Signatures in the Soil: the Use of Pottery in Manure Scatters in the Identification of Medieval Arable Farming Regimes, *Archaeological Journal (2005)*

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Fieldwalking data have traditionally been used to identify 'sites', exhibiting as high-density pottery concentrations, and to distinguish crudely between arable and non-arable zones on the basis of the presence or absence of low-density pottery scatters. Using material collected from an extensive survey of fields in north Buckinghamshire and southwest Northamptonshire, a deeper analysis of ceramic manure scatters has been undertaken here, revealing changes in medieval manuring strategies over time and between different arable farming regimes. These systems, such as infield/outfield cultivation, open-field farming, demesne blocks, and assarts can all be characterized by the manuring strategies they deployed and identified from the signatures these have left in the ground. The plotting of ceramic manure scatters thus permits the detailed mapping of each component of the medieval arable zone, leading to a more comprehensive reconstruction of the medieval rural landscape than has previously been attempted. Importantly, it is argued, the study of ceramic manure scatters may provide a new archaeological indicator of the origins and development of the open-field system.

READERS' NOTE

Densities of pottery scatters found during fieldwalking are here expressed as sherds per hectare (sh/ha). Since only 10% of each field surface was surveyed, the absolute number of sherds collected has been multiplied by ten to represent the total potential sherd population on the surface, before being divided by the number of hectares over which the spread was recovered. The resulting figures may therefore not be directly comparable with other data from other surveys which may have used different criteria to calculate densities without the appropriate scaling.

INTRODUCTION

The maintenance and improvement of soil fertility was a major pre-occupation for arable farmers of every social level throughout the middle ages. Historical texts reveal the strategies used to keep demesne ploughlands in good heart. These documents may be placed against archaeological evidence which shows that the peasantry too was active in taking steps to preserve or increase grain yields by insuring the quality of their land. Details of the steps taken to enrich arable land were set out clearly in treatises on estate management written in the mid-thirteenth century. By this period, it is clear that the treatment of demesne arable had become something of an art form, involving many of the estate officers and other workers, and exploiting many of the by-products of non-arable activities on the farm.

The *Seneschaucy* (Oschinsky 1971, 261-305), written around 1276, identifies the bailiff as the man responsible for arranging that land was 'marled, folded, manured, improved and enriched' (c. 18) and overseeing the carting of marl and compost on to the fields (c. 51). He had further duties to ensure the creation of this compost, by throwing surplus straw and bracken on muddy ground or on roads, moisture and trampling presumably quickening their organic decomposition (c. 23). Alongside the making of new organic material, the bailiff had to ensure that stubble was conserved on the fields themselves, a vital source of 'green' manure which would be ploughed back into the soil (c. 23). The reeve too was to increase the compost reserve in the same way (c. 41), but was also responsible for the maintenance of the demesne fold where young animals and cows were to be kept overnight 'to improve the soil' (c. 36). The reeve was assisted in this task by the cowherd (c. 57) and the shepherd (c. 61), while to the ploughmen fell the requirement to dig trenches to aid the drainage of the ground (c. 54).

If the *Seneschaucy* remained the preserve of estate lawyers, *Husbandry* written by Walter of Henley (Oschinsky 1971, 307-85), was more widely disseminated. The importance he placed on maintaining and improving soil conditions can be gauged by the fact that fifteen of the 113 pieces of advice offered in the text, covering all aspects of estate management, relate to this subject. Walter counseled on the methods of producing the best organically rich raw material, from the mixing of dung with earth (c. 64), to the regular marling of the sheepcote floor (c. 64; c. 102), and the collection and storage of detritus from the farmyard (c. 65). He advised on the most appropriate times of year when these should be collected, before the drought of March in the case of farmyard waste (c. 65), and when these should be ploughed back into the soil (c. 72; c. 73; c. 74). He was aware of the tenacity of marl over the short-lived effects of manure (c. 68; c. 70; c. 71), the need to be selective in what ground was treated and when this was to be undertaken (c. 67), the importance of preserving green manure (c. 44; c. 63), and the benefits of balancing the acidity of the manure (c. 69).

That these processes and procedures were not new when recorded in the thirteenth century is clear even from classical sources. It was Pliny who first noted that the Britons were known to marl their land (Fussell 1955, 97). In fact most of the medieval treatises relied heavily on the writings of the early agronomists such as Cato, Varro, and Columella,

borrowings made easier after their collation and publication by Crescentius in *c.* 1240 in his *Ruralium commodorum libri duodecim* (Sheil 1991). Columella, for instance, suggested that farmers who could not keep animals might collect vegetable matter and rubbish from their neighbouring properties (Fussell 1955, 99). This, together with the sweepings of the yard, burnt residues, sewage, and straw, was to be collected and kept in the ground to decompose to form rich manure, advice clearly followed by Walter (Oschinsky 1971, c. 65).

From the medieval treatises, then, six principal means of maintaining and enhancing soil fertility and texture emerge: the digging in of animal manure collected from stalls, sheepcotes, doevcotes, and folds; the folding of animals directly on to the fields whose dung might be spread on the hoof; the ploughing in of so-called 'green manure', notably stubble; the addition of marl; improvements made to the draining of the ground; and the use of periods of rest or fallow when a proportion of the arable was left uncultivated. Yet even this list fails to exhaust the options available. No treatise deals with beat-burning or Denshiring, the torching of weed-infested fallow after careful preparation, known to have been well established by the mid-thirteenth century in Devon (e.g. Tavistock Abbey demesne: Finberg 1951, 91-92). Amongst other green manures might be included nitrogen-entrapping legumes such as peas, beans and vetch (Campbell 1983). Their use as soil fertilizers shows in their increased appearance in manorial accounts, as for example on the Bishop of Winchester's estate of Rimpton, Somerset (Titow 1972; Thornton 1991). Seaweed was used to supplement other alternatives in coastal zones, whilst ploughing in weeds and other growth, which had been allowed to germinate over the fallow year, was as improving as stubble. Soil texture might be manipulated by adding sand for lime to break down clay soils (Finberg 1951, 89-91), or clay to lighter soils to provide more body. Nor were animals the only dung providers; human excrement in the form of night soil could also be added to the ground, often collected from the homestead or farm, but on occasion imported from neighbouring urban centres as was the case on farms within a 5 km radius of Norwich in the late thirteenth and early fourteenth centuries (Campbell 1983). Finally there was household waste, most importantly detritus from table and kitchen, rich in organic matter and other objects, which might add heart to failing soils or break down heavier soils.

