4 SPATIAL PATTERNING: TWO DIMENSIONAL

The butchery analysis has provided an in-depth understanding of the meat cuts produced from pig and cattle carcasses. In this chapter, the investigation of the spatial positioning of these parts will be described and discussed. A methodology for spatial investigation will be presented, followed by the results of the spatial analysis of pig and cattle bone.

The spatial investigation is divided into two sections: two-dimensional and three-dimensional. The two dimensional part uses the selected sample area to investigate the positions of different bones by pit. The intention here is to display overall trends, which could indicate that certain parts of the site were used for specific functions: waste disposal, manufacturing, or consumption activity, for example. The layers built up around the rampart can also be investigated in this way, although at a much coarser level of detail as layers are often less tightly defined and sometimes very extensive.

The three dimensional investigation will investigate layers within the pits, with the assumption that the separate layers represent separate episodes of activity. Here the intention is to assess differences between layers, to understand how homogenous the deposits within pits were, and to elucidate the exact nature (waste/ feasting, etc) of any temporal differences between deposits. Other issues can also be addressed, for instance the characteristics of bones found in the proximity of special deposits.

4.1 METHODOLOGY FOR SPATIAL INVESTIGATION

The bone has been split into early, middle and late phases in order to distinguish changes over time. Cunliffe suggests the ‘functional areas’ altered location from the early to late phase (Cunliffe 1995: 24), so where possible, the middle phases (cp 4-6) were also investigated, in order to flag any differences in deposition during this possible period of change.

4.1.1 Selecting the bone elements to investigate spatially

The carcass divisions, illustrated and outlined in chapter three, often resulted in the complete disarticulation of each individual bone. However sometimes a combination of bones (such as the metapodials and phalanges) or a part of a bone (for example the distal part of a tibia) formed a specific ‘unit’. It was decided that the most comprehensive manner of investigation would be to consider distributions initially at a gross scale (head, forelimb, hindlimb, torso) then in increasingly finer detail (individual bones or parts of bones).

The locations of primary butchery segments would be the starting point, so initially the head, fore limb, hind limb and torso bones would be mapped, to identify any areas or pits where these clustered. A pit containing large quantities of head and feet bones could be interpreted as containing the remains of primary butchery. Limb bones would first be investigated as whole limbs, then as upper and lower limbs, and then as individual bones. This would give an increasing magnitude of detail as the investigation progressed, to identify for example:

- Any part of the site that contained a high proportion of limb bones
- Any part of the site that contained a high proportion of fore limb bone
- Any part of the site that contained a high proportion of upper fore limb bone
- Any part of the site that contained a high proportion of humeri

Thus if a portion of the site contained a large number of fore and hind limb bones, but few lower limb bones, it could be interpreted as an area where the more 'meaty' parts were deposited, and perhaps a place where consumption activity was based.

Pig bones were investigated first using this method. The methodology was refined and adapted for the cattle bone, allowed for by the larger sample from this species.

4.1.1.1 Pig bone elements

The relatively small size of the pig bone sample, compared to that of the cattle, meant that relatively few complete bones were present to use in the analysis. It was therefore necessary to use all bone fragments, in order to provide a large enough sample. The possible biases from using fragmented bone are discussed below.

4.1.1.2 Cattle bone elements

The same method of analysis could have been applied to cattle bone, but a large sample of bone from this species (for pits) enabled the investigation of body part locations to be refined. Well-represented and robust bones were assigned as representatives of individual butchery 'units', considerably reducing the amount of time taken when selecting the appropriate bones for analysis.

The major divisions produced from cattle carcasses are suggested as follows: the head, hooves, upper limbs, lower limbs, ribs and thoracic/ lumbar vertebrae.

One bone element was chosen from each unit, and a diagnostic zone on each of these bones was selected for spatial distribution analysis. The specific part was always dense with a high survival rate. Thus, the **occipital condyles** and **mandibular toothrow** were chosen for the upper and lower parts of the head, the **first phalange** for the feet, the **distal metapodials** for the lower limbs, the **distal femur/ humerus** for the upper limbs, the **pelvic acetabulum** for the posterior, and **distal scapula** for the anterior part of the torso. The poor survival and the lack of species identification of the ribs and vertebrae exclude them from this analysis.

To ensure repetition of fragmented elements was avoided, only those bones showing more than 50% of the designated part were included.

4.1.2 Possible bias from young bone

It was thought that a high proportion of bone from younger animals could affect an analysis that used all bone fragments (in this case the pig bone). Bone from immature animals degrades more quickly than that from older individuals (Lyman 1994), resulting in the relatively more fragments recorded per bone from older animals. Selected pig bones were investigated to see if the location of complete bones differed from that of all fragments (part 4.2.3).

4.1.3 Possible bias from fragmented bone

Assessment of the extent to which the use of restricted bone parts to test distributions (as used for the cattle bone) could affect the results was also required. The results from total numbers of humerus and femur fragments were compared to those from restricted bone zones (distal humeri and femora).

