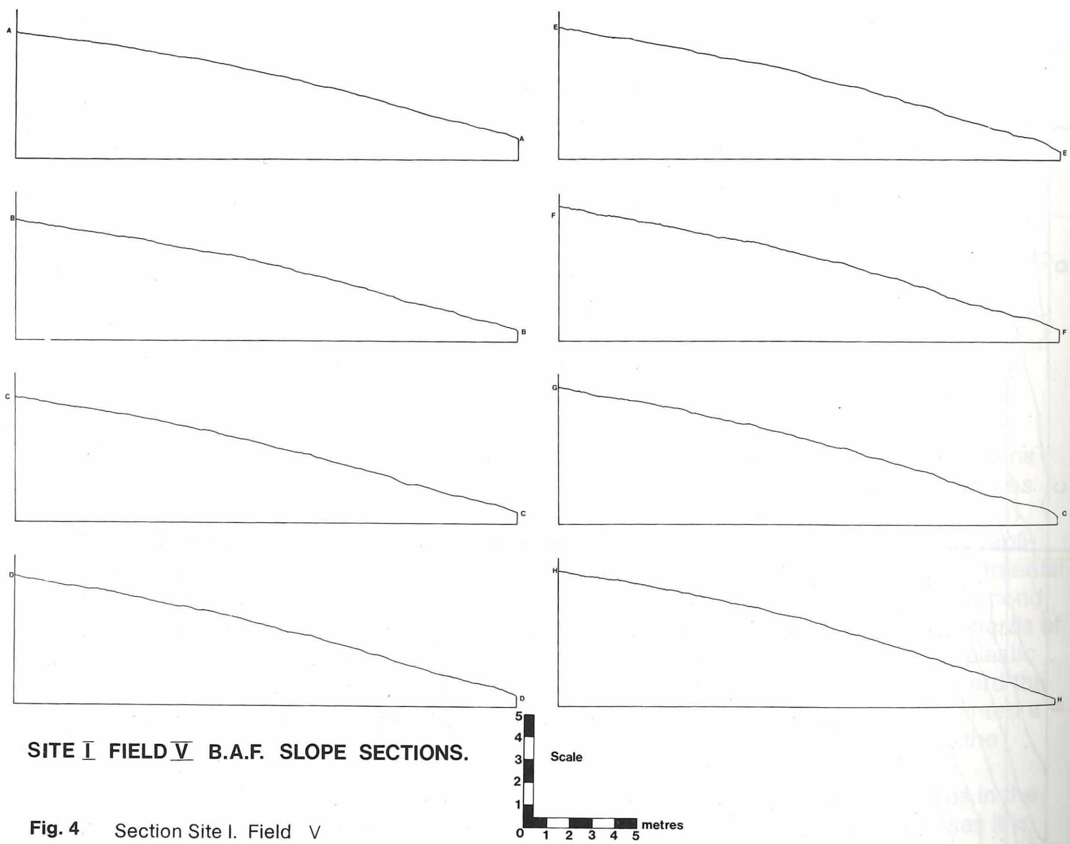

Fig. 4 Section Site I. Field V

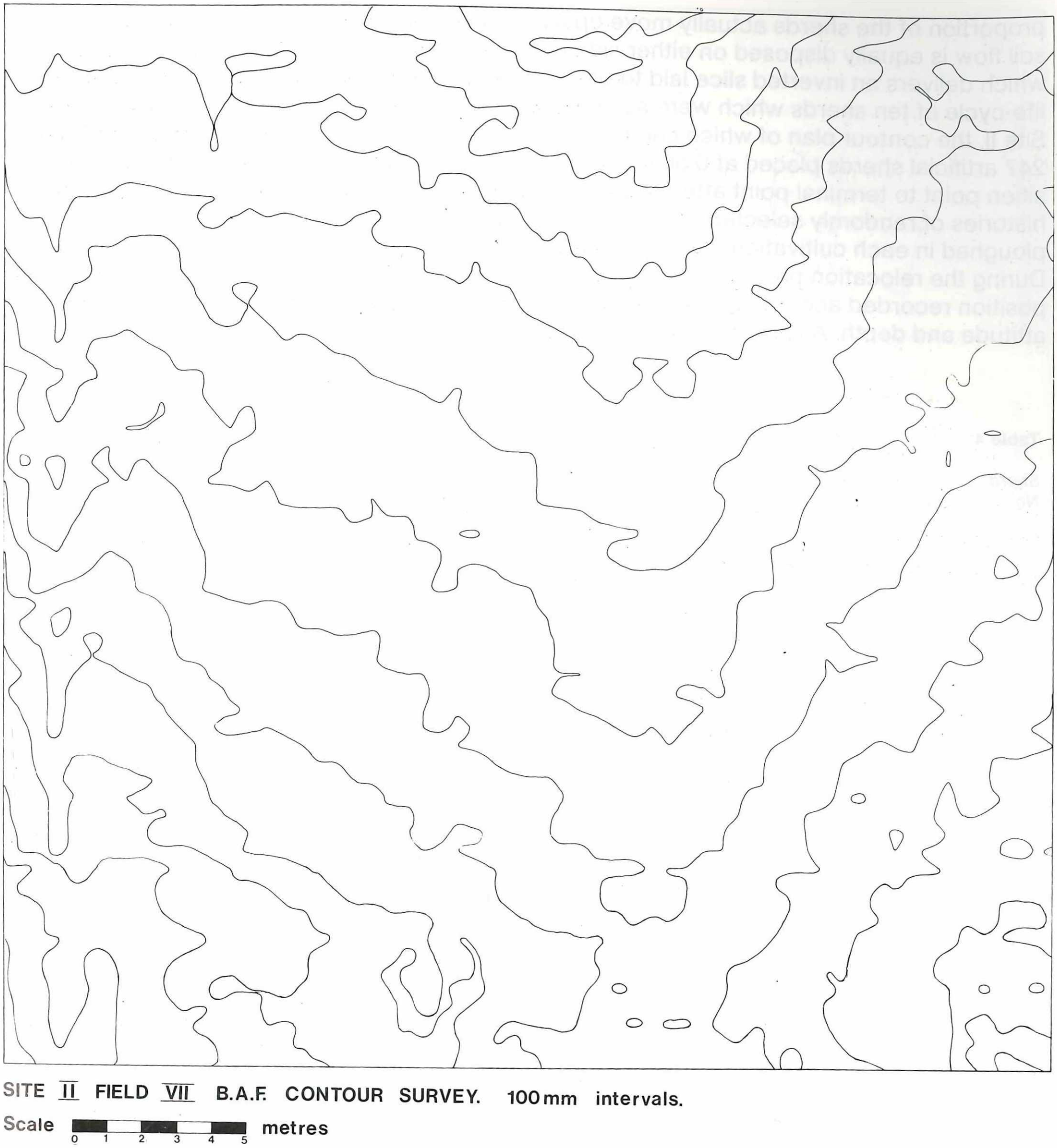

Fig. 5 Contour Site II. Field VII

prehistoric and Roman type plough action, the third at the effects of ultra modern farming. In each of the three sites a rectilinear grid has been laid out with the artificial sherds planted at specific intervals 50 mm deep in the horizontal mode with the major axis of each sherd oriented north to south. On the sloping site the grid measured 10 m x 10 m with 121 sherds, one set at each intersection of the grid lines set at 1.00 m intervals. The field normally bears a flax crop (*Linum usitatissimum*) once every three years, the other two years being a plough fallow. After six seasons of regular activity the total movement of the sherds are given in Fig. 6. The ards for ploughing have varied between the replica Donneruplund ard (Glob 1951; Reynolds 1981) and the Roman-type ard (Reynolds 1978), both of which create similar shapes and types of furrow (Fig. 7). The direction of ploughing is always along the contour of the slope. There is a clear drift of the sherds downslope but in gross terms it is minimal and a

proportion of the sherds actually move upslope. This is to be expected with an ard since the soil flow is equally disposed on either side of the share as opposed to a turnover plough which delivers an inverted slice laid to one side only. Perhaps of more specific interest is the life-cycle of ten sherds which were selected with the use of random numer tables (Fig. 8). Site II, the contour plan of which can be seen in Fig. 5, had a grid of 9.00 m x 6.00 m and with 247 artificial sherds placed at 0.50 m intersections on the grid. Total movement from deposition point to terminal point after nine complete cultivations can be seen in Fig. 9 with life-histories of randomly selected sherds in Fig. 10. In contrast to Site I this area was cross ploughed in each cultivation, north to south and east to west.
During the relocation procedure, each sherd is isolated with the fluxgate gradiometer and its position recorded according to the following criteria: its specific location, orientation, spatial attitude and depth. A typical record of an individual sherd can be seen in Table 4.