These manures were exploited in isolation or in combination, to greater or lesser degrees, depending on their availability and prevailing local soil conditions, in all medieval farming regimes. Thus the maintenance of permanently cultivated infields was only possible if the restricted arable received all available manure at regular intervals. Fallowing too was an essential component in the medieval farmer's repertoire. The episodic ploughing of leys, whole or part furlongs put under pasture within the open fields, might produce good yields since these areas could be rested often over extensive periods (Hall 1994, 97-98). The use of fallow, of course, was fundamental to all common field systems, both irregular multi-field systems and the more regular two or three field rotations of the Midland-type open fields. The laying to fallow of large sectors of the arable permitted the growth of nutrient-rich weeds

which might be ploughed back into the soil, and provided an area of rough grazing on which animals might folded. At its most developed stage, the folding of animals on to these zones might take place not only in the fallow year, but between autumn harvest and winter/spring sowing, or at night after a day spent on the common pastures, while specific fodder crops were grown to improve the quality of grazing. Folding had the additional benefit of opening up the closed system of nutrient recycling, adding nutrients garnered from the pastures to the arable through animal dung, although some studies question the actual efficiency of this practice (Cooter 1978). Areas farmed in severalty, either enclosed fields or assarts, also required manuring and rest if arable yields from these small plots were to be maintained. But despite the surprising richness of the historical sources which illuminate the mundane task of soil improvement and allow such an extensive list of strategies to be identified, our knowledge of medieval soil management, and of manuring in particular, remains largely restricted to the demesne. Even then, these texts deal in general rather than specific terms: they do not tell us which furlongs were manured, how or when. We rely then on the archaeological record to reveal peasant as well as seigneurial manuring practices and the different farming regimes in which this activity was taking place.

Few of the many medieval manuring materials used leave an archaeological signature recoverable on the ground. The two principal exceptions are marling, where the presence within the topsoil of spreads of clayey, chalky or sandy calcareous earth can be used to delimit the areas of this activity (Mathew 1993), and farmstead manure, containing within it inert objects, robust enough to survive subsequent ploughing episodes, and which are now recoverable through fieldwalking. By far the most commonly encountered of these artefacts are pottery sherds, broken in the homestead, discarded in more general compost, and later spread onto the fields. It is these ceramic manure scatters that form the focus of this paper.

THE DATA SET AND FIELD METHODOLOGY

The foundations on which the arguments set out below rest is an assemblage of over 16,000 sherds of pottery recovered from modern ploughland in a group of twelve parishes situated in south-west Northamptonshire and north Buckinghamshire, which together constitute the study area of the Whittlewood Project (Jones and Page 2003). The field survey was undertaken as part of this broader research project. This assemblage has been critically analysed against an even larger pottery assemblage of 20,000 sherds recovered from the Whittlewood villages, hamlets and farmsteads.

The fields were systematically line walked between 2000 and 2004 following the methodology employed in the Raunds Area Project (Dix 1996-97). Grid orientation was dictated by field shape. Lines were set 15 m apart, along which collection units or stints of 20 m were marked out. A width of 0.75 m on each side of the line was intensively surveyed,

each stint taking approximately two minutes to complete. Thus 10% of each field was trawled for surface finds. This method has allowed both extensive coverage (937 ha walked on approximately 700 km of line, with over ninety fields surveyed in eight parishes) whilst the fine grain of the lines will have guaranteed that small yet highly significant scatters of pottery will not have fallen between the sample zones. The use of a core walking team of four reduced, although will not have eliminated, the variability in collection caused by walker preference and means that a consistent approach was possible over all the fields walked. Some variance must expected, however, since it was not possible to walk all fields in optimum light, temperature, plough or crop conditions (Gerrard 1997). Pottery of all periods has been collected using this method. Each sherd is washed and marked to identify its finds spot, then analysed by a pottery specialist, before being plotted on Ordnance Survey base maps using a Geographic Information System.

It has long been recognized that plotting the presence or absence of low-density medieval pottery scatters in modern ploughsoil can assist in the partial reconstruction of the basic divisions of earlier land exploitation. The presence of pottery attests to manuring and therefore tillage, absence suggests areas lying beyond the arable zone, which depending on context might be interpreted as woodland, pasture, or meadow. However, as Foard (1978) noted, at best ceramic manure scatters might only be used to suggest the minimum acreage brought under the plough at any one period since archaeologically invisible manure sources may have also been used. Of course, several other types of information can be used to complement and add to the patterns observed in the pottery record, of which cartographic evidence (pre- and post-enclosure), field and furlong names in a variety of documentary sources, and in the Midlands in particular, surviving ridge and furrow, or former ridge and furrow plotted either from aerial photographs or by association with surviving headlands, may be cited. In combination, an accurate, and occasionally as Hall has shown in Northamptonshire and the Fens (e.g. Hall 1992; Hall 1995), a total reconstruction of the late medieval landscape for an individual farming unit (township or manor) might be achieved.

In Whittlewood, a rich historical record, good coverage of early seventeenth-century maps, piecemeal survival of both ridge and furrow and non-arable earthworks such as coppice banks or settlement remains, and extensive systematic fieldwalking means that the medieval arable can largely be reconstructed. It would be entirely wrong to believe, however, that the ploughlands of Whittlewood formed a homogenous block. Different parts of what might simply be defined as arable land in the late medieval period may have their origins in early medieval infields, or in the creation of the open fields, or as assarts. Some parts may have been farmed by an entire community, the so-called common fields, others by individuals in severalty. Here three questions are addressed. Can the pottery found within manure scatters offer clues to the precise chronological development of the arable zone? In particular might it provide further evidence for the dating of the origins of open fields? And thirdly, can different farming regimes be detected in the ceramic manure scatters?

Four factors have combined in the Whittlewood survey to allow this deeper analysis of manure scatters to be attempted. First, there is the combination of archaeological and historical research. All too often in the past fieldwalking has been undertaken in an historical vacuum. Understanding the details of tenurial arrangements and demographic levels has particularly aided the interpretation of the Whittlewood material. Secondly, the survey of several territorial units together, and not single units in isolation, has allowed comparisons to be drawn, and differences noted, between each farming zone. Thirdly, using an entirely new method, test-pitting in the villages themselves has produced a range of ceramic material which can be compared with that collected from the fields. We know, for example, what fabrics were being used in the homestead: are these equally represented in the field collections, as might be expected, or are there variations in the make up of each set of data? Finally, whilst fieldwalking has traditionally been used to identify 'sites' (see Williamson 1994), and indeed has been used in such a way during the Whittlewood research, equal weight has been placed here on understanding what was taking place between these settlements. This has only been possible by acknowledging the importance and significance of each individual sherd and not just definable concentrations.

