Proc. Hampsh. Field Club Archaeol. Soc. **44**, 1988, 11–23

THE DISTRIBUTION OF 'CELTIC FIELDS' ON THE EAST HAMPSHIRE CHALKLANDS

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ABSTRACT

Early field systems, often called 'Celtic fields', have been mapped on the East Hampshire chalklands and related to site factors such as soil type, slope and aspect. The majority are located on soils nowadays identified as rendzinas, and on gently to moderately gentle slopes. Southerly and westerly aspects are preferred. The choice of early agricultural sites is discussed, and it is concluded that crop failure caused by soil acidity was probably why soils on Clay-with-flints were avoided. Evidence for widespread soil erosion is presented, though it is argued that relatively little erosion occurred until Iron Age and Roman times when fields were enlarged and more efficient ploughs used. Soil maps are shown to be useful in the study of archaeological features, particularly for the way they reveal the complexity in soil pattern over a region, and identify soil types formed as a result of man-induced erosion and colluviation.

INTRODUCTION

'Celtic fields' and associated lynchets have been recognised in many parts of the British Isles, particularly in chalk and limestone districts. They were distinctive features of the landscape before major destruction by modern agricultural practices (e.g. Cobbett 1830; Hardy 1888). The earliest reference to archaeological interest in lynchets dates from the sixteenth century (Onions 1973), and the misnomer 'celtic' soon became firmly attached to all prehistoric fields, despite the lack of evidence to sustain such an association and the efforts of Bowen (1961) to rename them ancient field systems.

Though discussion over their ages and modes of formation continues, most modern authors agree that lynchets and early field boundaries have resulted from cultivation over long periods in the past (Bowen 1961; Bell 1981). The recent change in emphasis in archaeology to investigate early settlements within the context of their surroundings has shown the antiquity of many 'celtic' field systems and lynchets. On the southern chalklands, most of those investigated date from the Bronze Age (Bowen 1975; Fasham 1980; Drewett 1982; Fowler 1983).

Information on the extent and distribution of these features is vital to the study of prehistoric agriculture, but until recently, research has operated in a vacuum of detailed soil distribution information. Writers such as Whittington (1962) and Waton (1982) were forced to use very generalised data, often derived from geological maps. However, now that the 1:250 000 National Soil Map and accompanying Bulletins have been published (e.g. Jarvis *et al* 1983; 1984), work examining the effect of soil type on the distribution of agricultural practices is better placed. This paper discusses the ways in which soil maps help explain the distribution of early fields on the east Hampshire chalk plateau.

Today, most early field boundaries on the chalklands have little if any physical expression on the ground, and are best mapped using aerial photography. Even with this tool, however, strong reservations have been voiced over the ability to detect the full extent of these fields: later cultivation is likely to have removed or obliterated early field boundaries in some areas, making those which remain more impressive (e.g. Fowler 1983). Clearly such an effect impinges directly upon an attempt to relate early field distribution to soil type, as soil itself is likely to have been an important determinant in the pattern of later farming. Nevertheless, even granted these limitations, systems of fields can be seen covering large areas on air photographs, even though individual fields may not always be discernible. And they can be detected in areas of both thin (grey rendzina) and thick (argillic brown earth) soils, suggesting that modern agricultural practices may have done little substantially to alter the recognised pattern of early field distribution compared to its pattern in prehistory. With the acknowledgement, therefore, that the celtic field pattern mapped is unlikely to represent *fully* their previous extent, this study is based on aerial photograph recognition.

THE STUDY AREA

Fig 1 shows the location of the study area. The Chalk is the most extensive rock type, and Tertiary beds, consisting mainly of clays and sands, occur only in the north-east and south-