4.1.4 Spatial data manipulation: the use of a GIS for intra-site analysis

4.1.4.1 Theoretical issues

The obvious advantage of using a Geographic Information System in this study lies with its ability to articulate and analyse the locational component of any spatially referenced dataset. Its ability to handle large volumes of spatially referenced data makes it ideal for intra-site analysis, where a large area has been excavated, and when there are very large numbers of artefacts (Gillings & Wise 1990). In analysing the spatial component of any given dataset the

GIS is also able to integrate and employ all of the related attribute data we have relating to those locations. This makes it exceptionally useful for undertaking complex spatial queries, for example isolating the spatial occurrences of a specific type of bone or bone showing certain butchery characteristics. At Danebury this is especially important because we have a considerable amount of information *about* each bone, recorded in separate fields in the overall database.

It is appreciated that by using GIS as essentially a query tool in the present study, only a small proportion of its potential is utilised. However, one of the great advantages of such systems is their inherent flexibility. Whilst the range of analyses undertaken here is restricted to detailed query and limited spatial statistical analysis, the current database provides the ideal platform upon which to undertake a more detailed programme of spatial analysis and modelling operations (for example buffering around selected zones), which can help to further refine the querying process but is beyond the scope of this thesis.

In using GIS it is important to realise that GIS were not developed for archaeological use, being designed originally as geographic tools for land management applications such as predicting environmental impacts and determining land use, etc. In saying this, the predominance of spatially referenced data in archaeology make the systems ideally suited for both artefactual and landscape archaeology. While the former relates mainly to simple query operations, for example thematic distribution maps and plotting findspots (for example in SMR data), applications in the latter class engage a fuller complement of the GIS's range of analytical tools: for examples of the range of analyses possible using GIS see Gillings & Wise (1990) or Wheatley and Gillings (2002). Relevant applied methods include Lock & Harris (1996), Llobera (1993) and Dooney (1997).

A theoretical problem arises when using GIS as a tool for spatial display, one that is also pertinent to distribution mapping. This is the discrepancy in perspective between the researcher, who looks at simplified or narrowly categorised data, and that of the person or community that created the material being studied. A two-dimensional approach serves to widen the gap by distancing the researcher from the context of the original deposition. To some extent this mode of questioning is unavoidable, but its effects can be tempered by incorporating contextual information.

A more pivotal problem with this study is the huge timespan involved. The consecutive layers formed in pit deposits mean that viewing the site in a two-dimensional way is flawed.

The lack of stratigraphic information means that pits are dated by ceramic phases, and cannot be sequenced in relation to each other. This adds another difficulty when undertaking spatial analysis, as it is not possible to determine which, and how many, pits were open at one time.

Both of these issues can be addressed when investigating deposits in three dimensions. This allows more direct analysis of individual periods of deposition, by looking at vertical spatial patterns, and also facilitates identification of specific activities. Thus it is possible to look at the patterning in a more immediate manner.

4.1.4.2 Practical application

After the body parts were defined and the approximate sequence of their production estimated, the primary divisions were investigated using a GIS system.

The bulk of the data manipulation was performed in the spreadsheet which Grant's original computerised records had been transferred to (Microsoft Excel 2000). Table 2.2 illustrates a sample page. The data from pits and layers were already in separate files. For the purposes of this investigation, the data were split into appropriate sections. The first was species, so that pig and cattle bone could be extracted from the rest of the (unexamined) species. Then the bone was split into phases (see part 2.2) corresponding to ceramic phases 1-3, 4, 5, 6 and 7-8. Material from ceramic phases 4, 5 and 6 was amalgamated, forming one 'middle' phase, since these phases contained relatively few bones. It also makes comparison with other sites more straightforward. The late phase is relatively long at 310 years, which accounts for its larger bone sample.

For reasons explained in section 2.2, the phasing I used does not correspond exactly to that of Cunliffe, who split the site into early period cp 3-5 (up to 310BC) and late period cp 6-7 (Cunliffe 1995: 18). While his method provides a simpler dataset, any difference in the middle period(s) would be glossed over. Also, the bones dating to the last 100 years before the Roman conquest (cp 8-9) would form an extremely small sample, not useful in the present study which aims to elucidate time trends and patterns. The large quantity of bone in pits which could only be dated to cp7-8 would have to be omitted if strictly adhering to Cunliffe's categorisation.

Once the bones had been split into period based groups, the data were filtered to select the appropriate bone(s) and tables were produced using a pivot chart. For each query, pits were assigned values according to their content. For example a pit or layer containing ten distal humeri would be assigned a value of 10. The original records contained information not just on the presence or absence of bone ‘zones’, but the degree of completeness of each of the 7 zones on major bones, of which the distal epiphysis is one. A code was used for complete (1), over 50% (2) and under 50% (3) of each of these areas, so bones less than 50% complete could be filtered out.

The frequency of distal humeri in each pit or layer could then be listed, and the resulting table saved as a database 4 file, which can be linked directly to the feature’s location within the GIS (ArcView). The main mode of spatial enquiry involved pit location, for which points and/or the surface area can be used to define each pit (see end of this section for explanation of layer location). As a result ArcView was chosen as it combines a vector-based spatial data model, capable of representing the pits in such a fashion, with powerful querying capabilities (Environmental Systems Research Institute 1997).