ARABLE FARMING IN WHITTLEWOOD PRE-850AD

The potential of this technique to reconstruct the extent of the arable can clearly be shown by looking at the evidence for Romano-British and early medieval farming in Whittlewood. In the absence of any corroborative evidence, the only insight we have to landscape arrangement and exploitation in the period 43-850 AD comes from fieldwalking. Romano-British pottery scatters are found ubiquitously. High concentrations encountered every 800 m or so indicate a dense and dispersed settlement pattern. Between these sites, co-terminus low-density pottery scatters comprising the same fabric range found on the settlement sites fill the gap, revealing that these farms lay within extensive arable fields, all receiving the very type of household manure the use of which was advised by Columella. The same fieldwalking has also produced the earliest local medieval pottery, handmade wares dated crudely to the period 400 to 850 AD. A small number of concentrations have been found, highly reminiscent of other finds spots in Northamptonshire which have been shown in subsequent excavation to represent small farmsteads (Shaw 1993-94). It may be noted, however, that in Whittlewood these early abandoned sites are observed less frequently than in other parts of the county. Around these settlement foci there are sparse halos of the same pottery, perhaps indicating that a restricted arable infield was maintained close to the farm and manured from it, while the more distant parts of each farm were either farmed intermittently or were kept as wood-pasture.

Fieldwalking finds thus point to a dramatic shift in farming emphasis in this region between the Romano-British and the early medieval period, with a move away from intensive

arable cultivation towards a more mixed or largely pastoral economy. But not only does the Romano-British and early medieval evidence for arable farming provide the backdrop to later developments, and a benchmark against which the scale of later arable production can be measured, critically it also provides reassurance that subsequent changes in soil build up in Whittlewood are unlikely to have detrimentally affected later deposits. Later alluviation or colluviation (the accumulation and deposition of earth on the former field surface), which might mask earlier deposits, cannot be a factor since Romano-British pottery is found everywhere. And since it can be shown that the most friable of all medieval fabrics, the handmade wares of the early medieval period, have survived in the ground, this provides further reassurance that later plough action is unlikely to have destroyed other, more resilient, hard-fired fabrics if present in the ploughsoil. Thus, any absence of particular medieval pottery groups from the record and the chronological gaps that these reveal are in all probability real, the result of actual changes in manuring strategy or in the types of manure used.

IDENTIFYING THE ORIGINS AND DEVELOPMENT OF THE OPEN FIELDS OF WHITTLEWOOD

Medieval Whittlewood, it has been argued elsewhere, was a hybrid landscape zone, sharing aspects of both woodland and champion *pays* (Jones and Page 2003). Of the latter, the most obvious element shared by all our settlements, both nucleated and dispersed, was their regular open fields. These are dominated, when they first come into view in the documentary record, by a three-field system. The origins of all open-field systems have remained elusive despite prolonged historical investigation and more recent archaeological approaches (e.g. Rowley 1981). The most commonly held current view is to associate the laying-out of these fields with village nucleation. Fields of such size might only be established if the land had been emptied of individual farmsteads and their associated enclosed fields in favour of a communal centre. Dissenting arguments, however, have recently been proposed by Brown and Foard (1998) and Williamson (2003), who see village nucleation and open-field layout as two processes, at times closely interconnected, but at other times entirely separate. If the process by which they came into being is obscure, so too is their chronology. Hall (1995) would argue that open-field creation must post-date the abandonment of farmsteads underlying later fields which have produced only early and middle Saxon pottery, that is around 850 (e.g. Hall and Martin 1979). For Brown and Foard (1998), the 'Great Replanning' of the landscape should be seen as a late Saxon phenomenon, linked with the break up of larger multiple estates and increased sub-manorialisation (see also Fox 1981). This chronology is partially supported by increased alluvial build-ups observed both in the Nene and Thames valleys from the tenth-century which suggest increased soil instability, perhaps caused by an extension of the ploughlands or the creation of large unhedged fields (Brown

and Foard 1998; Blair 1994). From the same period, boundary clauses contained with Anglo-Saxon charters seem to allude to strips or acres within arable blocks, the charters themselves indicating some form of subdivision of holdings and the results of the intermixing of strips (Hooke 1981). Once created, of course, the open fields were not static. Even if the change from two-field to three-field systems is now disputed (Fox 1986, *contra* Gray 1915), Thirsk (1964) has argued for continual evolution of the common fields from their creation through to the eve of enclosure. Furthermore, there is some archaeological evidence for the initial laying-out of long furlongs and their later subdivision (Hall 1995) while furlong names points to the addition of new areas of arable at the peripheries of these fields at the expense of pasture and woodland. Contraction followed expansion; from at least the late thirteenth century there is evidence which shows that certain former arable furlongs had been laid to grass (e.g. Thornton, Bucks; Elvey 1968). Largely ignored to date is the detail that manure scatters might provide to locate these fields both in time and space and to trace their subsequent development.

With the exception of the handmade wares of the period 400-850 AD, the earliest medieval pottery fabrics present in the manure scatters of Whittlewood are Shelly and Sandy Coarse Wares which first appear around 1100. Of course, archaeological and historical evidence identifies the twelfth century as the moment when the manufacture of pottery intensified and its use in the home multiplied so its recovery from the fields in perhaps not surprising. When mapped, it is clear that in most instances these twelfth-century fabrics are found in an extensive arable zone, but one which extended not much beyond a mile from the medieval village core (Illus. 1). It might argued, then, that if this pottery represents the first manuring of recently created open fields, these cannot have been laid out before 1100, and when first created were restricted in size. Corroboration of the second point seems to be provided by the manure assemblages from beyond the magic mile. Here are found fields which contain only later medieval fabrics, for example Brill/Boarstall Ware, first made in the 1220s, and the locally-produced Potterspury Ware, first appearing around 1250 (Illus. 1). It would seem then that over time, and mirroring the demographic rise, more land was added to the village fields, a process which was only initially stalled and was finally reversed in the later fourteenth and fifteenth centuries. But can such a late creation date be substantiated?

Can twelfth-century Shelly and Sandy Wares be used as a terminus post quem for the laying-out of the open-fields of Whittlewood? The answer lies in the investigation of both village (or farmstead) and field. Common to both the Romano-British period and the early medieval period is the fact that the make-up of the material found in their surrounding fields reflects what pottery was being used in the home. The same is true of the later medieval period: in Whittlewood the proportion of medieval pottery fabrics found during fieldwalking correlate strongly statistically with that found in test-pits sunk within the village cores. Thus in the villages of Akeley and Lillingstone Dayrell (Bucks), their twelfth-century pottery assemblages are dominated by Sandy Wares rather than Shelly Wares, and this preference

is visible too in their field assemblages. Parity between these fabrics found in Leckhampstead (Bucks) and Wicken (Northants) is reflected again in the make-up of the manure scatters (Table 1). A further trend also emerges when the proportion of later medieval date are also considered. Both Shelly and Sandy Wares appear to be under-represented in the field, whilst Potterspury Ware (1250+) appears over-represented. This appears to reflect a change in the levels of use of domestic rubbish to manure the fields of Whittlewood. Before 1250, the fields were less regularly manured from this source, thereafter a large proportion of manure must have been carted from the village onto the fields. It is the first clear indication that there were temporal strategic changes in manuring regimes during the period under consideration.