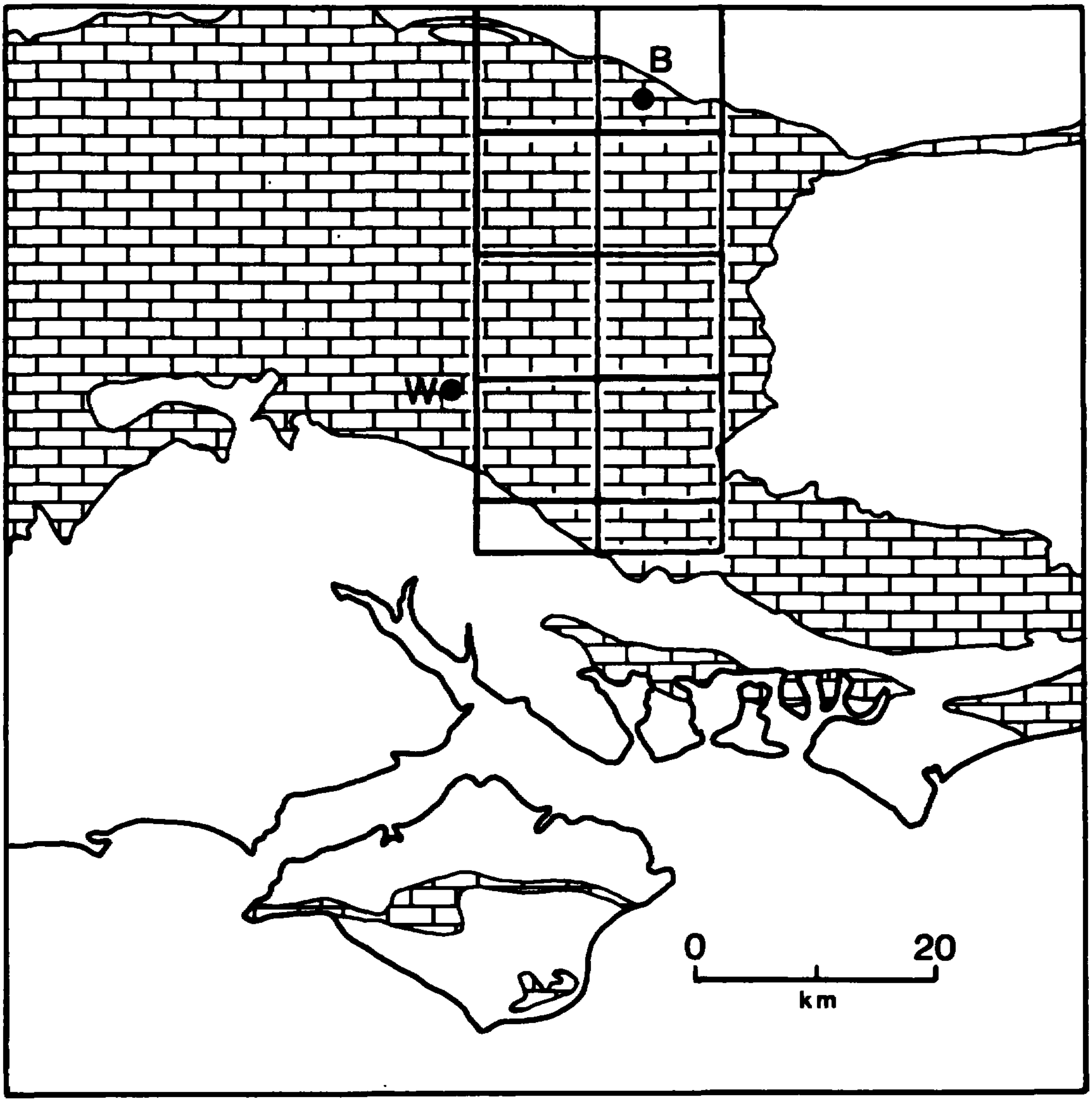

Fig 1. Study area. Hatching shows area of chalk outcrop. W: Winchester, B: Basingstoke.

Fig 2. Soil Associations on the East Hampshire Chalklands. Shading in order of decreasing density: 1) paleo-argillic brown earths, 2) argillic brown earths and brown calcareous earths, 3) brown rendzinas, 4) grey rendzinas, 5) alluvial and peat soils. Hatching: major urban areas.

west. As early fields are extremely rare in these areas, they have been discounted from further study. Clay-with-flints is widespread on the chalklands, particularly east and north-east of Winchester. It consists of flinty clayey material, in places several metres thick. Aeolian drift (often termed loess), a silt-rich windblown deposit, is a widespread component of chalkland soils, overlying both periglacially disturbed chalk and Clay-with-flints. The Test and Itchen river valleys are filled with alluvium, dominantly silty and calcareous. Associated with calcareous marl or tufa, humified peat is found along the lower Itchen floodplain.

The main present-day soil associations identified in the area (Jarvis *et al* 1983; 1984) are portrayed in Fig 2 and listed in Table 1. Thin (<30 cm) brown rendzinas, typified by the Andover series, are most widespread, with deeper brown calcareous earths (Panholes, Coombe and Blewbury series) and argillic brown earths (Charity series) in drifts in some valley bottoms. On steep slopes, chalky grey rendzinas (Upton series) are common. On the Clay-with-flints, silty over clayey Carstens soils are most extensive, with wholly clayey Winchester soils restricted to thin spurs and hillside convexities.

Colluvial deposits, the result of cultivation-induced soil erosion, are common in certain dry valley bottoms and on gently sloping footslopes, and in lynchets. Colluvial soils are defined (Avery 1980) as having weakly developed profiles, uniform colour and little evidence of leaching or weathering *in situ*. Two types of colluvium can be recognised: calcareous and non-calcareous. Calcareous colluvium is restricted to dry valley bottoms and lynchets below chalk soils of the Andover, Upton and Panholes series, whereas non-calcareous colluvium is mapped in areas mostly covered by Clay-with-flints, especially around the heads of dry valleys cut into these deposits.