Table 4

Sherd No.	*Date*	*Location*							
		Sub sq.	*East*	*North*	*Depth**	*Orientation*	*Attitude ±*	*Agricultural Process*	*Crop*
036 Trial 1	10.10.78								
036 Trial 1	10.10.78	022	0000	0000	50	N-S	H	–	Flax
	01.11.79	012	0006	0074	30	NW-SE	H	Full cycle	Flax
	13.06.80	011	0099	0065	30	NE-SW	H	Ploughed	Fallow
	08.08.80	011	0095	0086	40	NE-SW	<W	Ploughed	Fallow
	13.03.81	011	0095	0092	10	N-S	<N	Ploughed	Fallow
	14.08.81	011	0090	0079	5	E-W	V	Ploughed	Fallow

* Depth in mm from soil surface
± H – Horizontal, V – Vertical, <± sloping along major axis in direction shown, e.g. < N – sloping to north.

A summary of the experiments to date on the first two sites can be seen in Table 5.

Table 5

	SITE I	*SITE II*
Number of Cultivations	6	9
Average movement of sherd from deposition point to last find point	Av. 143.90 cm Mean 106,80 cm	136,61 cm 106,40 cm
Average movement of sherd between cultivations	Av. 52,40 cm Mean 42.90 cm	40.00 cm 40.60 cm
Number of sherds per cultivation on soil surface	16.6 %	16.6 %
Frequency of surface appearance	1 in 6	1 in 6
Change of spatial attitude from horizontal mode	46 %	45 %
Degree of rotation per cultivation	47°	49°
Average vertical movement per cultivation	2.75 cm	3.40 cm

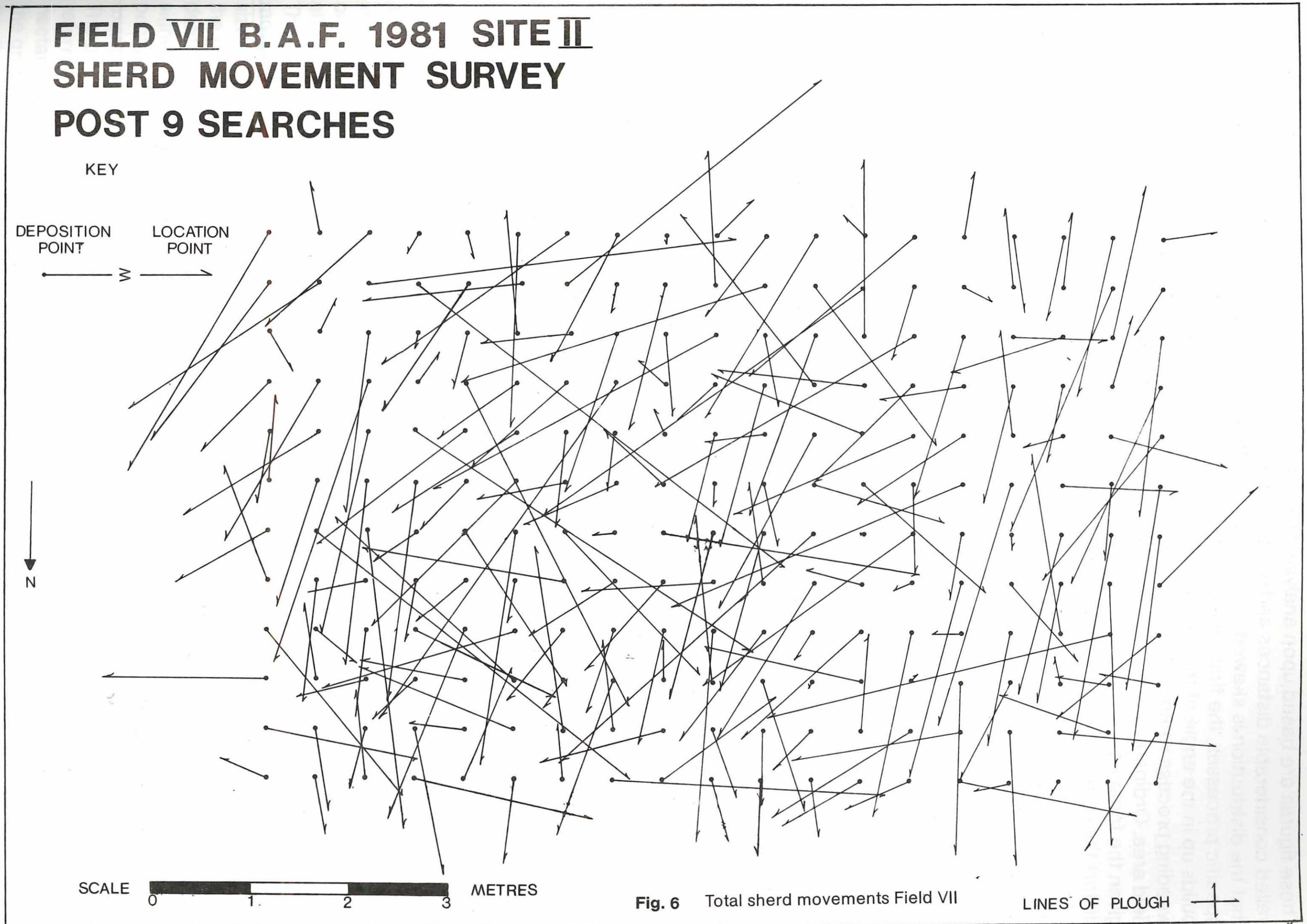

Fig. 6 Total sherd movements Field VII

These figures are based upon analysis of all sherds including those very few which have travelled considerable distances and which probably ought to be removed from the analysis in that the distribution is skewed. The gross movements (*q.v.* in Figs. 6 & 9) are caused by two specific processes, the first when the sherd is caught up in the tangle of roots and soil which builds up in the angle of the plough between the share and the beam, the second during the weeding process when material hand weeded from between the rows is removed from the field area. Ordinarily these latter sherds would not be encountered in a specific survey but given the foolproof location system with the fluxgate gradiometer they are included and thus distort the overall figures.