The linkage between the occurrence of medieval pottery fabrics in both village and field assemblages is critical since it reveals a single anomaly. All the Whittlewood villages which have been the subject of test-pit sampling, eight in total, have produced pre-Conquest pottery amongst which are St Neots Wares type 1 (850-1000) and type 2 (1000+) and Stamford Ware (900+). Yet not a single sherd of any of these distinct pottery types has been found in the field. Their absence cannot be accounted for by post-depositional processes: they are no more friable and thus potentially more liable to erode than later fabrics during subsequent ploughing, indeed they are more robust than the early medieval handmade wares which have been recovered; whilst the recovery of Roman pottery and pottery dated to 400-850 from modern field surfaces demonstrates that pre-Conquest deposits have not been deeply buried. Three conclusions might be drawn. First, and highly unlikely, there was no arable during the period 850-1100 and therefore no need to manure. This is, after all, the period when a growth in arable acreage is recorded in the alluvial record as seen in the river Nene basin and the assessment of ploughteams in Domesday Book shows that nationally perhaps as much as six million acres were being cultivated in 1086. Secondly, that changes to the way that rubbish was disposed meant that pottery did not enter farmyard manure stocks. But most likely must be a change in manuring strategy, with household material simply not being used to add heart to the soil or to encourage the break up of the heavy clays of Whittlewood.

Could it be that the creation of the open-fields went hand-in-hand with a new manuring strategy? It seems plausible. The first immediate effect of the creation of open fields was to reduce the area of pasture and to restrict access to this vital resource, pushing it away from the village perimeter. This problem was partially resolved by the adoption of field rotation, leaving a significant part of the arable fallow, on to which animals might be grazed. Animals, rather than people, would have become the principal manurers, their dung supplemented by green manure when the rough grazing was ploughed back into the soil when each field came out of fallow. A second effect was to separate for the first time, and often by some distance, fields from the farmstead. Strips located in outlying furlongs thus became divorced from the main manure reserves found in the farmyard. If this were to be

used, it would now have to be transported there, and at a cost of labour. Homestead manure may therefore have been reserved for the gardens and curtileges within the villages with more reliance being placed upon live animal manuring of the open-field strips.

The following scenario therefore appears to be borne out by the archaeological evidence. At some time before 850, that is before the arrival of new pottery fabrics such as St Neots Ware type 1 in Whittlewood, new open fields were being laid out. These spread over now abandoned farmstead sites and their manured infields, both areas already rich in organic material, as well as taking in pastures whose nutrient pool had not be previously depleted by arable cultivation. Initially these lands may have required little additional manuring, and if they did, this could be satisfactorily achieved using the community's livestock dropping dung on the fallow sector, or in the collection and spreading of dung from folded animals. It can also be noted that this is the very period when sheep, the most prized of all manurers, begin to dominate the faunal assemblages of villages in the champion regions of the central and southern Midlands (Sykes 2001, *passim*). Cereal yields were almost certainly further sustained and encouraged by a drier climate in the tenth and eleventh centuries (Roberts 1993, 453). Low population and low levels of rent and taxation meant that low yields could be accepted. But as rents and taxes grew, together with the increasing demands of feeding a rising rural, and equally important burgeoning non-agrarian population, productivity had to rise (Lewis, Mitchell-Fox and Dyer 1997). This increased demand led to the inflation in grain prices, the economic mechanism by which farmers could profit. Arable farming became commercialized, with peasant farmers active participants in the market place, both as producers and, as importantly in this discussion, as buyers of commodities such as pottery. But higher productivity could only be achieved by adding new arable land, keeping more of it under the plough, a possible reason why by 1300 in Norfolk fallowing had either ceased or was done after five plus years (Campbell 1983), and guaranteeing soil fertility by adopting a dual manuring strategy, the continued use of livestock folding and a return to the carting of domestic detritus and its spreading onto the land to supplement the restoration of the vital nutrients. This dual strategy appears to have been in place by soon after 1100.

IDENTIFYING DIFFERENT FARMING REGIMES: COMMON FIELDS, FIELDS FARMED IN SEVERALTY, AND ASSARTS

The medieval documents of Whittlewood make clear that the arable area was made up of at least three different components. By far the largest of these were the common fields. But beyond these lay areas of crop cultivation farmed in severalty. For the most part, in Whittlewood at least, these areas had been assarted from woodland or wood-pasture. Some holdings contained no more than a few acres, sometimes even smaller, whilst others formed quite extensive consolidated blocks of land. The actual method of farming these separate zones varied little from that employed in the village open fields. Just as these were divided

into furlongs and strips, so too were those areas that were farmed individually. As a result, it is impossible to differentiate between these areas on the basis of surviving earthworks alone since the ridge and furrow of each system is the same. But using ceramic manure scatters, the complex internal arrangement of the arable can be unraveled. To this end, the analysis of the density of sherds per hectare of arable provide a valuable indicator.

It can be shown in Whittlewood that there is a clear positive correlation between population size of any single settlement and the sherd density within its manured open-fields. Thus the fields of a large village such as Leckhampstead, already of significant size at Domesday, contain far more ceramic material than the fields of its much smaller neighbour Akeley (Table 2). At its most simplistic, the resultant formula would appear to read: more people, more pots in use, more vessels broken, more material to spread on the fields, more people to spread the material. By this token then, arable fields or assarts farmed in severalty, that is by a single individual or family, should exhibit as ceramic scatters as zones containing particularly light pottery spreads. One such area in Whittlewood, which can be reconstructed accurately from documentary and cartographic sources is the monastic grange of Monksbarn in Whittlebury (Northants). Lying at some distance from the priory of Luffield, the estate was overseen from small farm at its centre which cannot have house more than a few lay brothers. Its arable fields contain low-density ceramic scatters of no more than 8 sh/ha, in contrast to up to 250 sh/ha in Leckhampstead and 50 sh/ha in Akeley (Jones 2002). This appears to confirm, therefore, that the ceramics contained within manure scatters do indeed relate to the levels of domestic waste production and its availability, and that this in turn is a product of the number of people farming any individual block of land. There is also a relationship between the number of cultivators and the relative areas under cultivation: the headcount of farmers per land unit within the common fields of Leckhampstead, for instance, was far more dense than at Monksbarn. The fields of Leckhampstead were tilled under a form of intensive farming, whilst at Monksbarn a single household with a very large holding farmed unintensively.