The spatial position of each pit was obtained from co-ordinates in another spreadsheet. Danebury was excavated on a grid system (A-T), so pit co-ordinates were prefixed by a letter according to the grid in which they were located. These grid letters were given an X-Y value, calculated from the plans. This file of co-ordinates along with unique pit identifier code (pit number) was then converted by ArcView into a series of clearly labelled point locations corresponding to the pits. However, only a sample was required, so using the selection tool in ArcView, the sample area was highlighted and those pits inside the sample were selected. These were saved as a separate vector data layer (in ArcView terminology a shape file, also referred to as a theme). The pit points could then be linked to particular properties, contained in the database file (in the above example, the value of 10) using the unique identifier codes associated with both GIS points and database entries.

A ‘graduated symbol’ was used to display the values, which could demonstrate the relative numbers of bones from each pit by altering the size of the point. The flexibility of GIS meant that it was easy to display pits according to different variables or properties. For example each pit could be displayed according to the numbers of specific bone types it contained. This could be as an absolute number or standard deviation. Standard deviation was originally used for most analyses, so the size of the pit point was related to the deviation from the mean value of bones per pit. This display did not in any of the distributions differ from the absolute numbers, and as a result in the present discussion absolute numbers are usually displayed in order to indicate the size of the sample.

The default display in the Arcview system for number categories is ‘natural breaks’ which chooses five discrete numeric ranges. This method has the advantage of singling out pits that contained unusually large or small quantities of bone. Initially I chose to use ‘equal intervals’ which enabled a direct comparison to be made between analyses. It soon became clear that this option often masked differences between the majority of pits when one pit contained a large quantity of bones. In these cases, there were few or no pits in the mid-range and a vast amount in the smallest category, so it was decided to use ‘natural breaks’ as defined by ArcView.

An additional advantage of using GIS is the ability to integrate other thematic layers of spatially referenced information into the analytical environment. For example the earthworks and Cunliffe’s overall breakdown into functional categories by phase (housing, ritual and storage) could be displayed alongside the selected pit locations. They can also be used to further refine the querying possibilities, for example, all pits in the ‘housing’ area can be selected.

The displays could be viewed or exported from the GIS using templates as publication quality layouts. The author designed a template to produce a suitable scale, north arrow, key and heading. These could not be printed directly but were exported as Windows metafiles (or as bitmaps and manipulated in Paint) for insertion into a Word document.

Unlike the pits, it was often impossible to locate layers (built up in quarries and hollows) precisely from the archive. Often the layers were amorphous and/ or widespread so a precise co-ordinate was not appropriate. Layer positions were narrowed down as far as possible using archival data, but it was not possible to pinpoint them any more closely than to the 10x10m grid in which they were excavated. The grid was reproduced in ArcView using the fishnet command, which required the orientation of the grid (N-S) and the number of units wide each grid square was to be (10m).

After the bone distributions were displayed, nearest neighbour analysis was carried out on these patterns where appropriate. Nearest neighbour analysis tests the hypothesis that there is a random distribution of points (in this case selected pits) within an area (here, the section of the site selected as a sample). The number of points, area under consideration and mean distance of points from their nearest neighbour are used in a formula to calculate the R value (description of the distribution). An R value of 1 indicates a random pattern, values over 1 indicate a uniform pattern and those under 1 indicate a clustered pattern. A clustered pattern would suggest that certain bone elements were deposited close to each other and so were structured in some way. It is however unreliable when the number of points numbers less than 30 (Ebdon 1985), and so in many cases it has not been possible to use it.

This analysis was undertaken using a specially designed programme run within ArcView (a script) that was imported from the www.esri.com ArcView resources website, and incorporated into the project. A thematic layer consisting of one polygon, the outline of the sample area, was created (as a shape file). This was used to define the limits of the analysis. It, and a shape file created from the selected pits, were run through the script. The resulting 'R' value was then displayed in a message box, together with the number of features that were accounted for in the analysis.

The distribution of all pig bone fragments in the sample area was examined first, to provide a basis for comparison of the pits containing particular elements. A surprisingly even distribution of pig bone was seen across the sample area. The statistical analysis confirmed that there was no tendency to cluster, and that this was a random distribution.

4.2 INVESTIGATION OF SPATIAL DISTRIBUTION OF PIG BONE IN PITS

4.2.1 Early Phase

Statistically, the distribution of all pits in the early phase is not clustered (and see figure 4.1a). By eye, it can be seen that there is a higher density in the centre of the site, which diminishes towards the northern periphery and just below the centre to the south. The densest concentration is that around the so-called 'ritual' structure in the centre. There are few early phase pits found in the periphery (defined by Cunliffe as an area of housing).

The distribution of all pig bone fragments in the sample area was examined next, to provide a basis for comparison of the pits containing particular elements. A relatively even distribution of pig bone was seen across the sample area (figure 4.1b), although the densest concentration of bones is found in the central part, where the greatest numbers of pits are located in this phase. The statistical analysis confirmed that there was no tendency to cluster.

Certain pits have a large number of bones in them, and these are also found in the most central parts.

Head

The positions of all fragments from the skull (cranium and mandible) were investigated first (figure 4.1c). These showed a similar distribution to the total pig bone. There is however one pit in the centre which shows a significantly higher number of fragments. This is pit 740, which contains the remains of at least two pig heads, in layers 3 and 4.