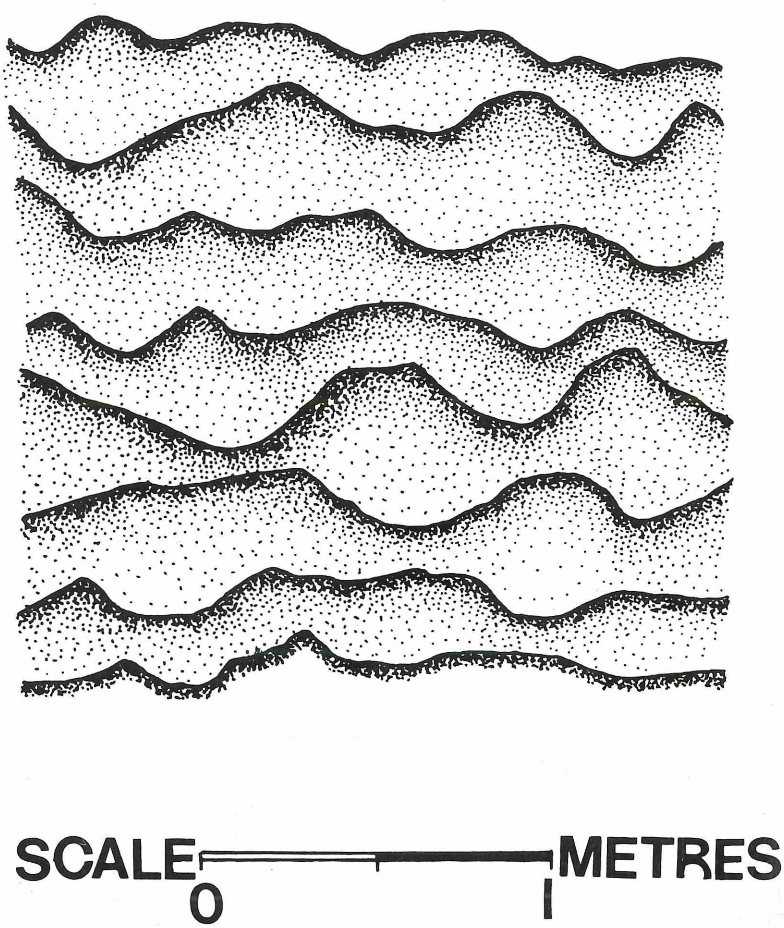

Fig. 7 Ard Furrow Profiles

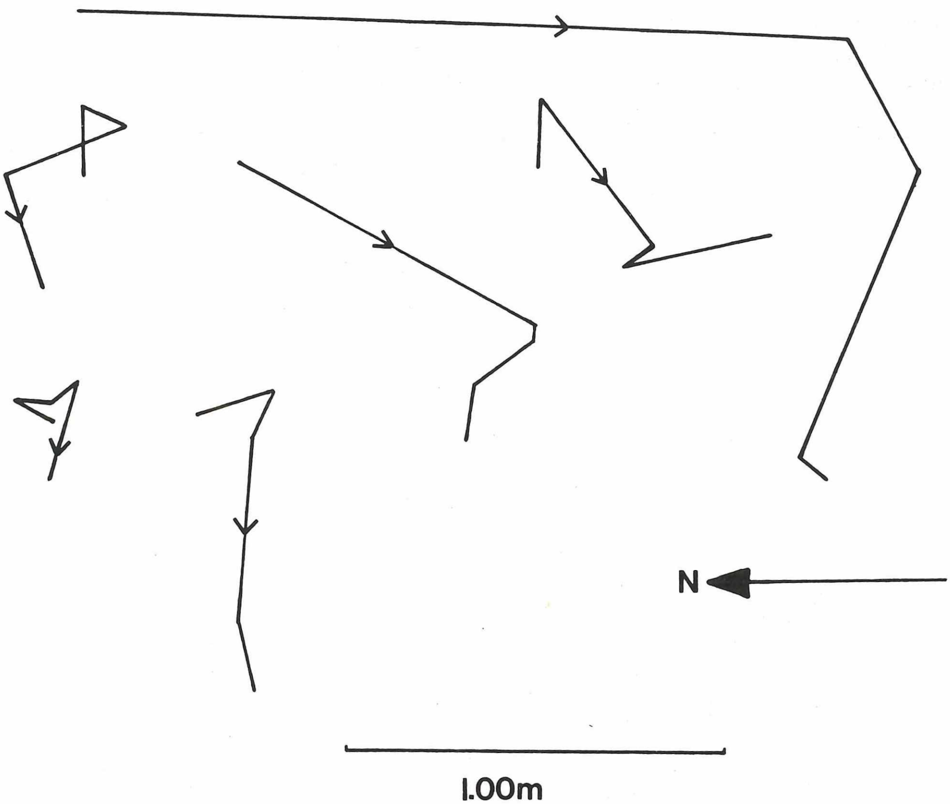

Fig. 8 Sherd lifecycles (Random Selection) Site I. Field V

A simple correction by omitting these anomalies leads to an average movement on both sites I and II closer to 0.80 m. Nonetheless, the results are remarkably similar despite the disparity in slope between the sites. The different soil types seem to have surprisingly little effect upon the movement patterns.

The experiment is not exhaustive in its treatment of the variables inherent in sherd movement in ploughsoil particularly with respect to variable movement occasioned by sherd size. It is not unreasonable to suppose that an increased sherd size would further introduce the potential variable of shape. Trials within the experiment have shown that within the standardised size of the artificial sherds, axes 500 mm x 2500 mm, shape proved not to be a significant variable at all. Similarly only two soil types have been examined and one might expect a heavy clay loam to have different behaviour characteristics. It is necessary to examine these variables empirically before any hard and fast conclusions can be drawn.

The problems posed by the threat of modern agriculture is presently being examined. Site III referred to above has been set up in 1981. It is located on level ground in the midst of a forty hectare field on a grid of 5.0 m x 5.0 m with thirty six sherds set on the 1.0 m intersections of the grid. To date it has not been in operation long enough to yield any valuable data although the first survey has provided similar results but with the expected variation of more standard lateral movements and increased vertical transfer through the soil.

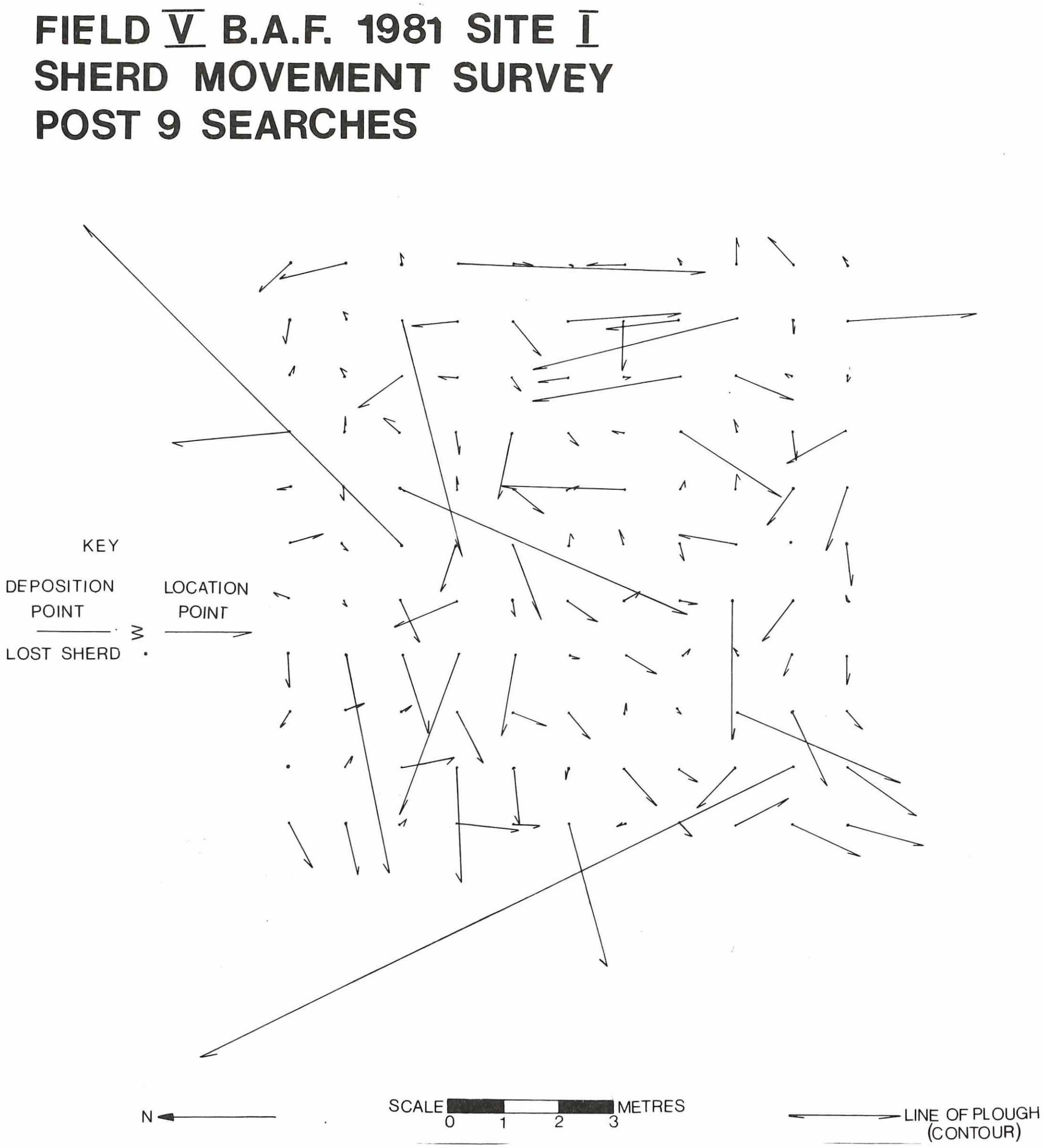

Fig. 9 Total sherd movements Field V

The initial results of Site III, however, do serve to underline the difference between modern ploughing which must include historic ploughing since in both forms the turnover mouldboard plough is used, the difference is but one of scale, and the prehistoric and Roman type ard. The data in Table 5 indicate that the vertical movement of the sherds within the topsoil is contained within the average of 27.5 – 34.0 mm, the second figure being drawn from the greater ploughsoil depth of Site II. The rotation in the horizontal plane is considerable at c.48° per cultivation. These data clearly demonstrate the stirring effect of the ard in a relatively shallow draught. The soil is rotated past both sides of the heel of the ard beam whereas with the modern plough the lateral movement is not significantly increased but the vertical movement with a rolling effect upon soil and sherd alike is quite different. In terms of abrasion on real sherds one would suspect that ard movement is more severe while fragmentation would be increased by modern plough action.