METHODS

Localities covered by early fields and flights of lynchets were delimited using 1:15 000 monochromatic aerial photographs flown in February and March 1982 by Meridian Airmaps Ltd for the Soil Survey of England and Wales (Fig 2). The photographs were taken to assist in the location of soil boundaries for a soil survey of the 1:50 000 Ordnance Survey sheet 185 (Winchester and Basingstoke). Hence winter months were chosen to show the maximum bare ground on the photographs (Carroll *et al* 1977). Traditionally, soil features of archaeological interest are considered to be most apparent during summer months, when soils are driest and soil moisture deficits highest (Jones & Evans 1975). However, recent research on chalkland soils of south-east England (Wellings & Bell 1980; Wellings & Cooper 1983; Wellings 1984) has shown that summer soil moisture contents are surprisingly large, and deficits correspondingly low or even absent. Consequently, detection of archaeological features such as field boundaries on chalk soils is probably best performed on aerial photographs taken in the winter. The distribution of early field systems determined in this way was further compared with information given in Schadla-Hall (1977) and inscriptions on 1:25 000 Ordnance Survey First and Second Series maps.

To examine the relationship of field distribution to soil type, the proportion of each Soil Association (Table 1) covered by fields was determined for each 1:25 000 100 km^2 Ordnance Survey map within the study area, using information contained in the 1:250 000 soil map (Jarvis *et al* 1983; 1984). For comparison, the actual proportion of the Soil Association in each 100 km^2 area was also determined. The results are presented in Table 2.

The relationship of field distribution to aspect was also examined quantitatively. Using the contours on 1:25 000 topographic maps, areas covered by field systems were divided according to whether they faced dominantly north, south, east or west, and proportions measured for each 100 km^2 area (Table 3).

RESULTS

The Distribution of Early Fields

Fig 3 shows that fields are widespread over much of the study area though clustered in some

Table 1. Soil types and their characteristics in the study area.

Subgroup[1]	*Soil Association*[2]	*Geology*[2]	*Soil and site characteristics*[2]	*Present land use*[2]
Grey rendzinas (342)	Upton 1	Chalk	Shallow well drained calcareous silty soils over chalk. Mainly on moderately steep, sometimes very steep land. Deeper silty calcareous soils in coombes and dry valleys.	Permanent grassland, rough grazing and woodland on scarps; cereals and short-term grassland on gentle slopes.
Brown rendzinas (343)	Andover 1	Chalk	Shallow well drained calcareous silty soils over chalk. On slopes and crests. Deep calcareous and non-calcareous silty soils in valley bottoms.	Winter cereals and short-term grassland. With dairying and stock rearing; some woodland.
Brown calcareous earths (511)	Blewbury	Chalk	Well drained calcareous clayey and silty soils over argillaceous chalk. Some silty over clayey soils with slowly permeable sub-soils and slight seasonal water-logging.	Cereals and short-term grassland, with dairying and stock-rearing.
Argillic brown earths (571)	Charity 2	Flinty and chalky drift over chalk	Well drained flinty silty soils in valley bottoms. Calcareous silty soils over chalk or chalk rubble on valley sides, sometimes shallow.	Cereals; cereal and grassland rotations, permanent grassland and some deciduous woodland on steep valley sides.
Paleo-argillic brown earths (581)	Carstens	Clay-with-flints	Well drained silty over clayey, clayey and silty soils, often very flinty.	Winter cereals, often in rotation with grass; stock-rearing; some deciduous and coniferous woodland.
Calcareous alluvial gley soils (812)	Frome	Chalky and gravelly river alluvium	Shallow calcareous and non-calcareous loamy and silty soils over flint gravel affected by groundwater. Small areas of peat. Risk of flooding.	Permanent grassland with dairying and stock-rearing; some cereals and short-term grassland; wetland habitats.
Earthy eutro-amorphous peat soils (1024)	Adventurers' 3	Fen peat and river alluvium	Deep peat soils with associated extremely calcareous mineral soils. Some deep stoneless silty and clayey soils with organic rich surface horizons in places. High groundwater levels.	Permanent grassland and rough grazing; some arable; wetland and grassland habitats.

[1] Avery (1980)
[2] Adapted from Mackney *et al.* (1983)