When looked at separately, the upper cranial bone and lower mandibular bones are both found in roughly similar distributions to the total pig bones (figures 4.1d and 4.2a). However, the positions of cranial and mandible fragments do not always correspond. It appears that while there is no obvious correlation of upper and lower head parts in the same pits, there is also no definite segregation of the two in different parts of the site: in some pits these bones are found together, while other pits contain either one or the other body part.

The teeth were omitted from the above analysis due to the possible influence large numbers of loose teeth might have on the results. The distribution of loose teeth closely mirrors that of the rest of the skull fragments (figure 4.2b), suggesting that teeth became loose after deposition, or that deposits containing loose teeth were made universally. Pits with a large number of teeth are normally those that contain many pig bones, although they do not necessarily contain many cranial fragments (figure 4.1d).

The atlas and axis distribution is extremely scattered, and there are not many examples (figure 4.2c). They are more common in the central area than the south or north, but there is one pit in the southern half that contains several examples. The majority are found singly, suggesting that these bones had been extremely widely scattered. There is little correlation between the positions of cervical vertebrae and skull fragments, which suggests that these two parts were distributed and/or deposited separately.

Torso

The distribution of all torso bone fragments reflects the distribution of all pig bone, with the upper and lower sections showing a very similar distribution both to each other and to the overall pattern (figures 4.1a & 4.3a, 4.3b and 4.3c). When rib and vertebral fragments were investigated, they showed an extremely similar distribution to the overall pattern (figure

4.3d). Throughout this analysis, one pit consistently contained many examples, probably caused by a special deposit of a pig in pit 674 (see below).

Fore limb

The total numbers of forelimb bone fragments have a similar distribution to the overall pig bones, again showing an especially large number of examples in pit 674, with fewer elsewhere (figure 4.4a). Pit 674 contains 555 bone fragments, of which 205 are from pigs, attributable to a special deposit of a pig in layer 4. This pit also contains more lower than upper forelimb parts, which is unusual since most pits give the opposite pattern. Lower forelimb bones are only found in 12 pits: two in the southern part and the remainder in the centre of the site. Upper forelimb bone fragments have a wider distribution (figures 4.4b and 4.4c). While this might suggest that the upper, meatier, parts were distributed for consumption, and the less meaty parts filleted and deposited immediately after butchery, it is perhaps more likely that the lower limb bone distribution is restricted due to the problems of assigning phalanges and fragmented metapodials to fore or hind limb. Many lower limb bones have been omitted and are described below (‘feet’). There is nothing to suggest that there was differential disposal of upper and lower fore limb bones within the site, as both are concentrated in areas with more pig bones overall.

Hind limb

Again the distribution of hind limb bones appears to mimic that of all pig bone, with more examples in pit 674, and the rest scattered widely although with a concentration in the central area (figure 4.5a).

The upper parts of the hind limb have a similar distribution to the overall hind limb distribution (figure 4.5b). The lower limb bones are found in the southern half in slightly greater densities than the northern half, but the number of examples is too small to indicate deliberate patterning (figure 4.5c).

Feet

Bones from the trotters which could not be assigned to fore or hind limbs (the phalanges and broken axial and abaxial metapodials) are found in similar distributions to the overall pattern (figure 4.5d). Three pits in a cluster show considerably more examples than the others, but these are also pits with particularly large numbers of all bone elements.

Summary of pig bone in the early phase

There appears to be very little patterning in pig bone distribution. Upper and lower limbs are scattered across the sample area, but those pits with larger numbers of upper parts do not generally contain many lower parts as well, suggesting that these parts of the carcass were separated following preliminary disarticulation. The atlas and axis distribution is also less focussed on the central area than the skull parts. These two bones are almost always found singly in pits. This corroborates the above suggestion that the carcass was widely dispersed across the hillfort, with bones that are found close together in the skeleton but parts of different butchery units often recovered from different pits.

4.2.2 Middle Phases

Middle phases did not contain enough examples of individual pig bone elements for spatial investigation of this species. The distribution of pits in this phase is described in part 4.3.2.

4.2.3 Late Phase

Nearest neighbour analysis tells us that that pits in the late phase are statistically random in distribution. By eye, pits appear to be slightly less dense in the centre than in the northern periphery and southern part of the sample (figure 4.6a). A similar pattern is produced when the numbers of pig bone in these pits are displayed (figure 4.6b). There is no clustering of the pits that contain large numbers of bone fragments.

There are two pits from which a very large number of pig bones was recovered, one in the south and one situated centrally. These both contained articulated remains, each of at least two individuals; this partly accounts for the high numbers of pig bones recovered.

Head

The positions of all skull fragments did not show any clusters, and instead paralleled the overall distribution of pits. The two pits that contained a large number of bones overall also contained a large number of skull fragments. The mandible is very dense and does not fragment as easily as cranial bone. However mandible fragments have a similar, scattered, distribution as the cranial bones, suggesting that fragmentation did not greatly influence the distribution, and perhaps that much of the fragmentation occurred post-deposition.

In the late phase pits there was no butchery evidence to suggest separation of the mandible from the skull. The locations of cranial bones do not however match those of mandible fragments, as they would if they had been deposited together. Separation must therefore have occurred at some point before deposition, though the process did not mark the bone.