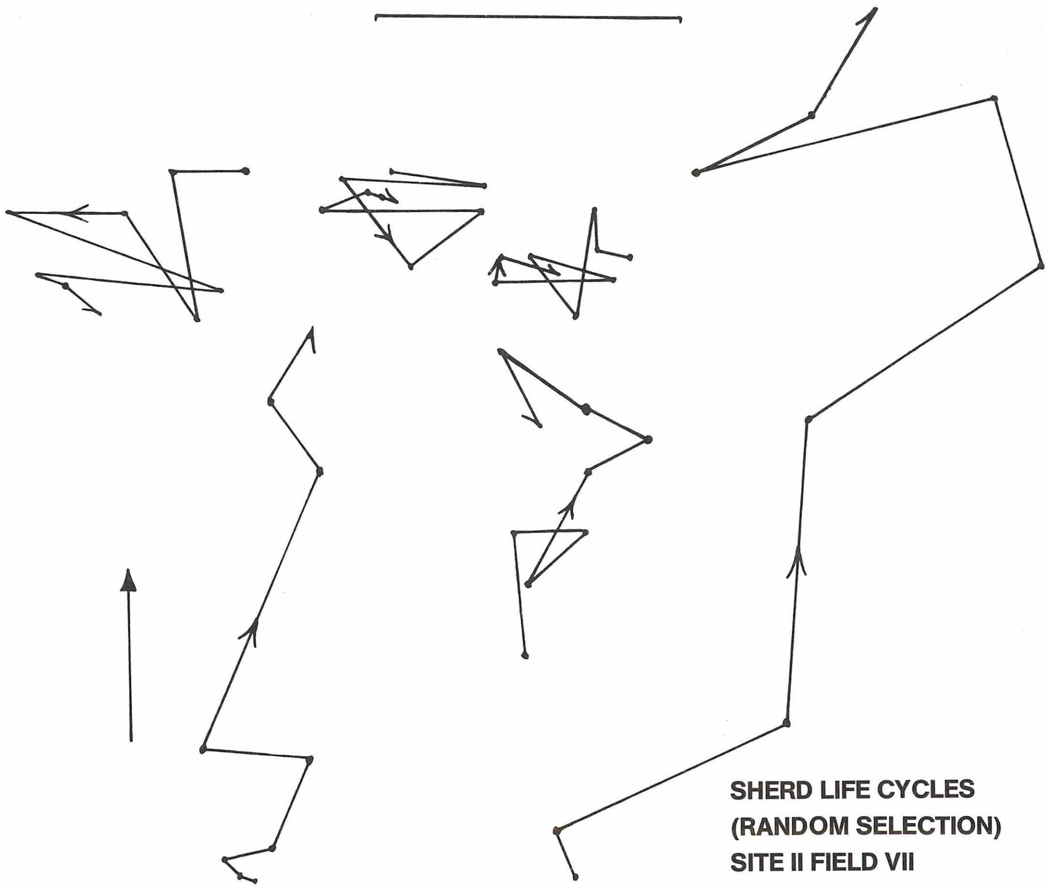

Fig. 10 Sherd lifecycles (Random Selection) Site II. Field VII

Given the *caveats* concerning the variables not yet examined and the interim nature of the results presented above, an important trend emerges. Should sherds travel on average no more than 0.80 m from deposition point to find location, their relationship to their original location is significantly close. There is every reason to pose the hypothesis that the careful location and accurate plotting of sherds and the artefacts in the topsoil, despite intensive agricultural activity whether prehistoric, historic or modern, will enhance the understanding of archaeological features in subsequent layers. This is especially true of one layer multi-phase sites where the bulk of the artefactual material is in the topsoil. A technique employing this approach may well allow greater interpretation of the function or role of such features because of artefact association. The corollary of this hypothesis becomes even more important on those sites where all the evidence is to be found in the topsoil azthe identification of artefact distributions is the only basic data from which to mount any kind of interpretation. The remaining element of particular interest is the data which refer to the frequency of

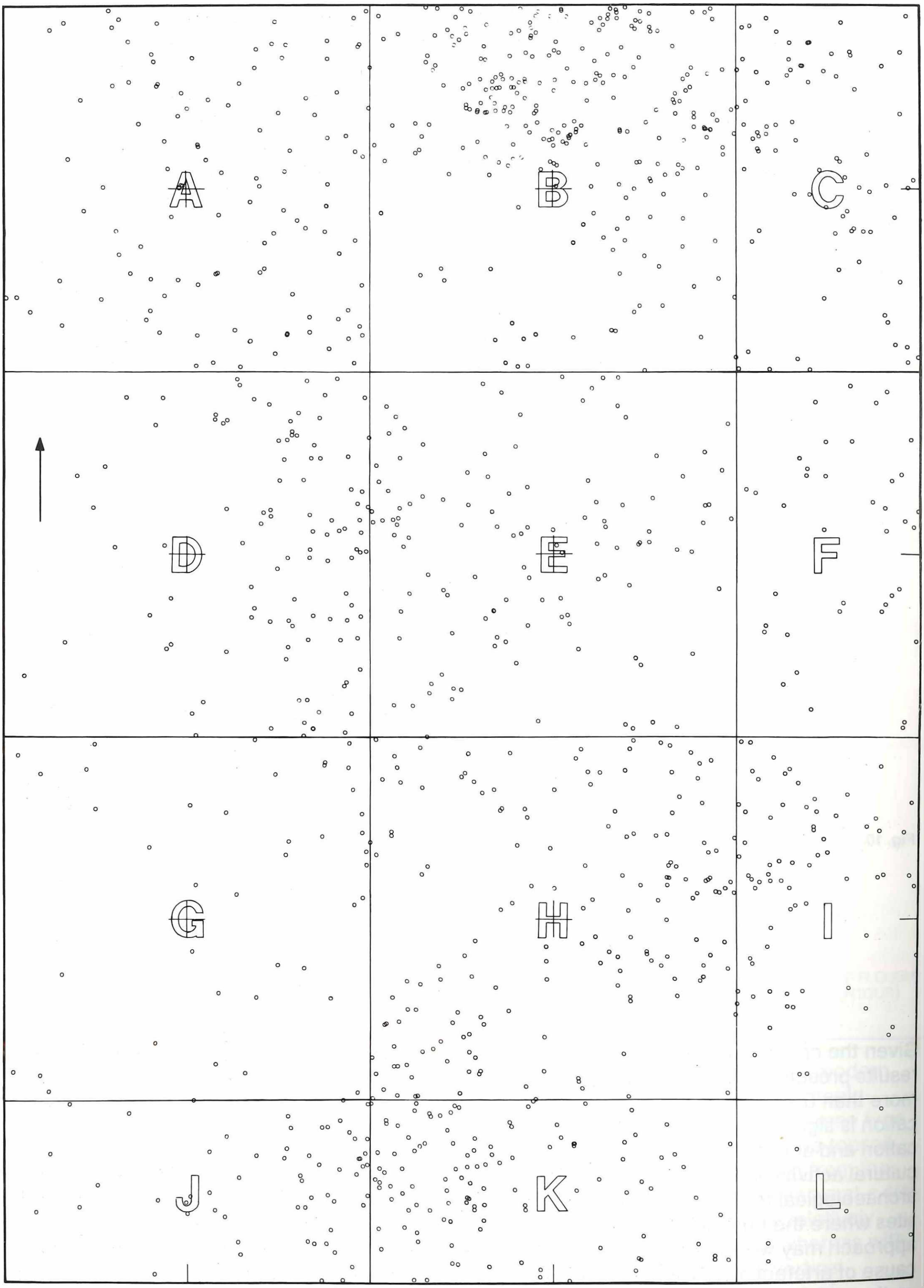

Fig. 11 Sherd distribution Plot. Field IV Butser Ancient Farm 1980

lected from the field during each survey the total sherd potential, in simplistic absolute terms, is reduced by the number of sherds recovered ($y = 6x - \frac{x1}{6}$). The resultant group of percentages are surprisingly similar and lend a degree of credibility to the sherd movement experiments. Mathematically one would expect an exponential rather than a straight line graph but such may be obviated by the intensity of the survey itself, allowing a more absolute conclusion. The subsequent excavation, which will yield a total of thirty five samples, will provide a sufficiently broad data base to allow proper statistical analysis. The excavation technique will involve wet sieving of all material through a mesh of 2 mm.
The actual distribution shown in Figure 11 appears to indicate significant clusters of pottery and blank areas. Should these mirror underlying features, they will provide an admirable example since the site of the Ancient Farm is believed to have been badly affected by subsequent agricultural activities. The opportunity of carrying out exhaustive long term trials on such a small area is most unusual and excavation will be postponed for as long as possible.
Concentration throughout this paper has been upon the ploughzone and the effects of movement upon the hard archaeological artefacts. Any consideration would be incomplete without recourse to geophysical and geochemical examination to complement these observations.