Table 2. Celtic fields and soil type. R=Spearman Rank Correlation Coefficient

1:25 000 sheet	Soil association	% occurrence on sheet	Celtic field (%)	occurrence (km^2)	R
SU52	Upton 1	1.9	13.4	2.6	
	Andover 1	76.2	84.0	16.3	
	Blewbury	0.8	0.5	0.1	
	Charity 2	4.2	–	–	
	Carstens	13.3	2.1	0.4	
	Frome	0.7	–	–	0.6
SU53	Upton 1	2.0	–	–	
	Andover 1	57.8	95.7	8.9	
	Charity 2	7.6	–	–	
	Carstens	24.8	4.3	0.4	
	Frome	4.2	–	–	
	Adventurers' 3	1.5	–	–	1.0
SU54	Andover 1	21.6	45.3	1.6	
	Charity 2	22.1	4.0	1.7	
	Carstens	55.8	50.7	4.2	
	Frome	0.3	–	–	0.8
SU55	Andover 1	32.7	42.3	6.0	
	Coombe	1.8	–	–	
	Charity 2	14.2	7.0	1.0	
	Carstens	50.7	50.7	7.2	
	Frome	0.6	–	–	1.0
SU61	Upton 1	25.9	35.7	2.0	
	Andover 1	28.3	44.6	2.5	
	Blewbury	4.4	3.6	0.2	
	Carstens	41.4	16.1	0.9	0.5
SU62	Upton 1	32.1	70.0	4.9	
	Andover 1	15.6	18.6	1.3	
	Blewbury	13.6	1.4	0.1	
	Charity 2	6.3	5.7	0.4	
	Carstens	30.6	4.3	0.3	0.7
SU63	Upton 1	28.7	22.2	0.6	
	Andover 1	5.6	44.5	1.2	
	Blewbury	1.3	–	–	
	Charity 2	3.7	–	–	
	Carstens	60.7	33.3	0.9	0.5
SU64	Andover 1	36.4	100.0	1.6	
	Coombe	–	–	–	
	Charity 2	–	–	–	
	Carstens	–	–	–	0.8
TOTAL	Upton 1	7.6	14.5	9.7	
	Andover 1	48.5	61.6	41.2	
	Blewbury/Coombe	2.6	0.6	0.4	
	Charity 2	8.5	2.5	1.7	
	Carstens	32.8	20.8	13.9	

Table 3. Celtic fields and aspect

	Aspect (% facing)			
Sheet	N	S	W	E
SU52	24	26	25	25
SU53	17	36	23	24
SU54	9	41	29	21
SU55	8	40	24	28
SU61	9	44	29	18
SU62	3	56	34	7
$\bar{x}$	13.9	37.7	26.2	22.2

places and notably absent from others. Comparison with Fig 2 shows that most occur where thin (less than 30 cm thick) chalk rendzina soils are predominant (Andover 1 association; Table 1). For example, the largest area of field systems occurs on land extending south-east from Winchester, where Clay-with-flints is absent. In contrast, on soils mapped over Clay-with-flints (Carstens association; Table 1), early fields are rare, except in the north-west of the study area between Overton and Kingsclere. Within most Clay-with-flints dominated areas (e.g. SU 54, SU 64), fields are usually restricted to valley sides where chalk soils are exposed. Soils in dry valley bottoms (Charity 2 association; Table 1) appear largely devoid of early field systems.

Table 2 quantifies these observations. Over 75 per cent of early field areas occur on thin rendzina soils, and only 20 per cent on Clay-with-flints, though rendzinas account for only 56 per cent of the total land area. Individual fields cannot always be detected so such statistics as chi cannot be used to examine the imbalance between the observed and expected distribution of fields in relation to soil type. Instead the Spearman Rank Correlation Coefficient is used. Based on percentage areas (Table 2), this shows a variable strength of correlation from 0.4 for sheet SU 61 to nearly 1.0 for sheet SU 53 and SU 55. However, the measured relationship between field occurrence and soil type in turn depends on the extent of fields on each 1:25 000 sheet: strong correlations occur in regions where fields are prevalent, and weak ones where fewer fields have been detected. Hence, in most areas there is a strong relationship of the apparent distribution of early field systems with shallow, silty soils rather than deep, more clayey ones, though in a few areas (e.g. SU 55) strong correlations suggest fields were sited irrespective of soil type. A similar lack of correspondence between present day soil type and settlement pattern was identified on the Clay-with-flints plateau further east by Shennan (1981; 1985). Such anomalies may be explicable in terms of population pressure in particularly favourable areas, but are more likely caused by changes in soil properties since settlement began. In other words, soils which today appear unlikely candidates for settlement (e.g. Winchester series on Clay-with-flints; cf. Shennan 1981, 113; 1985), would have then been covered by silty drift, allowing easier cultivation.

In relation to topography, most early field systems extend down from the highest ground, e.g. around Deacon Hill (SU 506 276), Cheesefoot Head (SU 531 277) or Old Winchester Hill (SU 640 206). Flatter plateaux are usually devoid of fields, though probably because in the study area these are covered with non-chalky soils (Carstens association) rather than because they are intrinsically flat. Most fields are on gently to moderately sloping land; strongly sloping land, e.g. the steep limbs of asymmetrical dry valleys, seems to have been avoided.

Fields are notably absent from river floodplains and dry valley floors. The level floodplains were probably mainly used as watermeadows for grazing animals (Cunliffe 1985) – in any event their lack of gradient would have precluded the formation of lynchets. Traces of field boundaries in dry valley bottoms may be obscured by younger colluvium, but in

