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Butchery evidence on animal bones

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Identifying and interpreting butchery evidence on animal bones is an important part of the analysis of bones from archaeological sites. This paper outlines the purposes for which butchery would have been carried out which can prove an aid for interpretation, this being related to one or other of those purposes. There is also some discussion of the type of evidence that may be found and the identification of that evidence. Interpretation must take account of the practical aspect of a range of butchery methods and the feasibility of meat utilisation under various conditions.

Introduction

With the growing emphasis on the study of animal bones from archaeological sites, it is important to observe and assess correctly the evidence of butchery. Signs of butchery are an indication that the bones are the remains of animals used for meat. There is, of course, the possibility that cutting or chopping bones was carried out as part of bone working and it is important to try to distinguish the difference between the evidence for bone working and butchery. Analysis of butchery evidence may indicate the method of utilising carcases which may add to the understanding of the general social conditions and activities of the place and time. Signs of cutting, chopping etc. on animal bones may be the result of:

(i) primary butchery - slaughter and dressing i.e. killing skinning or flaying and eviscerating; may also include removal of head and feet;

(ii) secondary butchery - initial division of carcase into the major cuts or portions, e.g. loins, legs;

(iii) tertiary butchery - reduction to household or pot- size pieces; (iv) utilisation for fat extraction; (v) bone working.

When assessing the evidence of butchery on animal bones it is obviously of great value if this can be related to one of the above categories, bearing in mind that categories (i) to (iv) will often overlap.

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Evidence of bone-working

Fine sawing of bones is almost certainly evidence of bone working. It is most unlikely that valuable saws would have been wasted on butchery, particularly as it needs a very good sharp saw blade with fine teeth to saw through long bones. Long bones from older animals are especially hard and require much effort to saw throuh, even with a modern sharp butcher's saw.

Most of the sawn bones I have seen from archaeological excavations have been cattle metapodials, the saw cuts on which must logically be assumed to be the result of bone working. This assumption is based on the following:

(i) there is no meat around metapodials - i.e. no reason for sawing for butchery utilisation;

(ii) removal of the feet can be effected quite easily by cutting the ligaments and tendons to separate the carpal/metacarpal joint or the tarsal/metatarsal joint;

(iii) splitting the bone for the removal of bone marrow can be achieved relatively easily using a chopper.

Indications £f butchery

Much of the butchery evidence indicates an extensive use of a chopper for primary and tertiary butchery and splitting bones for bone-marrow extraction. Evidence of chopping on bones may be seen in the proximity of the joint which could indicate the disarticulation of the limb. To conclude that such chopping was for the disarticulation of the limb, consideration must be given to the feasibility of the separation of the joint being effected by such chopping.

To arrive at such conclusions it is useful to estimate the direction of the chopping, bearing in mind the way in which the joint is held together. I have seen quite a number of cattle ulnae which have been chopped through starting at the shaft about 3 cm distal to the articulation with the humerus (Rixson 1971). The direction of the chopping is almost parallel to the long axis of the radius, angled slightly to the centre of the joint (Fig. 10). The effect of this chopping would be to separate the olecranon process, chopping through to the humero-radial-ulnari joint - a major step in disarticulating the joint. This joint is one of the most difficult to separate using a knife. It would therefore be logical for an experienced butcher to use his chopper in the way described above.

Another joint difficult to separate using a knife is the hip joint. It requires the blade of the knife, which must be thin, being manipulated into the acetabular socket to cut the ligament attached to the head of the femur. It would require only one blow of a chopper to cleave through the neck of the femur, providing the butcher's aim was true (Rixson 1978). I have chopped through the neck of a bovine femur with one blow using a 4 Ib (1.8 kg) chopper.

A good deal of the tertiary butchery was probably carried out using a chopper. The evidence for this is in the high degree of fragmentation of cattle bones from excavations. The effect of using a chopper, in many cases, results in the bone breaking rather than shearing with the only evidence of the use of a chopper being at the point of impact. It is sometimes observed that this chopping had been excessive, resulting in cattle bones being reduced to very small fragments. I have seen some cattle bone assemblages where even

the astragali and calcanae had been chopped into three or more fragments. A suggestion has been put forward that the purpose was for making soup (van Mensch 1974).

Fat extraction would also lead to fragmentation of the bones and bone working residue would also be fragmentary.

Some fragmentation could result after the bones were discarded. Ribs, vertebrae and some of the smaller bones may have become increasingly fragmented by scavenging animals although, in many cases, the scavenger would carry the bones off (note 1). Some fragmenting is quite likely to occur when the bones have become more fragile with the loss of collagenous connective tissue. This subsequent breaking of the bones may even have been the result of excavation but this should be distinguishable from the breaks that occurred when the bone was fresh.