Table 6

FIELD IV

		Actual no. of sherds recovered	Ideal no. of sherds to be recovered	Total sherd potential	Actual no. as a percentage of total sherd potential
SQUARE A1					
Search No. 1		12	12	22	16 %
	2	11	10	60	18 %
	3	6	8	50	12 %
	4	7	7	42	16 %
SQUARE A2					
Search No.	1	17	17	102	16 %
	2	12	16	85	14 %
	3	6	13	69	8 %
	4	2	9	56	4 %
SQUARE B1					
Search No.	1	43	43	258	16 %
	2	37	36	215	17 %
	3	31	30	179	17 %
	4	17	25	149	11 %
SQUARE B2					
Search No.	1	52	52	312	16 %
	2	45	43	260	17 %
	3	17	36	217	8 %
	4	32	30	181	17 %
SQUARE C1					
Search No.	1	23	23	138	16 %
	2	17	19	115	15 %
	3	9	16	96	9 %
	4	10	13	80	12 %

Geophysical surveys, the resistivity meter aside, depend upon magnetic enhancement of iron oxides contained in the topsoil brought about by human occupation. The magnetometer and fluxgate gradiometer detect features cut into bedrock which have had topsoil silted back into them, the topsoil being more magnetic than either the subsoil or bedrock since it contains a greater proportion of these iron oxides than underlying strata and of these oxides there tends to be a higher ratio of more magnetic forms. It is hypothesised by Le Borgne that burning and a fermentation effect associated with the decomposition of organic material are responsible for enhancing the magnetism of these oxides (Tite 1972; Aitken 1974).

Given the soil cover on the Ancient Farm site which averages a mere 100 – 120 mm in depth and the above arguments for minimal movement, such magnetic trace evidence of human occupation should prove to be especially valuable. Unfortunately surveys using a magnetometer and its variant the fluxgate gradiometer have been signally unrewarding. Magnetometers effectively detect local changes in the earth's magnetic field caused by soil that has silted into features cut into the ground but generally fail to detect such anomalies in the even spread of topsoil which has not been physically displaced. The surveys implied that rock cut features were either too insignificant to be isolated or non-existent.
On the other hand, magnetic susceptability meters which generate their own field are able to examine the magnetic properties of topsoil either by laboratory testing of prepared samples or with field apparatus. The magnetic enhancement of soil on archaeological sites even in the absence of distinct features has been demonstrated by Tite (1972). The field apparatus, however, has significant penetration beyond the limit of plough action and is prone to produce readings confused by varying topsoil depth and actual features cut into subsoil or bedrock. A new magnetic susceptability meter, produced by Conservation Instruments for the Department of the Environment Ancient Monuments Laboratory, has been recently developed. It has alternate measurement coils for laboratory and field use. The field apparatus has a coil of 180 mm in diameter which gives an effective penetration of *c.* 120 mm, and thus its response is invariably to the topsoil only. Its sensitivity to surface irregularity leads to less precision but compensation is gained by the speed with which it can be used to take numerous readings which can be smoothed mathematically (Clarke 1982).

Close liaison exists between the Butser Ancient Farm and the Ancient Monuments Laboratory and part of the early field trials of this new susceptability meter were carried out at the farm by the author and research assistants (Beighton 1981). Concentration was focussed upon Field IV, the site of sherd survey described above, in order to establish any correlation between sherd distribution and magnetic enhancement. The resultant plots, Figures 12 and 13, provide respectively the mathematically smoothed data as a dot density plot and a contour plot (Bartlett 1981). The data from which these plots are derived are given in Table 7. The readings were taken at 1.0 m intervals over the whole field area which correlates exactly to the boundaries of the sherd survey. By comparing these figures with Figure 11 the magnetic enhancement in the soil is seen to complement the sherd distribution. The areas of high concentration are effectively contained by the high sherd density cover. The deepest concentration of magnetic susceptability is thought to indicate the presence of a hearth.
The final phase to complement both magnetic enhancement surveys and sherd distribution plots will be a phosphate survey. This last will be similarly intensive with samples taken at 1.0 m intervals.
The focus of this paper has been firmly placed upon the ploughzone, that horizon of soil that has been subjected to prolonged agricultural attention. The research programmes quoted are all in a developmental stage underlining the nature and significance of the problem and its recent recognition. The development of existing and new techniques is as much experimental as any other forward development in archaeology.
It is this aspect, the development of new techniques, which inspires the provision of the raw field data as an integral component of the argument rather than as an annexe or appendix. The presentation of such data, here as elsewhere in, focusses attention upon the *minutiae* and their manipulation to increase an awareness of the problem and to encourage either reworkings of the data or the application of different or new techniques. Without the raw data and its subsequent manipulation the conclusion regularly passes unchallenged and, in point of fact, is unchallengable.
The ploughzone or topsoil is potentially of enormous value in that within it is to be found the material evidence which enhances our understanding of the structural features bound in the subsoil and bedrock. The very nature of the features visible in the substrata and ordinarily subjected to archaeological investigation should serve to remind us that human occupation in the remote past as now is on the soil surface. There is a growing body of evidence which

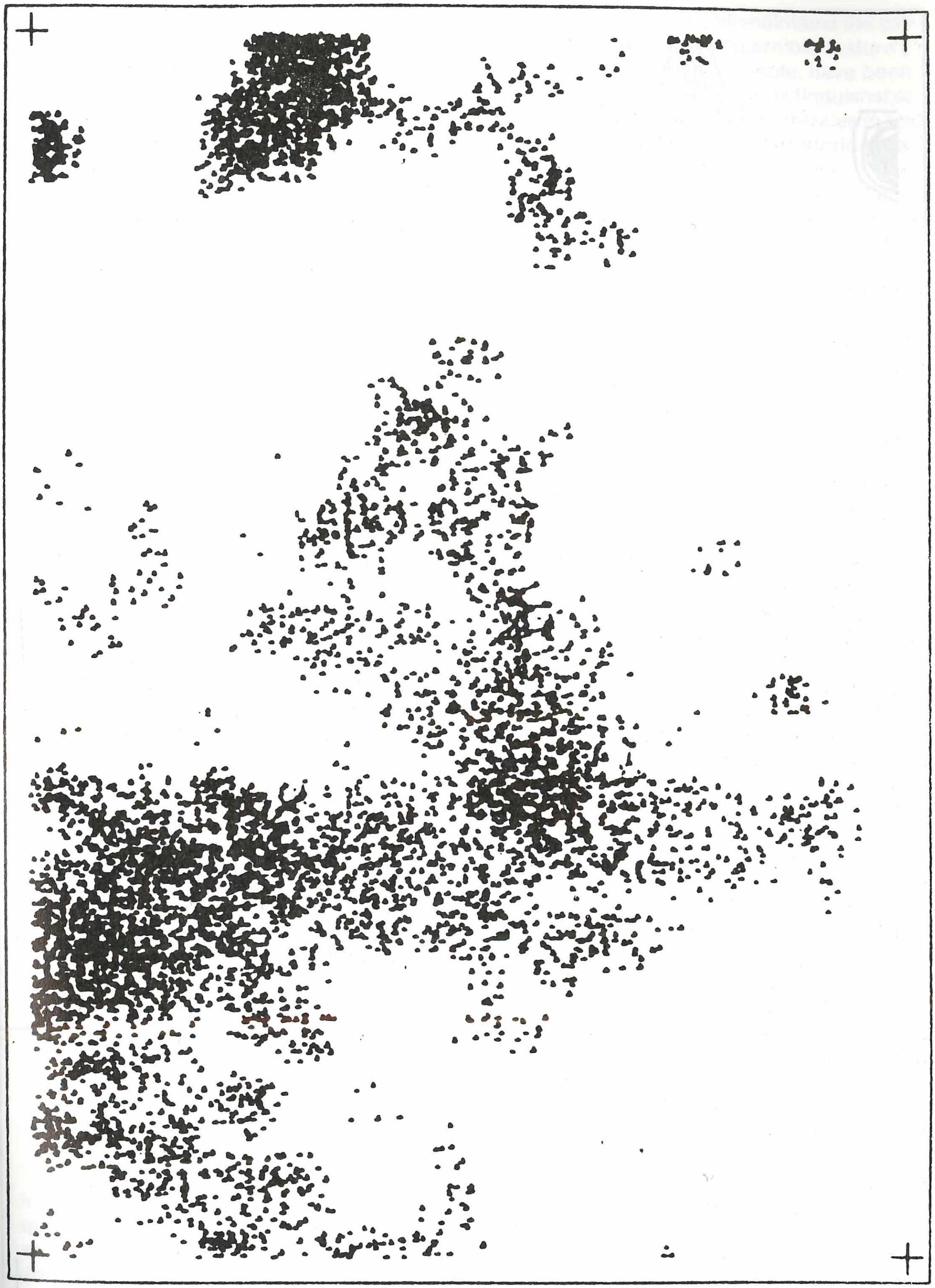

Fig. 12 Magnetic Susceptibility Survey – Dot Density Diagram (Mathematically Smoothed)