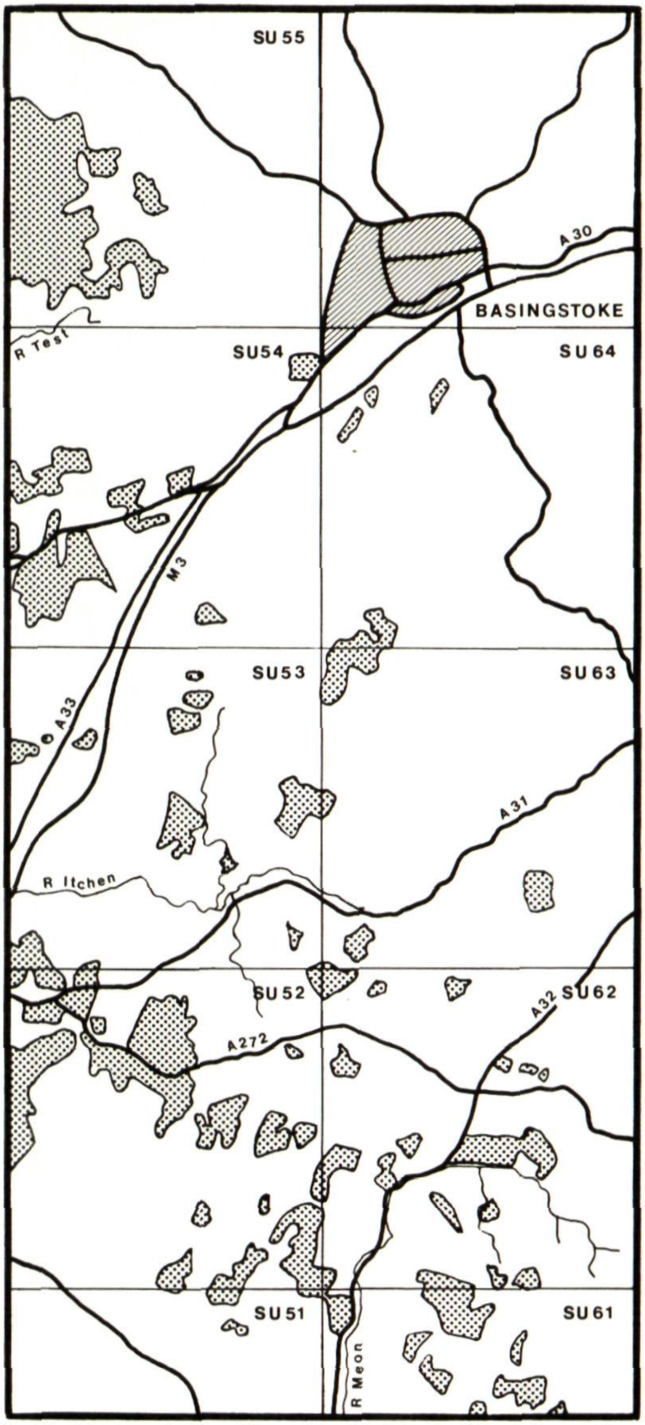

Fig 3. Distribution of 'celtic fields' on the East Hampshire Chalklands. Stippled areas denote blocks of celtic fields.

the chalkland 'v' shaped valleys, the floors are areally rather inextensive. Indeed, in most parts of the chalklands, these facets are not separated by soil association, and so any lack of identification of field elements in these positions will not affect the general results of soil/site analysis.

The size of east Hampshire early fields, mostly between 0.5 to 0.6 hectares, is slightly larger than those reported elsewhere (Cunliffe 1978). There is some evidence that smaller fields are more common on the steeper slopes (e.g. south-east of Winchester) and larger fields occur on gentler slopes (e.g. south of Frost Hill, SU 515 530), but there are many exceptions to this. Within early field systems, most boundaries meet at approximate right angles to one another, and they are crudely adjusted to slope. However, upon the rolling chalk landscape the rectangular arrangement means that many boundaries run counter to it. In a few areas, e.g. near Watership Down (SU 497 565) and Twyford Down (SU 498 272), boundaries run at 45° to the slope in extremely regular blocks of fields over 30 hectares in total area. In these areas, which slope up to 8°, the arrangement of field boundaries possibly reflects attempts to decrease the angle of slope for ploughing, as it is likely that this was done parallel to the field boundaries.

Table 3 shows the relationship of field distribution and aspect. Southerly aspects are preferred, and northerly ones avoided. In addition, west-facing slopes, which receive more insolation in the afternoon (Evans 1977) have a slightly greater area covered by early fields than the cooler east-facing slopes. Assuming that over the area of nearly 800 km^2, the main cardinal directions are more or less equally represented, there is a relationship between field occurrence and received insolation. This suggests that field systems are developed under the influence of microclimate as well as soil type and landscape position.

DISCUSSION

Although early fields commonly occur on soils mapped today as thin (often less than 30 cm), the lynchets at their boundaries and considerable thickness of silty colluvium in many dry valley bottoms demonstrates that soils were much thicker before cultivation commenced. The extent to which Neolithic or Bronze Age farmers reduced the soil cover is, however, unclear. Many writers consider that their agricultural practices severely degraded the soil (e.g. Macnab 1965; Bradley 1978; Fasham & Schadla-Hall 1981). Detailed soil mapping of some 150 km^2 (at scales of 1:25 000 or less) within the study area confirms that several areas with early fields have particularly thin, stony soils (e.g. Bridget's Farm (SU 5234) (Moffat 1986), the Longwood Estate (SU 5425) (Fordham & Staines 1984) and Preston Down (SU 6241)). In these widespread localities, flinty and chalky variants of the normal Andover brown rendzina soils have been noted, and testify to a loss of finer soil material and concentration of stones in the shallow soil profile. Prolonged cultivation from Neolithic or Bronze Age times may help to explain the apparent correlation between early field systems and thin stony soils, but it is likely that modern agricultural practices have reduced soil thickness as much as the longevity of cultivation in prehistoric times.