Torso

The bones from the torso show a similar distribution to that of all pig bone. The upper parts (cervical and thoracic vertebrae) show slightly more clustering than the lower (lumbar and sacral vertebrae), with a few pits containing large numbers of upper vertebral parts, and the remainder with small numbers (figure 4.6c and 4.6d). Numerous single examples of lower vertebrae are found. It is possible that the 'lower' part of the spine was split up into separate vertebrae, like chops, while the 'upper' vertebrae (which are more difficult to disarticulate) were split into chunks of several bones.

The pelvis and scapula are virtually identical in distribution to the total numbers of torso bone, and are scattered across the sample area in the same manner as all pig bone fragments in this phase.

Fore limbs

The distribution of fore limb bone fragments closely mirrors that of the total pig bone, with large numbers of examples in the pits containing bones found in articulation, and a random distribution across the rest of the site (figures 4.7a and 4.1a). The lower forelimbs were not widely distributed but were concentrated in certain pits (figure 4.7c). They did not seem to be found in small quantities all across the site. In comparison, the upper parts of the forelimb have a much more scattered distribution. Again this is probably due to the relatively small numbers of lower limb bones which could be assigned to fore or hind quarters, although it is possible that there was a patterning in the distribution of this carcass part (see early phase).

Hind limbs

Overall the hind limb bones were evenly distributed, although inevitably the pits containing articulated examples produced higher numbers. The upper and lower parts of the hind limbs had similar distributions, and individual bones were often found singly.

Feet

The phalanges and metapodial parts which could not be assigned to fore or hind limbs have a very even distribution in respect of the overall distribution of pits. Some pits contain several examples, but on investigation these pits were found to contain the bones from feet that were probably deposited whole (figure 4.7d).

The large number of bones in this phase enables investigation of the effects of bone fragmentation. The positions of whole bones were displayed in order to contrast the location of complete examples to that of fragmentary bone. It can be seen in figure 4.8a that whole bones are found scattered across the site, and they are found in equivalent positions to the fragmented examples.

Summary of pig bone in the late phase

There is no evidence to suggest any restriction or zoning of areas of deposition in the late phase. Fragmentation is not likely to have affected the results, as fragmented examples and whole bones have very similar distributions. Much of the bone fragmentation may have occurred post-deposition. Although upper and lower parts of limbs are found in similar distributions across the site, they are often not found in the same pits, indicating that they were separated before deposition. Lumbar vertebrae were more likely to be individually deposited, while thoracic vertebrae are more often found in groups. It is possible that lower forelimbs were more concentrated in particular parts of the site, but this apparent patterning may be a result of the exclusion of bones from the lower limb and foot that could not be assigned to fore or hind limb.

4.3 INVESTIGATION OF SPATIAL DISTRIBUTION OF CATTLE BONE IN PITS

4.3.1 Early phase

The overall pattern of cattle bone distribution in the early period is broadly similar whether using all bone fragments or just looking at a restricted range of bone parts (distal humerus representing upper forelimb, etc.). Figure 4.8 shows that while the distributions of both are similar, the restricted bone analysis appears to place the majority of cattle bones in the southern section of the sample area. The northern half is characterised by a greater number of pits containing only a few bones (under 10). So, while the restricted bone analysis appears at first glance to indicate an under-representation in the northern area, it is clear that the major factor determining the overall distribution is the presence in the southern half of a large number of cattle bones in six pits.

These pits are in the area to which Cunliffe did not assign a function (1995: 42) (see figure 4.8b). It may be that this area attracted different types of deposits- perhaps the remains of more complete cattle carcasses- than the northernmost part. When compared to the locations of pits in the early phase, it is clear that the pits with large numbers of cattle bone in them were not concentrated in the part of the site where pits were most dense. However, nearest neighbour analysis offered no evidence of clustering of cattle bone parts. It was thought probable that these pits contained special deposits, which would both increase the numbers of bones and explain the results of the restricted fragment analysis (as the bones are more likely to be whole). However this was not always the case (see section 4.3.4).

Cattle occipital condyles are infrequently found in early phase pits, with a roughly similar distribution to mandibles. Both follow the overall pattern of cattle bone disarticulation, of scattered pits concentrated centrally (figure 4.9a). One pit has several examples of both mandibles and occipital condyles (figure 4.9b). This is pit 674 in the north part of the southern area, which also contained large numbers of pig bone.

The distal scapula and distal humerus have completely different distributions: of the 16 pits with either bone in, none coincide (figures 4.9c and 4.9d). It is likely therefore that the scapula and humerus were separated after disarticulation and deposited in different pits. Similarly, of the 17 pits containing either the distal femur or pelvic acetabulum, only two contained examples of both (figures 4.10a and 4.10b). This again indicates separation of these elements from one another prior to deposition, although the smaller numbers of examples here suggest caution in this interpretation.

Metapodial parts are concentrated in the southern area, with none in the northernmost part where the majority of pits is located. They are not only found in pits with large numbers of bone but are well distributed in this southern area. First phalanges are also concentrated in the south but there is also a relatively even scatter across the rest of the site, in direct proportion to the total numbers of cattle bones (figure 4.10c, 4.10d and 4.11a). Thus the head and feet bones are not concentrated in any one area.