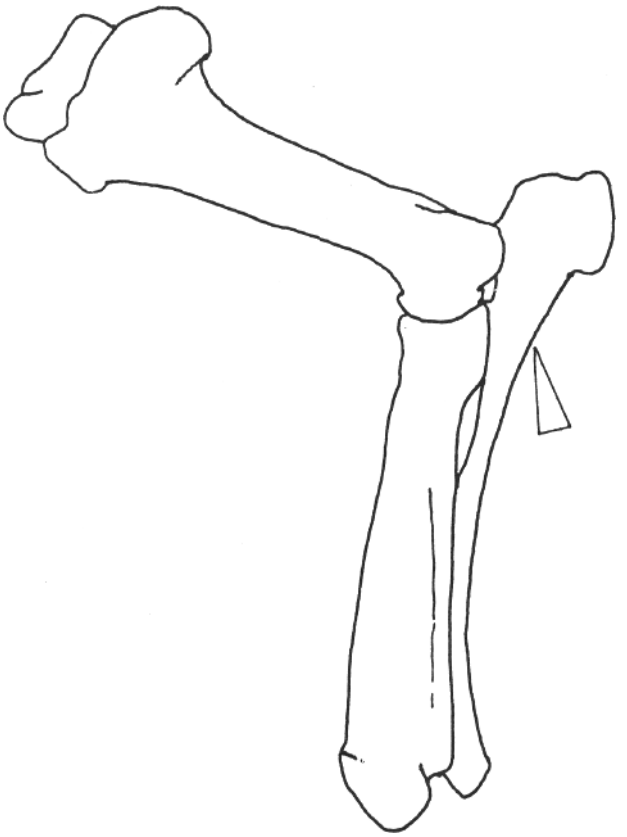


Figure 10. Location and direction of a single chopping blow to disarticulate the elbow.

There are indications that a chopper was often used to remove flesh from a carcase. Evidence for this is where the spinous process of the scapula (Rixson 1978) and the processes of the vertebrae were chopped through, probably to remove the flesh around these processes, leaving only the main body of the bone. Further evidence of a chopper being used to remove flesh is where chopper cuts are found on the shaft of a bone at a very acute angle or where the chopper has flaked pieces of bone from the surface. Chopping of the cancellous bone can be distinguished from a break by the smoothness of the cut surface and by this surface being level and even.

The chopper would often have been used to remove the horns from cattle, much in the same way as today. There is archaeological evidence for this from Roman levels at Billingsgate (Armitage 1974) and from medieval Baynards Castle (Armitage 1977), both in London.

If a carcase was hanging, the horns would need to be chopped from behind(i.e chopped in a caudal-cranial direction) but if the animal's body was on the ground, they could be chopped quite easily from either direction. Removal of the horns from the head would make it easier to separate the horns from the horn cores by boiling.

Removal of the bone marrow fat from the medullary cavity can be readily facilitated by splitting the long bones with a chopper. To chop a bovine long bone across the shaft is very difficult and sometimes impossible using only a light chopper, but by chopping the bone from the end it can be split sufficiently for the removal of the marrow.

Using the 4 lb chopper referred to previously, I have split femora from adult cattle with five or six blows. The method is to place the bone on a firm surface (a butcher's block, tree trunk - or something equally solid) with one end towards the butcher and chop through the epiphysis in a longitudinal direction to the bone.

Because there is only a thin layer of compact bone covering the epiphysis, the chopper will shear through this and the cancellous bone tissue causing the thick compact bone of the shaft to split more or less longitudinally.

Bone-working residue

It is important for the people recording animal bone to try to recognise the residue from bone working so this can be distinguished from butchery remains. To this end they should familiarise themselves with the type of products and the type of bones normally used and the probable methods used in bone working. It is unfortunate that, on some occasions, the animal bone analysts do not get to see the worked bone from a site as this is passed to some other specialist.

One form of bone debris which I have seen fairly frequently and have concluded to be a type of bone working residue, is the proximal end of a cattle metapodial, sawn with a very fine toothed saw through the shaft at right-angles, about 2-3 cm from the proximal end. There were also a few distal ends of metapodials sawn similarly, about 1-2 cm proximal to the epiphysial line (Rixson 1974). The evidence for sawing was the squareness of the cut and a few fine lines left by the saw on the cut surface. The cut surface on these pieces of bone had not been smoothed after sawing because on most there still remained a small flange on the edge of the bone where the saw-cut ended. I would suggest that these ends of the metapodials are the residue and that the shaft was the part used for bone working. The shaft of a metapodial enables thick straight even pieces of compact bone to be obtained. The shape and size of a metapodial shaft makes it ideal for use as a handle with the hasp of a blade being wedged into the medullary cavity.