But distinguishing between farming regimes on the basis of sherd density alone is hindered by the fact that no manure scatter is uniform by the very nature of its haphazard creation. There is often a marked difference between fields or furlongs produced by accident of whether particular loads of homestead manure were rich or deficient in ceramic material. Anthropogenic choices further complicate the picture. Most ceramic scatters show a drop in density the further they are removed from the manure source, implying that factors such as the time, labour, and cost involved in transporting farmstead manure to the far corners of each field unit may have largely discouraged its use in these places, with reliance being placed on other manure sources notably livestock. Thus even within the same system, those furlongs closest to the settlement received more material than those furlongs at the periphery of the field system. But even this trend can be bucked. Dyer (1998; 2000), for example, has identified furlongs at Admington and Compton Verney (Warks) which appear to have been

purposely selected to receive proportionally more manure despite their distance from their respective settlements.

The manure scatters of Lillingstone Dayrell (Bucks) amply demonstrate the variation that can be found within a single system. Here the manure scatter densities conform to expected drop-off patterns (Table 3; Illus. 2): the further one moves from the source of the pottery, the less which arrives in the field. This fall-off trend is further exaggerated by the late date at which some parts of the open field were added to the main arable core (Illus. 1). Thus pottery had less time, that is fewer manuring episodes, to accumulate. In the case of Lillingstone Dayrell these densities at the periphery of the arable block fall to a fraction of those found within 750 m of the village, 132.4 sh/ha in the core compared to 19.6 sh/ha at the periphery. Even more complexity and unevenness in sherd density is produced when there was more than one principal source of manure for any single field system, a situation encountered in Whittlewood due to the dispersed nature of many of its settlements. Leckhampstead (Bucks) may stand as an example. Here the village was made up of four sizable hamlets, albeit located centrally to their territory (Illus 3, 4). Rather than maintaining their own fields, each shared and farmed intermingled strips within in a single three-field open-field system. Some parts of these fields lay close only to one hamlet/manure source and distant from all the rest; other parts lay close to two or more hamlets; whilst other parts lay distant from them all. As a result, the levels of manuring gauged from sherd densities varies far more than that observed at Lillingstone Dayrell. Nevertheless, if pottery densities are correlated with their distance from their nearest source, the normal drop-off pattern is still visible (Illus. 4). Similar patterns have been observed elsewhere as at Barton Bendish (Norfolk; Rogerson 1997).

Drop-off of sherd density over distance from source, differences in the length of time under the plough, differential manuring intensity, and multiple manure sources all conspire together to create an uneven base line from which the significance of sherd density as a marker of different farming regimes can be gauged. Yet despite these complications, it can be shown in Whittlewood at least that, when a statistically significant proportion of any one settlement's fields have been sampled, and densities across the whole of the arable zone are averaged out, the positive relationship between population size and sherd numbers survives, and even despite multiple manure sources, the inverse relationship between sherd density and distance from source or sources of manure is also retained. This only holds true, however, if those parts of the fields which have been surveyed, and from which the data is derived, were all formerly farmed as a *single* unit under the *same* farming regime, that is to say either as communal fields or as fields cultivated in severalty. An absence of statistical correlation in these areas then implies the presence within one farming territory of two or more farming systems.

If the ceramic scatters found in Lillingstone Dayrell and Leckhampstead conform to the model, statistical analysis of data from Akeley reveals an absence of correlation (Table 3;

Illus 5, 6). It is here that additional cartographic, tenurial and demographic information can be used to supplement the fieldwalking data to help explain the misfit. By the mid-thirteenth century Akeley shared its territory with the small manor of Stockholt one mile to the north of the main village (Illus. 7). Documentary sources describe Stockholt possessing no less than 200 acres of arable farmed separately from the village fields by the time of emparkment in late fourteenth century. Our demographic model, showing the relationship between population and sherd density would predict that the manorial fields would receive proportionally less pottery since less would be available to spread. This is indeed the case at Stockholt, where sherd densities do not rise above 10 sh/ha, in contrast to the village fields where up to 50 sh/ha are found. But it may not only have been the low levels of household waste available as a manure source here, or the ratio of cultivators to acreage, that resulted in such low densities. Lords might require peasants to fold their sheep on the demesne; lords possessed more animals than peasants, so demesne land could potentially receive a larger share of direct dunging than the village fields, making them less reliant upon household waste as their principal manure source. This, in part, may explain the failure of the medieval treatises to mention household waste as a valuable source of manure. Since they dealt exclusively with demesne farming, their focus lay on the ready availability of animal manure. Conversely, while peasants did have limited access to large numbers of animals, the assembled village flock or herd, their dung was spread lightly over a much larger area, requiring the peasant farmer to place more emphasis on domestic refuse and stall dung to maintain soil fertility on their open-field strips. The loading, carting and spreading of manure from the farmstead would have been a time-consuming and labour-intensive affair, a task only capable of being undertaken by a peasantry with time to devote to this operation and access to sufficient labour. Even on a demesne such as Rimpton, able to invest in the third decade of the thirteenth century in purpose-built horse-drawn manure carts, little more than 10 acres of land were manured with transported dung per annum (Thornton 1991, 99). In the case of folding, animals walked to the fields. Marling pits could be dug close to the fields. But with domestic dunging, muck was often required to be transported a long way from source to field, so much so that it is unlikely that more than half a dozen loads per day might be deposited in the nearest furlongs, and far less to the margins of the arable zone. Despite this, reliance upon domestic refuse as the main ingredient of peasant manure meant that proportionally more ceramic material was deposited on peasant strips than on those in demesne.

Thus by conflating information from two very different farming regimes and two different manuring strategies and treating Akeley as a homogenous farming unit, the expected statistical markers disappear. In reality, here one farming system, a block farmed in severalty, was largely dependent upon the folding of animals to ensure soil fertility, whilst the farmers of the common village fields, on the other hand, were reliant upon the transportation

of the admixture of human and animal waste from the farm to the fields to improve soil conditions.

A similar lack of statistical correlation appears from analysis of material from Wicken (Northants). But here it would appear that it was not the existence of separate demesne land as in Akeley which has complicated the picture, but existence of a number of separate field systems, together with the further addition of smaller arable blocks from late assarting. The modern parish of Wicken is made up of two smaller medieval parishes (and manors), those of Wyke Dyve and Wyke Hamon, each with its own parochial village and church. Each parish also contained another hamlet, Elm Green set one mile south of Wyke Hamon and Dagnall, again approximately one mile south-east of Wyke Dyve. Elm Green does not appear in the historical record, its existence only proven by archaeological evidence (earthworks associated with quantities of pottery). Dagnall is referred to in a single fourteenth-century manuscript, although this fails to indicate its size and status. Again archaeology has shown it to be a sizable hamlet, whose origins may lie in the immediate pre-Conquest period. In the absence of corroborative evidence, however, their existence and approximate locations would have been predicted through analysis of the manure scatters. First, the spread of twelfth-century pottery well beyond the expected mile radius from the main villages would indicate other settlement foci as the source of this material (Illus. 8). Secondly, the absence of any positive correlation between distance from village and pottery density would again argue for more than one pottery source per territory and the probability that these multiple sources were of unequal size and thus producing differing amounts of material (Table 3; Illus. 9). In fact an estate map of 1717 indicates that both villages had their own open-field systems, and beyond these field names indicate that Dagnall farmed its own separate fields, and in all likelihood so too did Elm Green. When the ceramic scatters are treated within their historic farming units, the correlations are apparent. The evidence for assarting comes from the north and east of Wyke Dyve (Illus. 10). Here the late date of the first pottery fabrics making up the manuring scatters point to undocumented assarting or the episodic cultivation of outfields. Remarkably then, Wyke Dyve had preserved non-arable land immediately beyond the village until the thirteenth century. The majority of this new arable land appears to have been held in severalty rather than added to the open fields, since the number of sherds per hectare, particularly in the north, is one of the lowest encountered throughout the project area.