In the study area as a whole, there is little difference in soil depth between areas covered by early fields and those with no evidence of their existence. Particularly chalky and stony soils (Upton 1 association, Table 1) are more common in areas covered by early fields and may be due to prolonged arable cultivations, but in many cases they are associated with steeper slopes where thinner soils would be expected to occur even on uncultivated ground. The uniformity in present-day soil depth over areas with and without early fields suggests that in areas devoid of them either (a) evidence of field boundaries has been totally destroyed by more modern agricultural practices, (b) loessial cover was initially thinner than in areas exploited by early man or (c) considerable cultivation-induced erosion has taken place over the whole region since the time 'celtic' fields were last imposed on the landscape.

Early field boundaries are now rarely apparent on the ground, and it is likely that in small areas all evidence of their previous existence may have been lost. Nevertheless (a) their total destruction in large areas of the chalklands is unlikely; field boundaries are conspicuous on aerial photographs even in areas with very thin soils and only in valley bottoms is it conceivable that boundary features have been masked by colluvial deposits. Similarly, there are no reasons to suppose that on similar geomorphological positions the loessial cover was not reasonably uniform over the whole area.

Detailed soil survey (Moffat & Cope 1984; Moffat 1986) of dry valley bottoms in areas with and without evidence of celtic fields has shown colluvial soils (*sensu* Avery 1980) to be common in these positions. These generally consist of at least 80 cm of uniformly coloured (Munsell colour 10YR4/3, 4/4 or 5/4) flinty silty clay loam, in places overlying buried topsoil horizons containing more organic matter (10YR3/3). Such material is undated, but lack of profile development suggests it is modern, at least post-dating prehistoric farming. (Similar, very recent, colluvium was reported by Allen (1984) in East Sussex.) This material demonstrates that (c) is most likely, much erosion of the chalklands having taken place in late prehistoric or modern times.

Evidence of settlement from at least the Neolithic implies cultivation and probable soil erosion during these and later times in parts of the study area. However, the relative extent and type of erosion taking place during the Bronze Age and later periods remains unclear. Bell (1982) has shown a wide range in the dates at which colluvium was initiated across England, from Neolithic to Post-Medieval times, and argued that this indicates colluviation was as much a process of early prehistory as of later times (cf. Bradley 1978). Nevertheless it can be argued that the earliest ard-type light ploughs used before the Iron Age would have had comparatively little erosive effect on the soil, material mostly accumulating against celtic field boundaries by downslope creep to form lynchets. Evans (1980), in a survey of modern water-initiated soil erosion noted none in fields of lengths of less than 50 m, and little until lengths of 100 m are exceeded. Early field lengths are usually much shorter. But when more vigorous tillage was undertaken using heavier ploughs with coulters, probably from Iron Age or Romano-British times, soil inversion would have led to better weed suppression and bare soil conditions for longer each year. Aided by larger field sizes developed in these times (Fasham 1980), more serious soil losses probably resulted, by flash flood erosion as well as soil creep. The only information on colluvial fills in the study area, at Owslebury, suggests that colluviation began there in the Middle Iron Age (*c.* 250 BC) (Collis 1968; 1970; Bell 1982) and demonstrates that Bell's assertion on the onset of colluviation is not necessarily applicable to all regions.

Given a probable original thickness of loess covering the Chalk of one to four metres (Catt 1978), the predominantly thin rendzina soils present today suggest that a very large amount of silty material must have been lost from chalk dry valley sides. Much was obviously removed soon after deposition in the Late Devensian by periglacial and fluvial action. However, remnants of silty drift up to one metre thick are preserved today under ancient woodland (Moffat & Cope 1984) and suggest that brown earths rather than rendzinas were the normal soil type before early cultivation began to reduce soil thicknesses. Colluvial deposits only account for a proportion of the total removed by cultivation because silty alluvial sediments in the Test and Itchen valleys (Allen & Brewer 1984; 1985) demonstrate that much silt has evidently reached the river systems; some may have been removed from the catchment by fluvial activity. Unfortunately, the peat has not yet been fully characterised or dated.

Colluvial soils are notably absent from some dry valley bottoms, particularly those within large outcrops of Clay-with-flints. Here the soils are flinty and silty over rounded flint gravel, usually at 30–40 cm depth. The gravel is of fluvial origin and most likely Devensian in age (Moffat & Cope 1984). The absence of colluvium in these valley bottoms may be because adjoining land was little cultivated or left as woodland. Alternatively, flash floods or periodic bourne flow may have removed colluvium that collected. Bournes are well known on the Hampshire chalklands and were probably more common in historic and prehistoric times when chalk water-tables were higher (MacDonald & Kenyon 1961).