Comparison of the distribution of upper and lower limb bones shows that although they are found in similar areas, they are not often found in the same pits. Of the ten pits in which distal humeri were found, only three also contained distal metacarpals. A similar pattern is established for hind limb bones. This suggests that the metapodials were divided from the meaty parts of the upper limbs before deposition. It may be worth noting that the upper limbs are more frequently located in the northern sector of the site than the lower limb bones.

Summary of cattle bone in the early phase

Most pits in the early phase contain some cattle bone, but those with the most numbers of cattle bone are mainly found in the southern half of the site. The reason is not simply that these are larger or more densely filled pits, as this pattern is not seen for pig bone. The methods of analysis have not influenced the pattern: using all fragments does not alter the result, nor does the use of equal interval counts in defining numerical distinctions rather than natural breaks. It seems instead that large numbers of cattle bone were deposited in some pits in the southern half of the site, rather than in the more densely pitted central area. The southern part, where the large numbers of cattle bone were located, has not been given a function by Cunliffe, although other areas were defined as storage, housing or ritual in nature. The significance of the unusually large quantities of cattle bone in the ‘unassigned’ area is further discussed in part 4.4.

The bones representative of upper and lower limbs were generally not found in the same pits, nor were the upper and lower parts of the head and torso. It is therefore suggested that the cattle carcasses were extensively re-distributed after butchery and before burial. However there do not appear to be designated areas for disposal of particular parts of the carcass (e.g. butchery waste, meat joints, etc.).

4.3.2 Middle phases

Cattle bones are scattered more evenly across the sample area in the middle phases than in the early phase. There is a slightly greater concentration in the central-southern part and a small cluster in the northern periphery, with relatively fewer in the central-northern area. However nearest neighbour analysis indicates that there is not significant clustering anywhere in the sample area.

Head and foot bones are evenly distributed. The positions of distal metapodials do not correlate well with the first phalange; five pits contained examples of both, but 15 had only one or the other bone. The limb bones are spread evenly over the sample area, but humeri and scapulae are not found together, nor are femora and pelves.

In the middle phase pits, selected cattle bone fragments do not have a distinctive patterning, although the separation of the bone elements indicates that the carcass had been divided up prior to deposition. There does not appear to be any difference in distribution of bone elements compared to the early phase.

4.3.3 Late phase

The overall distribution of cattle bone in the late phase is scattered (figure 4.11a). There are cattle bones in pits evenly spread throughout the functional areas. One pit, 761, is situated in the central part and has the largest number of examples.

Mandibles are distributed evenly in proportion to the total numbers of cattle bone. The occipital condyles are found mainly in the northern half of the sample area, again with the central pit showing most examples (figure 4.11c). Numbers are too small to suggest patterning, and nearest neighbour analysis did not indicate any clustering.

The first phalange distribution is equally scattered, and corresponds to head bone fragments in only six pits (figure 4.11d). Metapodials are also distributed widely, although it may be worth noting that there are no distal metacarpals in the pit with the largest number of cattle bones. However, there is no evidence to suggest that ‘waste’ bones were being deposited exclusively in the same pits or in a certain area, since occipital condyles, metapodials and phalanges are both widely distributed.

Distal humeri and femora show a scattered distribution. The distribution of distal scapulae differs slightly from distal humeri: in some pits they coincide (9) but in some they do not (25) (figures 12a and 12b). Similarly, the femur and pelvis are found together in 10 pits, but 19 pits contain either one or the other bone (figures 12c and 12d).

Again there does not appear to be any evidence for segregation of specific parts in certain areas. The bones have been widely dispersed before deposition.

4.3.4 Conclusions

Throughout the phases cattle bones were evenly distributed across the sample area, with no clustering or segregation of parts. Cattle bones were most numerous outside the main area of concentration of pits in the early phase, and were found in very large quantities in several pits. This pattern is the opposite to that for cattle bones in middle and late phase pits, and pig bones in early and late phases; in these phases bone distribution was directly proportional to pit distribution.

The location of large quantities of cattle bone outside the main pitted areas and areas with circular structures may be important. Initially I assumed these pits contained special deposits of cattle or calves, which would account for the higher numbers of bone. However, on investigation, two of the six prolific pits did not contain any articulated bone. Of the others, pit 674 contained nine skull fragments from one individual, pit 63 contained six articulated foot bones, and pits 664 and 587 three fragments of cranium each. This is certainly not enough to account for the large numbers in each. Instead it is proposed that these pits contained large quantities of cattle bone either because they were located in an area where cattle butchery and consumption were taking place on a large scale, or because they happened to be open at the time the cattle were consumed and deposited.

The location of skeletally conjoining bone elements in separate pits suggests that after butchery the carcass parts were distributed before deposition in different pits and thus some time passed between butchery and consumption. The extent of redistribution is further examined by looking at the difference between vertical deposits within the pits (chapter 5).

4.4 DIFFERENCES IN DISTRIBUTION BETWEEN CATTLE AND PIG BONES

It is probable that both species were divided and the carcass parts significantly distributed after butchery. In the early phase it is possible that cattle were treated differently from pigs; they were possibly butchered and consumed in a separate area, or they may have been deposited in a specific area (the south of the site). A whole ox would provide a large quantity of meat, which would need to be consumed relatively quickly or preserved before it spoiled. Thus in the early phase it could be that the remains of cattle eaten by large groups of people were deposited in the southern part of the site, and that patterns of consumption in the northern part were different.