THE MANURING OF ARABLE IN THE LATER MEDIEVAL PERIOD

The introduction of new pottery fabrics during the course of the fifteenth century provides the opportunity to track the extent of arable land through to the end of the Middle Ages, and to establish the levels of ceramically-rich manure that these were attracting. In Whittlewood, five separate wares can be identified: Late Medieval Reduced Wares, beginning around the turn of the century, Late Medieval Oxidized Wares and Midland Purple Ware introduced in mid century, Cistercian Ware and Border Wares from the 1470s. All the villages and hamlets

surveyed by test-pits have produced pottery of this period. Fifty-six of the ninety-five fields walked in the Whittlewood survey have produced one or more of these fabrics in their assemblages. Of these eight finds locations can be firmly associated with settlement, the remaining forty eight therefore deriving from manure scatters.

There is nothing in their distribution to suggest a regular contraction of arable at this period. Sherds of these fabrics are found both close to settlement within the arable core, and within furlongs that stood at the edge of the open-field system. Contrary to this stands the fact that on nearly half of the surveyed area which has produced evidence for manuring during the period 1100-1400, no pottery of fifteenth-century date has been recovered. Before deducing from these results that approximately half of the arable land had been abandoned and turned to pasture during this hundred-year period however, two factors must be taken into account. First the miniscule amounts of pottery that make up those field assemblages that do exist. In terms of pottery density, these never appear to exceed six sherds per hectare and in the majority of areas stand at below one sherd per hectare. Such low levels of pottery within the ploughsoil may mean that vital evidence from fields apparently with no pottery present has been missed by the survey. Secondly, well over 90% of the area surveyed have produced pottery dating from 1500 onwards, notably Red Earthenwares. Almost every field in Akeley has produced this material, perhaps unsurprising since it was not enclosed until 1794. Even in a parish of early enclosure such as Lillingstone Dayrell, fully enclosed by the end of the sixteenth century, most of the fields have produced this later material.

It would appear then that the contraction of arable in Whittlewood can in large part be associated with the move to enclose in the post-medieval and early modern periods. Despite population decline from 1300, and then a probable halving of the population during 1348-49, the large part of the arable was maintained and worked. But new circumstances forced peasants to change their manuring strategies once more. Despite the prevalence of pottery, by the fifteenth century pottery was more widely available and used by the peasantry than in previous centuries, little of this material arrived in the fields. It must be concluded then that a reduced labour force could no longer afford to allocate time to the carting of material from the homestead to the arable holding. Once more animals became the prime manurers, aided by continued fallowing, and supplemented by the ploughing in of weeds, stubble and other growth. As such manuring strategies had come full circle, returning to those that had first been used when the common fields had first been laid out.

MANURING MODELS

Until now modelling medieval manuring strategies and their effects has remained the preserve of historians taking their evidence from documented demesne estates. Traditionally, it was considered that rising rural and urban populations in the later Middle Ages, requiring

more land to be brought under the plough in order to produce sufficient grain quantities, adversely affected the number of livestock that could be kept due to reduced pasturage and grazing opportunities. As a consequence, insufficient animal manure was available to maintain soil fertility, resulting in lower grain yields per acre (Postan 1966; 1972; Titow 1972). Revisionist theories support an opposing view, regarding high population as a prerequisite for efficient manuring and soil quality maintenance, stressing the human input required to undertake the multitude of tasks required to keep the arable in good heart (e.g. Campbell and Overton 1991). Smith (2002, 187-88) provides a detailed breakdown of the situation around 1300 when population levels reached their height. By this period more land was under the plough than in previous centuries, but this could be more intensively farmed by an increasingly large, cheap and more flexible workforce. This first allowed for more complex rotations to be followed, carrying less fallow land in any one year. Additionally, and critically, more hands could now be found to prepare seed beds more thoroughly by repeated ploughing, seed could be more heavily sown, crops could be more frequently weeded, fold dung and night soil could be more regularly collected and spread, and marl more readily obtained and distributed (e.g. labour services owed on the demesnes of Downton (Wilts) and Littleton (Hants, Titow 1969)). As a total package, soil fertility could be maintained or even improved, and yields per land unit rose.

The Whittlewood archaeological data in large part supports this general revisionist model, showing that the apparent intensification of manuring, or at least manuring with homestead materials, does indeed mirror population rise, and equally follows its later fourteenth-century decline. Since the archaeological data derives mainly from the peasant sector rather than the seigneurial, it can be concluded that the peasant agrarian economy developed in parallel to the documented manorial estates. But the physical evidence takes us beyond the universal models of historians, revealing different medieval arable farming regimes identified by the variant manuring strategies followed by their cultivators. The clearest division of systems is that between those with a basic reliance upon animal dung and those that used domestically-sourced refuse as their principal manure stuff. The Whittlewood survey also reveals temporal changes in the manuring strategies adopted even within a single farming system. A summation of the evidence allows the following characterizations of farming regimes based on their manuring traits.

Early Medieval Arable Cultivation (400-850 AD)

A discrete area around the farmstead manured with domestic material containing pottery, the infield in an infield/outfield system or simply an area of permanent arable surrounded by wood and pasture. This outer zone contains no pottery. The relative rarity of the original material, and low numbers of people domiciled at source, result in very low densities of sherds per hectare.

Open Fields (850-1100)

For the first time, farming blocks became spatially divorced from domestic manure sources. This, together with the taking in of new land, land that was already organically rich, and the opportunity to rest land regularly reduced the need to manure intensively. Soil fertility could be sustained by dung dropped by live animals grazing of the fallow field and folding stock at night. As a result, domestic manure was not spread on the open fields, but probably deposited on gardens near the houses. Pottery was consequently not brought into the fields.