Some writers (e.g. Bradley 1978; Bell 1981) have suggested that 'celtic fields' might represent attempts to counter soil erosion. In the study area, most fields are arranged in a more or less rectangular pattern, and in rolling chalkland terrain are only crudely parallel or perpendicular to the contour. If the prime motive in their creation was to conserve soil, a pattern more adjusted to slope might be expected. Instead, their pattern suggests that boundaries were probably territorial, and that any function of erosion control they served was fortuitous.

Many discussions on the prehistoric agriculture of the chalklands use a bipartite division of 'light' and 'heavy' soils, but recent information on the soil types of the study area (Jarvis *et al* 1984) suggests this classification is grossly simplistic. In east Hampshire, important factors appearing to affect early agricultural exploitation include the thickness of loessial and Clay-with-flints covers as well as the texture of the soils. For example, north of Overton (SU 55) many fields are sited on silty over clayey soils of the Carstens association. Beneath woodland such soils are commonly very acid (pH 4–5) (Jarvis *et al* 1984), and would not support arable crops of early cereals such as emmer and spelt (Percival 1974).

However, in this district, the Clay-with-flints is comparatively thin, and many early fields (e.g. around Frost Hill) each have a 'marl' pit within their boundaries. This suggests that early farmers dug through the clay to obtain the marling chalk beneath. In most other locations within the study area, however, depth to chalk is much greater (White 1909) and Clay-with-flints is too thick to allow the extraction of liming material. On the main plateau (SU 63), where thicknesses of 5–10 m are usual (Hydrotechnica 1983), woodland has persisted on soils whose acidity was difficult to remedy in prehistoric times. Today these woodland soils often retain the thickest silty cover compared to those which have been subject to prolonged agriculture. When limed they are amongst the most fertile in the region. Despite their clayey subsoils, studies show these soils to be freely drained (Jarvis *et al* 1984; Moffat & Cope 1984). Rather than being simply considered 'cold' and 'wet', therefore, acidity was probably why early man left them alone.

CONCLUSIONS

A study of early fields in east Hampshire has shown that their form and location are explicable in terms of several environmental factors including topography, soil type and microclimate. Bowen (1975) has pointed to the planned nature of many early field systems.

This study demonstrates that sites exhibiting prolonged cultivation from early times would today be looked upon as some of the most favourable in the area. However, early farmers probably experimented on a range of substrates before settling more permanently on those recognised in this study.

Texture and drainage status are important soil parameters deciding the location of celtic fields, but soil acidity, and the inability to remedy it, was probably the main reason why many of the Clay-with-flints soils were uncultivated for so long.

The earliest users of 'celtic' fields initiated some soil erosion, but it is argued that serious soil losses probably began in Iron Age and Roman times when agriculture was intensified, particularly on silty chalkland soils nowadays identified as Andover 1 and Upton 1 associations. Detailed soil survey would help to elucidate this point.

ACKNOWLEDGEMENTS

I wish to thank Mike Hodgson, Orpah Farrington and Mike Allen for critically reading an earlier draft of this paper.

REFERENCES

Allen, M J 1984 Ashcombe Bottom excavation, AB84. First Interim Report; August 1984, *Lewes Archaeological Group Archive Report*, 39 pp.

Allen, R H & Brewer, T R 1984 National Peat Survey. Hampshire *Rep Rothamsted Exp Stn for 1983, Part 1*, 202.

——— & ——— 1985 National Peat Survey. Hampshire *Rep Rothamsted Exp Stn for 1984, Part 1*, 207.

Avery, B W 1980 Soil classification for England and Wales (Higher categories) *Tech Monogr Soil Surv GB* **14.**

Bell, M 1981 Valley sediments and environmental change, in Jones, M & Dimbleby, G W (ed) *The Environment of Man: the Iron Age to the Anglo-Saxon Period*, British Archaeological Reports Brit Ser **87** 75–91.

——— 1982 The effects of land-use and climate on valley sedimentation, in Harding, A F (ed) *Climate Change in Later Prehistory*, University Press, Edinburgh, 127–142.

Bowen, H C 1961 *Ancient Fields*, British Association for the Advancement of Science.

——— 1975 Pattern and interpretation: a view of the Wessex landscape from Neolithic to Roman times, in Fowler, P J (ed) *Recent work in rural archaeology*, Moonraker Press, Bradford-on-Avon, 44–56.

Bradley, R 1978 *The Prehistoric Settlement of Britain*, Routledge and Kegan Paul, London.

Carroll, D M, Evans, R & Bendelow, V C 1977 Air photo-interpretation for soil mapping, *Tech Monogr Soil Surv GB* **8**.

Catt, J A 1978 The contribution of loess to soils in lowland Britain, in Limbrey, S & Evans, J G (ed) *The Effect of Man on the Landscape: the Lowland Zone*, Council for British Archaeology Res Rep **21** 12–20.

Cobbett, W 1830 *Rural Rides*, W Cobbett, London.

Collis, J R 1968 Excavations at Owslebury, Hants, *Antiq J* **48** 18–31.