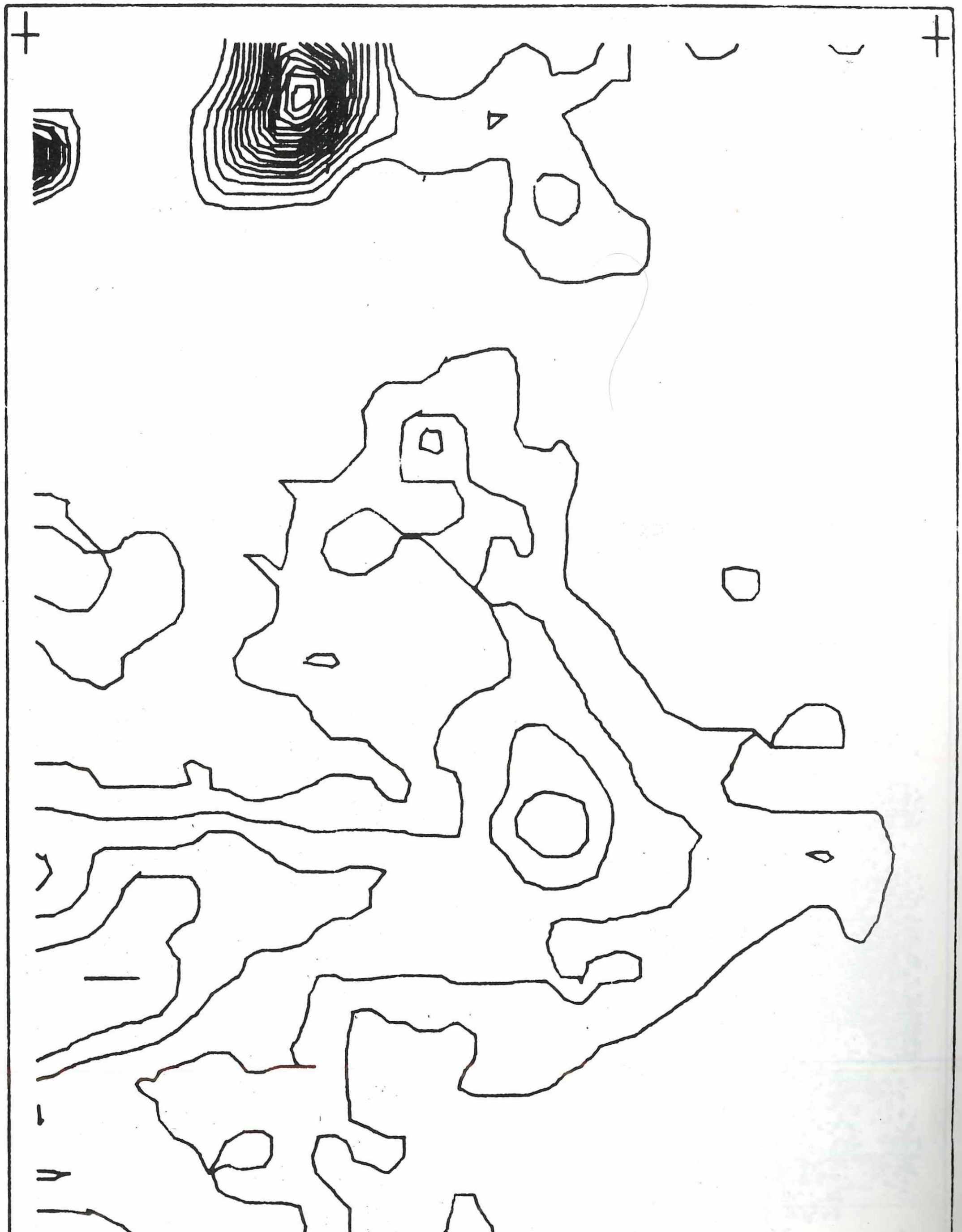

Fig. 13 Magnetic Susceptibility Survey – Contour Plot (Mathematically Smoothed)

argues that the topsoil, despite continuous disturbance by agriculture, still maintains the profile evidence as created at occupation even when there is minimal or indiscernible feature evidence in the subsoil. Archaeological features visible from the air, for example, have been demonstrated to penetrate the bedrock very little or not at all and survive as distinguishable soil marks (Bowen 1975). Ditches have been shown to survive in topsoil as differences in texture and enhanced organic content. Phosphate enhancement on ploughed prehistoric sites has been shown to retain their detailed definition (Craddock, forthcoming). Magnetic enhancement, which does not necessarily correlate with phosphate enhancement similarly preserves definition (Clarke 1977). It would seem that abandonment of the topsoil based upon the assumption that it is so distorted as to be of minimal archaeological value is a practice with a limited future.

Table 7

FIELD IV Magnetic Susceptibility Survey 4/81

16	19	13	20	13	17	29	100	48	48	12	18	13	26	25	17	26	27	18	37	28	12	20	40	16	14
18	23	21	20	18	21	30	122	139	43	25	20	22	28	31	29	27	28	17	17	17	13	22	14	12	13
15	23	18	16	22	36	73	129	97	31	35	32	31	39	21	24	20	17	25	19	23	15	13	08	12	10
130	13	11	15	18	32	66	73	33	16	25	30	27	20	31	29	18	25	16	24	14	20	21	12	11	12
20	14	14	17	16	38	27	22	26	15	19	24	19	14	35	38	24	20	16	19	19	21	14	10	11	11
18	13	17	16	15	20	15	17	19	22	19	20	27	25	32	29	26	29	20	20	16	17	17	17	16	14
20	21	20	18	17	16	17	16	28	24	25	19	24	21	25	35	27	33	23	18	16	12	15	14	14	17
12	16	17	18	12	21	19	13	17	18	16	22	24	20	27	22	16	22	11	13	18	13	10	15	12	09
17	19	24	23	15	19	15	12	18	18	14	19	17	23	21	14	21	20	26	12	17	17	19	08	09	12
21	18	19	20	27	22	28	24	22	22	24	23	36	31	24	24	25	21	21	17	19	12	12	15	13	09
23	26	18	21	26	21	22	22	22	26	31	23	25	26	24	22	22	23	22	18	13	12	16	14	11	16
24	20	19	18	20	27	21	20	22	21	26	52	33	25	19	28	20	24	18	17	23	14	13	13	11	10
22	28	26	20	17	20	26	28	24	26	32	31	29	28	31	31	18	16	15	15	16	13	16	13	13	08
29	25	18	22	22	26	19	24	24	30	29	22	31	31	31	22	18	14	19	13	22	15	13	15	18	13
21	28	26	32	24	25	27	22	35	39	32	34	35	26	37	23	20	18	17	21	21	21	18	18	15	15
22	20	24	26	26	20	28	25	31	30	27	30	35	27	27	21	25	24	21	27	35	23	18	15	18	26
30	22	30	30	29	20	18	25	21	27	27	23	24	34	31	25	26	20	20	19	26	19	19	16	13	18
23	34	25	23	21	24	24	34	36	29	28	33	26	26	39	26	30	20	18	24	18	14	15	19	26	16
22	23	29	21	17	23	29	26	31	30	28	25	29	27	33	31	28	29	22	25	24	16	18	18	15	14
18	20	19	22	20	24	16	15	28	25	30	28	33	34	38	32	28	25	24	26	16	15	48	23	16	22
28	28	23	21	28	29	18	24	24	22	25	33	32	36	37	38	31	30	26	27	25	26	16	28	25	21
23	25	21	27	18	24	15	23	26	20	16	26	28	31	40	41	35	28	24	25	19	20	20	20	24	16
44	37	32	34	31	47	35	35	27	30	32	28	23	46	47	56	33	38	33	34	30	27	29	32	26	22
21	32	42	36	35	35	38	33	32	39	36	38	28	29	39	37	32	29	31	24	28	27	35	30	26	23
31	33	40	51	58	31	39	39	42	36	32	32	35	31	35	34	36	37	31	33	26	34	20	30	24	15
38	37	40	36	32	39	35	45	30	33	38	27	30	35	30	21	27	23	25	25	28	22	19	24	25	19
44	49	47	51	41	38	32	28	27	38	32	32	37	31	34	31	35	36	28	27	22	22	22	25	22	18
40	45	44	46	38	30	37	33	29	21	26	23	24	29	23	34	27	28	25	23	22	17	18	21	25	17
53	43	38	40	32	29	35	28	27	21	23	18	19	33	24	26	24	24	18	25	28	22	28	26	25	23
32	36	37	25	29	23	33	31	36	19	26	22	26	28	24	27	23	23	27	23	16	22	19	24	22	22
27	43	35	35	26	26	22	24	28	22	24	25	25	23	24	17	22	24	23	24	22	16	13	24	18	12
30	30	26	27	32	29	48	27	23	28	27	22	23	16	29	19	20	18	16	14	18	14	19	12	11	11
43	41	40	29	38	23	24	20	24	20	27	23	24	19	19	18	21	22	16	18	17	15	14	07	09	10
23	24	30	36	35	34	35	41	26	28	20	20	29	24	21	23	20	17	16	14	17	15	17	11	17	16
26	22	27	28	33	23	29	29	30	18	22	26	28	27	18	23	22	22	18	17	12	15	14	11	16	13
28	26	26	24	25	41	32	26	28	32	28	29	27	27	18	15	17	18	26	14	16	22	17	16	18	14