Open Fields (1100+)

Continuous cultivation, albeit with period of rest, began to drain soil of its critical nutrients. External pressures, such as a growing population and increasing monetary rents, prompted the need for greater return from the land. Increasing yields could only be achieved by adding more land to the arable zone, reducing the area under fallow at any one time, and increasing soil fertility. This prompted a return to the use of domestic refuse as a manure source to supplement the dung of animals. Increased levels of pottery use in the home at all levels of society meant that more sherds entered the manure reserve. Unable to draw on large animal stocks, peasants in particular made great use of domestic manure to ensure the soil fertility of their individual strips. Pottery thus arrived on the fields in great quantity, actual levels dictated by the number of households working each field. Being of better quality and resilience, this pottery was better able to survive later ploughing episodes and as a result has surviving in the ploughsoil. As a result, the later open fields are characterized by higher densities of ceramic manure scatters than any other medieval farming regime.

Demesne Blocks (1100+)

The archaeological evidence is consistent with practices described by medieval treatises which emphasize reliance upon marling, animal folding and green manure and the principal nutrient providers. Under-exploitation of domestic detritus results in few pottery sherds arriving in the field. They are present, however, indicating that some farmstead material was intermittently used, or used in small quantity, sourced either from the capital messuage or imported in manure carted to the estate by tenants as at Cuxham (Oxon: Newham and Harvey 1997, 121) and Podimore (Somerset: Fox 1986). As a result, densities of pottery per hectare are significantly smaller than those found on open-fields farmed by a larger community.

Assarts (1100+)

The peripheral location of many assarts will have discouraged the transportation of large quantities of domestically sourced manure to these arable grounds. If required, their proximity to animal grazings and wood-pasture may have encouraged the use of live animals as the principal manure providers. In addition the fact that they broke new ground that had not been depleted of nutrients may have negated the need for intensive manure. Coupled with their cultivation by individuals, the result is a very low density of ceramic manure scatters often comprising only late medieval pottery fabrics.

WIDER PERSPECTIVES

The Whittlewood work shows that signatures of different medieval farming regimes, their origins and development, have been left in the ground and can be read through careful analysis. Such analysis is dependent upon the marriage of history and archaeology, and the need to study both fields *and* the settlements from which they were farmed. By so doing, it has been possible to reconstruct in detail the arable area of Whittlewood over the critical medieval millennium which saw the abandonment of 'traditional' infield/outfield farming methods and its replacement with an entirely new system based on common holdings, field rotation, and the sharing of space for animal grazing and arable cultivation. It was a period that began with a restricted arable zone, which saw over time considerable growth in tillage area particularly at the peripheries of cultivation, and which concluded with the initial reversions of this ploughland to grass.

It may be questioned, however, whether the models formulated here, using a previously under-explored archaeological resource, have any application beyond the boundaries of the intensive local study of a discrete block of landscape on which they have been based. Comparative analysis with other ceramic manure scatters found by extensive fieldwork elsewhere in the country is frustrated by the lack of a standard approach to data collection and variations in the recorded detail of make up of these assemblages. Large-scale projects have employed walking transects (Shennan 1985), walking lines orientated to points of the compass field by field (Medleycott and Germany 1994), walking lines orientated according to the field layout, or walking grids. Grids have been laid out on a number of different base measures, lines have been set 15 (Dix 1986-7), 20 (Zadora-Rio 1987), 25 (Gerrard 1995), 30 (Lawrence n.d.) or 50 m apart, transect intervals and the length of collection stints are equally divergent. Other projects have initially walked fields on spaced lines before targeting particular areas of interest with the more intensive grid method (Gerrard 1995). The reporting of results is equally inconsistent, with the majority concentrating on 'sites' rather than off-site information (e.g. Shennan 1985; Medleycott and Germany 1994).

The full implications of the Whittlewood research must therefore await full re-analysis of these massive data sets. Yet there are tantalizing glimpses in the available literature which

suggest that some of the proposed Whittlewood manuring models will find parallels elsewhere. In the pre-850 AD period, low-density pottery scatters have been found around the Anglo-Saxon settlement at Witton (Norfolk), for example, suggesting the manuring of infields with domestic material (Fowler 1997, 268), and the same pattern is seen at Higham Ferrers (Northants: Shaw 1991). The absence of late Saxon material has been noted from the fields at Wharram Percy (Yorks). Here the excavated tofts produced large amounts of this material suggesting that it was not exploited as a field manure but deposited and left close to the homestead (Beresford and Hurst 1990, 43-44). By contrast, there was very little post-Conquest pottery, even within rubbish pits, within the village, but significant amounts on the field. From *c.* 1100 at Wharram Percy, in similar fashion to that observed in Whittlewood, it would appear that every scrap of household waste was being spread on the fields. Scatter plots from Higham Ferrers also show a dearth of pottery in the fields between *c.* 850 and *c.* 1000 AD, an episode sandwiched between both earlier and later period of domestic midden manuring (Shaw 1991, *passim*). So too at West Heslerton (Yorks), where parts of the earlier settlement zone were taken into the field system, one headland sealing beneath it earlier building sites. On the basis of the material associated with the settlement, it appears it had been abandoned around 900 AD, with the headland established shortly thereafter. Yet the field assemblage again does not include pottery dated to the tenth or eleventh century; the first datable sherds were consistent with a twelfth-century deposition date (pers. comm. Alan Vince).

Medieval treatises on estate management provide a detailed picture of lengths to which farmers went to improve and maintain soil fertility. Concentrating on the demesne, however, where the principal manure suppliers were animals, whose dung could be supplemented by marling and the use of green manures, these texts ignore the main source of manure for the peasant farmer, household waste. For the archaeologist, this is the very material which leaves a readable signature in the soil, most commonly in the form of low-density ceramic scatters. As the Whittlewood survey shows, if analysed carefully, these scatters hold vital information for the reconstruction of the medieval arable and the identification of the different farming regimes used in its exploitation. Mapping manure scatters permits both the tracing of the general expansion and contraction of medieval ploughland over time and the pinpointing of periods of revolutionary change, notably the introduction of new farming systems such as the open-fields. Ceramic manure scatters are thus a rich and readily accessible resource that can throw new light on one of the most important aspects of the medieval rural economy, crop cultivation. It can only be hoped, therefore, that future fieldwalking programmes attach as much significance to the pottery scatter as they currently give to the pottery concentration. If such a situation were to transpire, it might be envisaged that rapid advances might be made in understanding how, when, why, and by whom the medieval rural landscape was laid out, managed and exploited.

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BIBLIOGRAPHY

Beresford, M. and Hurst, J. 1990 *Wharram Percy Deserted Medieval Village*, London: Batsford

Blair, J. 1994 *Anglo-Saxon Oxfordshire*, Stroud: Sutton

Brown, T. and Foard, G. 1998 'The Saxon landscape: a regional perspective', in P. Everson and T. Williamson (ed.) *The archaeology of landscape*, 67-82, Manchester: Manchester University Press

Cambell, BMS. 1983 Agricultural progress in medieval England: some evidence from eastern Norfolk, *Economic History Review*, **36**, 26-46

Campbell, BMS. and Overton, M. (eds.) 1991 *Land, labour and livestock: historical studies in European agricultural productivity* Manchester: Manchester University Press

Cooter, W. 1978 Ecological dimensions of medieval agrarian systems: an ecologist responses', *Agricultural History* **52**, 478-83

Dix, B. 1996-7 The Raunds Area Project: Second Interim Report, *Northamptonshire Archaeology*, **21**, 3-30.