——— 1970 Excavations at Owslebury, Hants: a second interim report, *Antiq J* **50** 246–61.

Cunliffe, B W 1978 *Iron Age Communities in Britain*, 2nd edn, Routledge and Kegan Paul, London.

——— 1985 Man and landscape in Britain 6000BC–AD400, in Woodell, S R J (ed) *The English Landscape: past, present and future*, Oxford University Press, 48–67.

Drewett, P 1982 Later Bronze Age Downland economy and excavations at Black Patch, East Sussex *Proc Prehist Soc* **48** 321–400.

Evans, I S 1977 World-wide variations in the direction and concentration of cirque and glacier aspects *Geog Annlr* **59A** 151–75.

Evans, R 1980 Mechanics of water erosion and their spatial and temporal controls: an empirical viewpoint, in Kirkby, M J & Morgan, R P C (ed) *Soil Erosion*, J Wiley, Chichester, 109–28.

Fasham, P J 1980 Excavations on Bridget's and Burntwood Farms, Itchen Valley Parish, Hampshire, 1974. MARC 3 Sites R5 and R6 *Proc Hampsh Field Club Archaeol Soc* **36** 37–86.

——— & Schadla-Hall, R T 1981 The Neolithic and Bronze Ages, in Shennan, S J & Schadla-Hall, R T (ed) *The Archaeology of Hampshire*, Hampsh Field Club Archaeol Soc Monogr **1** 26–36.

Fordham, S J & Staines, S J 1984 *Soils and Land Resources of Longwood Estate, Winchester, Hampshire*, Unpublished Report, Soil Survey of England and Wales, Harpenden.

Fowler, P J 1983 *The Farming of Prehistoric Britain*, Cambridge University Press, Cambridge.

Hardy, T 1888 *Wessex Tales*, MacMillan, London.

Hydrotechnica 1983 *Geophysical surveys of the Upper Arle Catchment*, Report for Southern Water Authority by Aspinall Hydrotechnical Services Ltd.

Jarvis, M G, Allen, R H, Fordham, S J, Hazelden, J, Moffat, A J & Sturdy, R G 1983 *Soils of England and Wales. Sheet 6. Soils of South East England*, Ordnance Survey, Southampton.

Jarvis, M G, Allen, R H, Fordham, S J, Hazelden, J, Moffat, A J & Sturdy, R G 1984 Soils and their use in South East England *Bull Soil Surv GB* **15**.

Jones, R J A & Evans, R 1975 Soil and crop marks in the recognition of archaeological sites by air photography, *Council for British Archaeology Report* **12**, 1–11.

MacDonald, A T & Kenyon, W J 1961 Run-off of Chalk streams *Proc Instn Civil Engrs* **19** 23–38.

Macnab, J W 1965 British Strip Lynchets *Antiquity* **39** 279–290.

Mackney, D, Hodgson, J M, Hollis, J M & Staines, S J 1983 *Legend for the 1:250,000 Soil Map of England and Wales*, Soil Survey of England and Wales, Harpenden.

Moffat, A J 1986 *Soils of Bridget's Experimental Husbandry Farm, Martyr Worthy, Winchester*, Unpublished Report, Soil Survey of England and Wales, Harpenden.

——— & Cope, D W 1984 The Hampshire Chalklands, in Jarvis, M G & Findlay, D C (ed) *Soils of the Southampton District*, British Society of Soil Science, 82–116.

Onions, C T 1973 (ed) *The Shorter Oxford English Dictionary*, Clarendon Press, Oxford.

Percival, J 1974 *The Wheat Plant*, 2nd edn, Duckworth, London.

Schadla-Hall, R T 1977 *The Winchester District: the archaeological potential*, City of Winchester.

Shennan, S J 1981 Settlement history in East Hampshire, in Shennan, S J & Schadla-Hall, R T (ed) *The Archaeology of Hampshire*, Hampsh Field Club Archaeol Soc Monogr **1** 106–21.

——— 1985 *Experiments in the collection and analysis of archaeological survey data: the East Hampshire survey*, University of Sheffield, Department of Prehistory and Archaeology.

Waton, P V 1982 Man's impact on the chalklands: some new pollen evidence, in Bell, M & Limbrey, S (ed) *Archaeological Aspects of Woodland Ecology* (Symposia of the Association for Environmental Archaeology **2**) British Archaeological Reports Int Ser **146** 75–92.

Wellings, S R 1984 Recharge of the Upper Chalk aquifer at a site in Hampshire, England. I. Water balance and unsaturated flow *J Hydrol (Amsterdam)* **69** 259–73.

——— & Bell, J P 1980 Movement of water and nitrate in the unsaturated zone of the Upper Chalk near Winchester, Hants., England *J Hydrol (Amsterdam)* **48** 119–36.

——— & Cooper, J D 1983 The variability of recharge of the English Chalk aquifer *Agricultural Water Management* **6** 243–253.

White, H J O 1909 The Geology of the country around Basingstoke *Mem Geol Surv UK*.

Whittington, G 1962 The distribution of strip lynchets *Trans Inst Br Geog* **39** 115–30.

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