In conclusion, should one accept the foregoing arguments, the premise arises that techniques need to be developed to excavate the topsoil or ploughzone. That the following experiment virtually predates the present appreciation of the problems posed by the plouhgzone is testimony to the range of experiment and the immediacy of response which can be achieved empirically. Often it is by carrying out an experiment which is designed to solve a specific problem that a further sequence of questions emerge which have greater significance than the original problem.

Excavation of a recently ploughed soil presents little difficulty since the soil is already loosened and little or no plant cover exists. Especially is this the case with modern farming methods by which the ground is cleared of invasive plant cover by agrochemicals. Quite frequently, however, the excavator is faced with a grass covered site and the normal procedure is either to deturf the area to be excavated by hand or alternatively machine strip both turf and topsoil. It is this condition of the ground which is probably the most difficult to deal with in terms of examining the ploughzone layer.

In order to solve this particular problem an experiment was carried out at the Ancient Farm research site on Little Butser in 1974. Here the turf cover was, in fact, very old and largely undisturbed. Excavations elsewhere on the site showed no evidence of any agricultural activity although tradition speaks of a root crop being grown there immediately after the last world war. Since the soil cover of this site averages only 100 mm in depth, the grass cover had effectively bound the total soil depth with roots so that when a turf was lifted the chalk surface was immediately revealed but for the very thin interface of dry dusty soil beneath.

Several areas were examined using the ordinary technique of stripping off the turf cover by hand. Although there is clear indication of a late Bronze Age – early Iron Age settlement on the site, evidenced by a sunken circular house platform and an unfinished length of ditch, the results from these excavations were particularly disappointing with a paucity of pottery or other finds and very few features of any note. In contrast, while digging the fields for research trials into the yield capacities of the prehistoric type cereals of Emmer (*Tr. dicoccum*) and Spelt (*Tr. spelta*), many hundreds of potsherds were discovered in the soil of the newly created fields. In fact, during the digging process itself very few were observed. It was only after a period of frost and subsequent heavy rain that a crop of sherds emerged. These were the "dragons teeth" from which sprang the major concern over the ploughzone and the experiments detailed within this paper. The sherd survey programme is detailed above but it was that the evidence of this site could well exist primarily and perhaps totally in the topsoil that inspired the following experiment. The problem was how to extract that evidence for this and any other similar site.

The root-bonded topsoil had, in some way, to be broken down into a state capable of being excavated but with minimum disturbance and no long term damage. Wet or dry sieving would yield the evidence but the process would be extremely slow and labour intensive and more importantly would remove the ability to locate artefacts to a precise find position. It would have been possible to use a chemical to destroy utterly the plant cover and thus produce a workable surface but such a resort would have been extreme and denied the land from subsequent use until the effects of the chemical had dissipated. There is a real element of doubt that given so little depth the soil would ever have recovered. In all probability wind erosion would have totally denuded the site. It was, nonetheless, this line of reasoning which provided the solution.

Destruction of the plant life can be achieved quite simply by negating the energy source, the sun. Plant energy and consequently growth is achieved by the process of photosynthesis. The experiment, therefore, which was carried out in 1974 comprised the spreading over an area a sheet of black heavy duty plastic. This was pegged down securely onto the ground surface to prevent the wind from getting under it.

Thereafter the ground thus covered was carefully monitored every five days. The first phase was the discolouring of the grass, followed by matting and ultimately rotting. After twelve weeks the plastic was removed. The grass was completely destroyed and areas of earth were clearly visible. The dead grass when lifted from the soil removed the fine tendrils of root with it but left the stronger roots in place although the bonding of the topsoil by the roots was completely broken down. The area of the experiment was only 5 m x 10 m yet remarkably a total of fifteen sherds were observed actually lying on the surface of the ground. These had been held in suspension by the roots at the base of the plants. The condition of the soil surface was ideal for immediate excavation.

appearance of the sherds on the soil surface. After each cultivation on both Sites I and II *c.* 16-17 % of the total number of sherds were found on the surface of the ground. A less complex programme carried out in Italy by A. Ammerman (pers. comm. & Ammerman & Feldman 1978) has yielded similar results. Marked white clay tablets were used. Initially they were laid on a plough surface, rather than 50 mm deep as here, in two lines at right angles to each other, the tablets being 100 mm x 100 mm x 10 mm thick. Monitoring was visual rather than any kind of machine search. The agricultural régime was exactly similar to the experiments where a simple ard was in use. Frequency of surface appearance, based upon several years of observation, averages out at 16-17 % per cultivation. In addition, of the tablets located the average gross movement recorded is *c.* 0.90 m. A proportion have been lost over the period of the programme equating crudely to the anomalous artificial sherds referred to above. This confirmatory information to the frequency records raises an interesting hypothesis. If a relationship between the artefactural evidence in the topsoil and underlying features actually exists, is a 16-17 % sample sufficient to isolate that relationship? Given the normal principles of field walking, where pottery scatters especially are taken to be indicative of the presence of a site, it would seem that there would be considerable benefit to be extracted from careful plotting of such scatters in order to ascertain the nature of the underlying material evidence. This hypothesis necessarily implies that a body of data be gathered to examine the significance of such a relationship. Such an enterprise has been in train at the Ancient Farm since 1979.

On the research site located on the Little Butser spur there is abundant evidence for late Bronze Age – early Iron Age occupation. Several fields have been created to accommodate the cropping trials designed to establish yield factors per hectare of the prehistoric type cereals. One of these field areas, Field IV, situated on the most level area of the spur, has been the subject of intensive field walking for the past four years. Pottery sherds have been found on all the field areas and generally these sherds have been carefully assigned to a 5 m x 5 m find location. In Field IV it was decided to record the exact find positions of all sherds as they appeared on the soil surface in order to build a precisely recorded distribution plot. The ultimate purpose is to excavate the area and provide an initial direct comparison record of artefact to feature relationship.
The agricultural régime is spade cultivation which mimics, more than any other system, the turnover plough. Cultivation has been so designed that the soil inversion and lateral movement is reduced to an absolute minimum. This has been achieved by reversing the spade cultivation each time. Thus the soil while experiencing total rotation and dispersal does so only within a 200 mm range in any horizontal direction. Consistent consecutive movement in any one direction has been avoided. The composite plot of all sherds found from the first three surveys is presented in Figure 11. Patterns are discernible and are complemented by a magnetic susceptability survey discussed below. If one applies to these sherds thus found the hypothesised principle of 16-17 % presence on the soil surface per cultivation, an interesting trend can be observed. The method of recording the sherds involves the division of the field, measuring 35 m x 25 m in large lettered squares 10 m x 10 m, each of which is subdivided into four numbered squares 5 m x 5 m. The field walking is best described as extremely intensive. The area is walked always in ideal conditions following frost and heavy rainfall. All sherds discernible to the naked eye are located, measured in situ and then bagged up separately with their own individual number and removed from the field. In the survey plot no analysis of size, shape or condition is indicated. The only qualification is identification on the soil surface. Two people, the author and a very experienced field walker, have made the survey. Randomisation of sampling in such an area is virtually impossible but nonetheless selection of a strip across the field was made by lot. The results of the sherd survey in this strip comprising squares A1, A2, B1, B2 and C1, a total area of 25 m x 5 m, is presented in Table 6. It includes the survey of February 1982 which is not shown in Figure 10. The calculations assume that the total number of sherds collected per square (5.0 m x 5.0 m) represents sixteen percent of total sherd potential of that square. Since the sherds are col-

In order to determine that no serious damage was done to the area a worm count was carried out over two square metres randomly selected, by spraying onto the surface a dilute solution of formaldehyde. The count was only marginally less than the average per square metre of the normal grassland cover elsewhere on the site. Thereafter the area was left in order to observe plant regeneration or more accurately recolonisation. Apart from the two squares used for the worm count, within eight weeks total plant cover was recorded. Even these squares were totally covered after sixteen weeks. The body of the soil, while initially reduced through collapse of fibrous material from 22 % to 4 %, was basically undamaged and totally restored after sixteen weeks.