Dyer, C. 1998 Medieval pottery from the Admington survey: some preliminary conclusions, *Medieval Settlement Research Group Annual Report*, **13**, 24-5

Dyer, C. 2000 Compton Verney: Landscape and People in the Middle Ages, in R. Bearman (ed.) *Compton Verney: A History of the House and its Owners*, 49-94, Stratford-upon-Avon: Shakespeare Birthplace Trust

Elvey G. 1968 *Luffield Priory Charters Part 1*, Northamptonshire Record Society, **22**

Finberg, HPR. 1951 *Tavistock Abbey. A Study in the Social and Economic History of Devon*, Cambridge: Cambridge University Press

Foard, G. 1978 Systematic fieldwaking and the investigation of Saxon Settlement in Northamptonshire, *World Archaeology*, **9** no. 3, 357-74

Fowler, P. 1997 Farming in Early Medieval England: some fields for thought, in J. Hines (ed.), *The Anglo-Saxons from the Migration Period to the Eighth Century: An Ethnographic Perspective*, 245-68, Woodbridge: Boydell

Fox, HSA., 1981 Approaches to the adoption of the midland system, in T. Rowley (ed.) *The Origins of Open Field Agriculture*, 64-111, London: Croom Helm

Fox, HSA., 1986 'The alleged transformation from two-field to three-field systems in medieval England', *Economic History Review*, 2nd series **39**, 526-48.

Gerrard, C. 1997 Misplaced faith? Medieval pottery and fieldwalking, *Medieval Ceramics*, **21**, 61-72.

Gray, HL. 1915 *The English Field Systems* Harvard: Harvard University Press

Hall, D. 1992 *The Fenland project no. 6: The South-Western Cambridgeshire Fenlands*, East Anglian Archaeology Reports, **56**.

Hall, D. 1994 Ridge and Furrow in the English Midlands, in S. Foster and T.C. Smout *The History of Soils and Field Systems*, 94-100, Aberdeen: Scottish Cultural Press

Hall, D. 1995 *The Open Fields of Northamptonshire*, Northamptonshire Record Society, **38**.

Hall, D. and Martin P. 1979 Brixworth, Northamptonshire: an intensive field survey, *Journal of the British Archaeological Association*, **132**, 1-6.

Hooke, D., 1981 Open-field agriculture – the evidence from pre-conquest charters of the West Midlands, in T. Rowley (ed.) *The Origins of Open Field Agriculture*, 39-63, London: Croom Helm

Jones, R. 2002 The Luffield Priory Grange of Monksbarn, Whittlebury, Northants, *Northamptonshire Archaeology*, **30**, 126-39

Jones, R. and Page, M. 2003 Characterizing Rural Settlement and Landscape: Whittlewood Forest in the Middle Ages, *Medieval Archaeology*, **47**, 53-83

Lawrence, P. n.d. *A summary of the archaeological fieldwork conducted in the parishes of Deanshanger, Furtho & Potterpury by students of Birkbeck College, University of London between 1994-1998* Unpublished Report

Lewis, C., Mitchell-Fox, P. and Dyer, C. 1997 *Village, Hamlet and Field: Changing Medieval Settlements in Central England* Manchester: Manchester University Press

Mathew, WM., 1993 Marling in British agriculture: a case of partial identity, *Agricultural History Review*, **41**, 97-110

Medleycott, M. and Germany, M. 1994 Archaeological fieldwalking in Essex, 1985-93, *Essex Archaeology and* History, **25**, 14-27

Newham, E. and Harvey, P. 1997 Did soil fertility decline in medieval English farms? Evidence from Cuxham, Oxfordshire ,1320-40, *Agricultural History Review*, **45** (2), 119-36

Oschinsky, D. 1971 *Walter of Henley and other Treatises on Estate Management and Accounting* Oxford: Clarendon Press

Postan, M., 1966 Medieval agrarian society in its prime: England, in M. Postan (ed.) *The Cambridge Economic History of Europe I: The Agrarian Life of the Middle Ages* Cambridge: Cambridge University Press

Postan, M. 1972 *The Medieval Economy and Society: an Economic History of Britain in the Middle Ages* London: Weidenfeld and Nicolson

Roberts, B.K. 1993 Some Relict Landscapes in Westmorland: A reconsideration, *Archaeological Journal*, **150**, 433-55

Rogerson, A. 1997 An archaeological and historical survey of the parish of Barton Bendish, in A. Rogerson, A. Davison, D. Pritchard and R. Silvester *Barton Bendish and Caldecote: Fieldwork in South-west Norfolk. East Anglian Archaeology*, **80**

Rowley, T. (ed.) 1981 *The Origins of Open-Field Agriculture* London: Croom Helm

Shaw, M. 1991 Saxon and Earlier Settlement at Higham Ferrers, Northamptonshire, *Medieval Settlement Research Group Annual Report*, **6**, 15-19

Shaw, M. 1993-4 The discovery of Saxon sites below fieldwalking scatters: settlement evidence at Brixworth and Upton, Northants, *Northamptonshire Archaeology***, 25**, 77-92

Shennan, M. 1985 *Experiments in the Collection and Analysis of Archaeological Survey Data: the East Hampshire survey* Huddersfield: Charlesworth and Co.

Sykes, N. 2001 *The Norman Conquest: a zooarchaeological perspective*, Unpublished PhD thesis, University of Southampton.

Thirsk, J. 1964 The Common Fields, *Past and Present*, **29**, 3-29

Thornton, C. 1991 The determinants of land productivity on the Bishop of Winchester's demesne of Rimpton, 1208 to 1403, in B.M.S. Campbell and M. Overton (eds.) *Land, Labour and Livestock: Historical Studies in European Agricultural Productivity* Manchester: Manchester University Press

Titow, J.Z. 1969 *English Rural Society 1200-1350* London: George Allen & Unwin

Titow, J.Z. 1972 *Winchester Yields: A Study in Medieval Agricultural Productivity* London: Cambridge University Press

Williamson, T. 1994 Site, settlement, landscape: some reflections on fieldwalking in eastern England', in M. Parker-Pearson and R. T. Schadla-Hall (eds) *Looking at the Land: Archaeological Landscapes in Eastern England. Recent work and future* directions, 5-9, Leicester: Leicester Museums, Arts and Records Service

Williamson, T. 2003 *Shaping Medieval Landscapes: Settlement, Society and Environment*, Macclesfield: Windgather Press

Zadora-Rio, E. 1987 Archéologie du peuplement: la genèse d'un terroir communal, *Archéologie Médiévale*, **17**, 7-65