4.5 TWO DIMENSIONAL ANALYSIS OF CAT, DOG, BIRD AND DEER BONES AND SPECIAL ANIMAL DEPOSITS

All fragments were included in the analysis, as the bones from these species were scarce. Sheep and horses were not included, as the intention of this section was to isolate any possible differences in depositional practice between the domestic species already investigated and the more unusual animals and deposits.

4.5.1 Early phase

Bird bones are concentrated exclusively in the southern section of the site (figure 13a). This differs from the overall pattern, but mirrored cattle bone distribution. Red deer are infrequently found in the sample area. Only one example was found and this was from the southern half (figure 14a). Dog bone is found mainly in the centre of the site, the area of the densest concentration of pits (figure 13c). No cat bone was found in the early phase, although in the middle phases some is present in the southern half. Special deposits are found in the southern half of the sample only (figure 14a).

4.5.2 Late phase

Bird bones are concentrated in the southern half but there is one example in the far north (figure 13b). This distribution echoes that of the early period but also conforms to the distribution of all pits in the late period. Red deer bones are found in small numbers in the northern half of the site (figure 14b). Dog bone is again located in direct proportion to the concentration of all pits in this phase, with relatively few in the centre and the majority around the periphery (figure 13d). Cat bones are found in small numbers with two examples in two pits in the north and south peripheries. Special deposits are found in the southern and northern peripheries, but not in the centre (figure 14d).

4.5.3 Comparison of animal bone distribution between phases

The bird bone in the early phase is concentrated in the southern half. This contrasts with the main area of concentration of pits and pig bone and could imply a depositional pattern for these animals that is similar to cattle in this phase, but different from the main pattern of bone distribution. In the late phase bird bone locations are very scattered, but replicate the overall distribution of bone. The small numbers of bird bones make drawing a conclusion difficult, but it seems that the bird and cattle bones may have been treated differently to the majority of the other bone in the early period, but were not afforded any special treatment in the late phase.

Red deer bones were very rarely found, and occur in pits in the southern half in the early period and in those in the northern half in the late phase. Again, any conclusions reached from this are extremely tentative, as bones were incorporated into deposits very infrequently. However from the limited evidence it could be suggested that different systems were in operation in the early and late phases, and that in the early period the deer bones do not follow the same pattern as the majority of the rest of the bone in terms of their distribution.

Dog bones are more numerous, and it may be for this reason that their distribution appears to follow roughly the same spread as the majority of the bone in both phases. However, if not a symptom of sample size differences, it could imply that dogs had a more similar status to sheep and pig, as a domesticated animal.

Cat bones are rare, and are absent from the sample area in the early period. However their distribution in the middle period mirrors that of red deer and bird bones; they are found exclusively in the southern half. In the late period cat bone is found in both peripheries in proportion to the distribution of late phase pits.

Special deposits are found outside the main area of pit concentration in the early phase, but are found in similar proportions to the majority of animal bone in the late phase. They do not appear in the same areas as the 'ritual' structures in either phase.

In summary, the bones of red deer, birds and cats are found outside the main area of pit concentration in the early phase, but their distribution mirrors the overall pattern in the late phase. This could suggest that while they have some sort of special or different status in the early period this has diminished or disappeared by the later phase. Special deposits also follow this pattern, as does much of the cattle bone. This could support Cunliffe's suggestion that the nature of use altered midway through the Iron Age occupation, and it looks likely that there was some difference between the north and south parts, at least in the early period. The blending of 'ritual' and 'secular' activities, which Cunliffe envisaged for the late phase, is corroborated by animal bone distributions, which seem to be homogenous in the late phase (Cunliffe 1995: 25).

Dogs appear to follow the same pattern as the majority of the animal bone overall and this suggests that they were not given special status at any time.

4.6 TWO-DIMENSIONAL DISTRIBUTION OF LAYER MATERIAL

Fragment counts were used for these analyses as the numbers of whole examples are too low to provide any comparative data. Here the late phase material is investigated first, as the early phase produced so little material.

4.6.1 Late phase

4.6.1.1 Pig

First the total number of pig bone found in each grid was displayed (figure 4.15b). This showed a large number of bone fragments in D12, a moderate number in C82 and a low number (1-13) in the remaining grid squares (see figure 4.15a for location of grids).

Fore limb bones were found in the greatest numbers in D12 and C82 in a similar proportion to the rest of the pig bone, except the radius, which was not found in C82. Hind limb bones are found in very low numbers (figures 4.15c and 4.15d), but in similar proportions to the rest of the bone. This suggests that the bone elements were not segregated in one area or hollow, but were scattered. Pelves and femoral fragments were found in the same grids, suggesting that they had not been widely distributed before deposition. However, the large size of the grids (100m^2) means that results based on analysis of the extent of bone element distribution in layers are less significant than for pit deposits.

4.6.1.2 Cattle

Cattle bone fragments for the late phase have a similar distribution to those of pigs (figures 4.16a and 4.15b). Grids D12, C73 and C82 contain the most cattle and pig bone. The forelimbs are dispersed across the area, in similar proportions to the total numbers (figures 4.16a, 4.16b and 4.16c). However, the humerus and scapula fragments are concentrated in different grids (C82 and D12 respectively). This suggests that these carcass elements had been spread widely before deposition, although the numbers of bone are too small for firm conclusions.