The conclusion, therefore, is that given advance warning of an excavation on a grassland site it is perfectly possible to conduct that excavation from the ground surface downwards and to include the soil or ploughzone horizon in the archaeological record. Further, the fact that sherds were actually recovered from the soil surface after the black plastic treatment provides undeniable proof in this instance of archaeological artefacts being actually in the rootbonded topsoil. If further argues that worm sorting does not necessarily bury all the larger material at the base of their activity zone (Darwin 1881).

APPENDIX

The Butser Ancient Farm Project Trust is unique in British and World Archaeology in that it sets out to reconstruct and operate an Iron Age Farm dating to approximately 300 B.C. By using evidence from archaeological excavations, field work, documentary sources and the writings of the Greek and Roman authors about Britain and the Celts, the purpose is to recreate a real working model. In this way it is possible to test the explanations and theories raised upon archaeological evidence. In reality the Ancient Farm is a huge open-air scientific laboratory for research into prehistoric archaeology and agriculture.

The Demonstration Area of the project has been developed so that the Ancient Farm can be seen and explained to a wider audience. All research projects have a responsibility to the public and especially those projects which seek to understand our heritage. All the aspects of the work of the Ancient Farm are represented in this demonstration area. Indeed nearly every individual item is itself an extension of a research experiment. For example, the crops growing in the two fields are yielding vital information on yields per acre for prehistoric cereals and the weather station is one of a network recording the micro-climate on Butser Hill. The house reconstruction, on the other hand, is a unique experiment. Never before has a physical interpretation of such a large prehistoric round-house been attempted.

The Butser Ancient Farm Project Trust is an independent organisation relying upon grants from Trusts and Charities, Voluntary Donations and a proportion of the income from the Demonstration Area. Every visitor to the site actually helps the research programmes.

Zusammenfassung

Durch Intensivierung der archäologischen Luftbildforschung und durch steigende Grabungskosten gewinnt das systematische Absuchen von Feldern und Äckern wieder an Bedeutung. Davon, und von unterschiedlich gut erhaltenen Scherben der bronzezeitlichen Höhensiedlung Camel Down in Hampshire, ausgehend, untersucht der Autor einerseits detailliert die Faktoren, welche auf Keramik in und auf der vom Pflug bewegten Humusschicht von Feldern einwirken können und deren Auswirkungen auf Scherben. Andererseits wurde versucht, Aufschlüsse über die Wanderung und Bewegung von Gefäßresten in diesem Pflugbereich zu erhalten.

Zu diesem Zweck wurden künstliche „Scherben“ aus Kunstharz gegossen, die einen kleinen Stabmagneten enthielten, der es ermöglichte, die genaue Position und Lage im Boden von jeder einzelnen „Scherbe“ exakt zu bestimmen. Diese „Scherben“ wurden auf unterschiedlichem Boden in einem regelmäßigen Raster gleich tief in die Erde eingebracht. Die jeweiligen Areale wurden mit prähistorischen, römisch-mittelalterlichen und modernen Methoden beackert, um die Auswirkungen jeder Art von Agrikultur auf archäologische Stätten beobachten zu können.
Durch genaue, mehrjährige Beobachtung und Aufzeichnung der „Scherbenwanderungen“ kommt der Autor zu dem Schluß, daß einerseits Keramik durch Pflügen in der Regel nicht weiter als 0,80 m vom ursprünglichen Lagerungsort verschleppt wird. Andererseits erscheinen auf der Ackeroberfläche pro Bodenbearbeitung etwa 16-17% aller im Pflugbereich enthaltener Objekte.
Das bedeutet, daß intensives und regelmäßiges Absuchen von Feldern und das exakte dreidimensionale Einmessen der Funde die Interpretation und Gliederung von „Lesefundstellen“ in weit größerem Umfang gestattet, als dies bisher für möglich gehalten wurde. Außerdem unterstreichen in dieser Hinsicht die Untersuchungen des Autors die Bedeutung des Pflugbereiches auch bei Ausgrabungen, da viele archäologische Stätten überpflügt und gestört sind.
Abschließend berichtet der Autor über eine von ihm entwickelte Methode, die es ermöglicht, in grasbedecktem Gelände, ohne Störung der lokalen Schichtung durch Grassodenabstich, von der eigentlichen Erdoberfläche ausgehend auszugraben und damit den Pflugbereich in seiner Gesamtheit der archäologischen Auswertung zu erschließen.

(N. Baum)

Aitken, M.J. 1974 — Physics and Archaeology – 2nd edition. Oxford: Clarendon Press

Ammerman, A.J. & M.W. Feldman, 1978 — Replicated collection of site surfaces. American Antiquity 43, 734–40

Andrieux, 1976 — Essai d'un four de potier reconstitue due type de Sevrier (Bronze Final). Etudes prehistoriques no. 13, 37–40

Bartlett, A. 1981 — Butser Susceptibility Data, Geophysics 9/81. Ancient Monuments Laboratory Report, Department of Environment, London

Beighton, J.M. 1981 — Analyses of soil for magnetic susceptibility from a reconstructed Iron Age Farm. B. Sc. dissertation, University of Surrey (unpublished)

Bocquet, A. & Cowen J.-P. 1975 — Le four de potier de Sevrier, Haute Savoie (Age de Bronze Final). Etudes prehistorique no. 9, 1–6

Bowen, H.C. 1975 — Air photography and the development of landscape in central parts of Southern England in Wilsen, D.R. (ed.). Aerial reconnaissance for archaeology (Research Report No. 12), 103. London: Council for British Archaeology

Clarke, A.J. 1975 — Geophysical surveying in Archaeology, Antiquity 49, No. 196, 298

Clarke, A.J. 1977 — Geophysical and chemical assessment of air photograph sites, in Hampton, J.N. and Palmer, R., Implications of aerial photography for archaeology. Archael. I., 134, 157

Clarke, A.J. 1982 — The Testimony of the Topsoil (forthcoming)

Craddock, P.J. 1973 — The soil phosphate survey at the Cat's Water subsite, Fengate, 1973 in Pryor, F.M.M., Excavations at Fengate, Peterborough, England: the fourth report. Royal Ontario Museum archaeology monograph 10 and Northamptonshire archaeology monograph 10. Ontario: Royal Ontario Museum

Cunliffc, B.W. 1973 — Chalton, Hants: The Evolution of a Landscape, Antiquaries Journal Vo. LIII, Pt. II

Darwin, C. 1881 — The Formation of Vegetable Mould through the Action of Worms with observations on their habits. London: Murray

Glob 1951 — Ard og Plof.

Hinchcliffe, J. 1979 — Excavation within the Roman city of Verulamium 1978, Hertfordshire Archaeology 7, 10–27

Payne, S. 1973 — Paleoeconomy. Cambridge: University Press

Reynolds: P.J. 1978 — Iron Age Farm – The Butser Experiment. London: British Museum Publications

Reynolds, P.J. 1981 — The Donneruplund Ard – publication forthcoming National Maritime Museum, Greenwich

Saunders, C. 1973 — Verulamium under Plough. Unpublished paper prepared on behalf of Verulamium Museum

Taylor, T.P. 1979 — Soil mark studies near Winchester, Hampshire. Journal of Archaeological Science 6, 93

Tite, M.S. 1972 — Methode of physical examination in archaeology. London & New York: Seminar Press

Zeitschrift/Journal: Abhandlungen der Naturhistorischen Gesellschaft Nürnberg

Jahr/Year: 1982

Band/Volume: 39

Autor(en)/Author(s): Reynolds Peter J.

Artikel/Article: The Ploughzone 315-341