Cattle pelves, tibiae and femora are spread across the area evenly (figure 4.16d), so it is not possible to suggest that the carcasses had been extensively distributed after preliminary butchery. However, the large size of the 10x10m grids means that carcasses could still have been widely scattered prior to deposition.

4.6.2 Early phase

4.6.2.1 Pig

There were very few bones in this sample, only seven fragments in two grids. These both included ‘meaty’ and ‘waste’ bones in equal proportion (table 5.1 defines bone as of high, low or medium meat value; here those of high and medium meat values are called ‘meat’ bones, and those of low meat value, ‘waste’). There were not enough examples to investigate the extent of bone dissemination.

4.6.2.2 Cattle

Cattle bones were found in five grids, although a total of only 25 bones was recovered in this period. When all cattle bone fragments were displayed there appeared to be a concentration in two grids, C71 and D12 (figure 4.17a). When ‘meat’ and ‘waste’ bones were displayed, the concentrations remained in approximately the same positions, but with more ‘waste’ bones in D22, and more ‘meat’ bones observed in C72 (figures 4.17b and 4.17c). Unfortunately, this sample is too small to draw any conclusions.

Cattle humerus and radius fragments were not found in adjacent grids, with the humerus in grid squares C71 and C72 (figure 4.17d) and the radius found in grid D12 only. The separation of these parts could suggest the widespread dissemination of the carcass, although again the numbers are too small for any conclusions to be made.

4.6.2.3 Comparison between species in the early phase

Overall both species appear to show a scattered distribution of all parts, with no correlation between the humerus and radius. This suggests that the parts had been deposited after dissemination from the carcass and not directly after butchery/ eating. Small sample size hindered analysis, so the possible differential deposition of bones from more meat bearing parts of the cattle carcasses cannot be established.

4.6.3 Summary of pig and cattle bone in layers

Very small numbers of pig and cattle bone in the early phase make interpretations inconclusive. Although possible segregation of ‘meaty’ parts could be suggested, no conclusions are drawn here.

The majority of the bones are concentrated in the north-eastern part of the sample area. When species and bone element are considered separately, the observed pattern is unaltered. There is no evidence that certain bones were deposited in particular areas. Grid areas are too large to enable interpretation of the extent of distribution of the carcass parts, but there is no suggestion that skeletally adjacent bones are found together in deposits.

4.7 CONCLUSIONS OF TWO- DIMENSIONAL SPATIAL ANALYSIS

From the analysis carried out in Arcview, there is relatively little evidence for patterning across the hillfort at the broad level of the content of entire pits and the layers in $100m^2$ grids. In none of the distributions of bone elements did nearest neighbour analysis show a tendency to cluster; this would have indicated that pit content varied according to location. Nor is there any evidence that certain parts, for example ‘meat’ and ‘waste’ bone, were concentrated in particular areas. In general, the functional areas as defined by Cunliffe do not appear to contain specific carcass parts, but bone densities are instead directly proportional to the areas of densest concentration of pits or layers by phase.

The exception to this seems to be cattle and the less well represented animals in the early phase. Their bones are found outside the main area of pits, and in the case of cattle bone, often in large quantities (though not usually as articulated skeletons). This suggests differences in deposition between species, and perhaps that the pits with large numbers of cattle bone in them were specific repositories for this species (and maybe also birds). It may be that in the early phase cattle were more often feasted upon, so their bones would be more likely to be deposited in large quantities. This differentiation is not found in the late phase, suggesting that activities that had been taking place in the earlier period had ceased.

Special deposits are not found near the ‘ritual’ structure or ‘sanctuary’, but are in the early phase located outside the area of densest pit location, much the same as the cattle and bird bone concentrations. In the later period special deposits are found in direct proportion to where pits are most concentrated. Thus, in the early phase only, special deposits, birds and large quantities of cattle bones were placed in different areas to the majority of the bone. These deposits may have been produced by special activities that had ceased or lost their status by the late period.

Dogs are clustered in the same places as pig and cattle in all phases, which suggests no special status for this species.

Bones were often observed singly, and bones from the same primary or secondary butchery division (such as the feet or forelimbs) are not necessarily found together in the same pit or layer. The radius and humerus for instance are not consistently found in the same pits. However there is some indication that thoracic vertebrae are found in clusters within pits, and are less frequently found singly than lumbar vertebrae. This may be related to butchery or consumption activity, where the thoracic vertebrae are left in chunks and the lumbar vertebrae are split into individual chops.

There is no evidence that bone working had an effect on the distributions. Dumps of bone working waste could be expected to include cattle ribs, metapodials and femora (section 2.4.4), but no pits contained large quantities of any of these bones. Similarly, these bone elements were not noticeably absent, as would be expected had they been worked and taken off site.

The macro scale of this investigation may have obscured many patterns. In some cases, the amalgamation of numerous layers within one pit may have obscured the nature of the individual episodes of deposition that filled the pit. It is possible that the numerous layers filling individual pits have totally different characteristics to each other. Investigation of these layers separately may show more evidence of specific activities than pits as a whole, and this is the focus of the next chapter.