A quantity of bone working residue was obtained from a 17th century context at Southwark, London; the main purpose of the bone working seemed to be the manufacture of dice. All the identifiable bone fragments of this residue were cattle metapodials. The method of manufacture of these dice seemed to be to split the shaft of the bone longitudinally to obtain fairly straight sections of bone and then shape these pieces

until they were neatly square in cross section. The piece of bone would then be sawn through at right angles, sawing off dice cubes from the shaped end.

Another type of bone working evidence that I have seen is sheep humeri that have been cut through the shaft squarely at right angles, about a third of the way from the proximal end. The squareness of this cut was effected by chipping a groove around the shaft of the bone until it finally broke along the line of this groove; the operation probably carried out using a chopper. I have also seen some sheep humeri scored neatly around the shaft with a knife. The intention here could have been the same as above. When fresh bone is scored this way and then given a sharp tap it can be broken along the scored line in the same way as cutting glass.

Carcase handling and meat preservation without refrigeration

In assessing evidence of butchery it is important to adjust one's thinking away from the modern methods of meat distribution and butchery practices to the situation in the past with its many problems that modern technology has eliminated.

One of the major problems would have been the absence of refrigeration. Documentary evidence from the past, and evidence from less developed countries today, indicate that most meat would have been consumed on the day of slaughter and certainly not more than one or two days after slaughter.

A statute of the streets of the City of London during the reign of Henry \l forbade butchers to 'sell any flesh that had been killed above three days in the winter and two days in the summer' (Hammett and Nevell 1929). Although hanging meat (especially beef) for seven to 14 days is recommended today to improve flavour and tenderness, this would have been generally impracticable without refrigeration. A point worth noting is that meat is more tender if cooked and eaten before rigor mortis has occurred; this takes about 12-14 hours after death in normal healthy cattle. Added to this is the claim by everybody I have spoken to from Africa and the Far East that, where meat does not undergo refrigeration, this meat has more flavour than refrigerated meat.

An obvious thing to do with meat in the absence of refrigeration is to hang it, allowing a good circulation of air. This would result in some partial drying of the surface, retarding bacterial growth and thereby slowing the process of putrefaction. If meat was left lying on a surface, the part in contact with the surface would more rapidly decompose and even sour (note 2). Because of the need to hang carcases, it would follow that the easiest way to dispense the meat would be to cut the flesh as required from the hanging carcase. This is a practice still common today in many parts of the world. This method of cutting meat as required from a hanging carcase would also have improved the keeping qualities of the meat. The longer meat is kept intact in large pieces, the slower the rate of bacterial decomposition because the maximum bacterial activity is on the cut surfaces. Therefore, the more delay there was in cutting a carcase into pieces, the longer it would remain palatable. Healthy animals slaughtered in unstressed conditions will have no bacteria in their tissues to cause spoilage ('a high proportion of sterile tissue samples can be obtained from normal healthy animals', International Commission on Microbiological Specifications for Foods, 1980). This means that, in most cases, bacterial decomposition will only occur on the cut surface where it will have become contaminated by bacteria. Bacterial growth requires moisture; therefore the drying of the surface of the muscle will retard bacterial growth. This drying can reach a point where bacterial growth virtually ceases.

I have hung a piece of beef for three days in an average temperature of 25 C. The surfaces became very dark and dry but, after the surfaces were trimmed, the meat underneath was in perfect condition and extremely palatable. There was a considerable loss from evaporation and, of course, the trimming but I am certain that this piece of meat would have been in the same condition after a week.

During the cooler weather of late autumn and winter, poultry and game will keep quite well without refrigeration if it is not eviscerated. These birds will need to be hung to allow air to circulate, in which case they will keep for at least two weeks.

Where carcase meat has a layer of subcutaneous fat, this will largely prevent evaporation of water from this muscle surface and the fat itself is not subject to the type of bacterial spoilage that occurs on muscle but will undergo spoilage by oxidation (causing rancidity) which is much slower than bacterial spoilage of muscle, especially in the fat of cattle and sheep. The soft fat of pork and poultry is oxidised more rapidly.

Drying strips of muscle has long been a method of preserving meat, e.g. biltong, the South African dried beef, charqui of South America, and pemmican produced by the North American Indians (Lawrie 1979). Biltong is still produced as a commercial product; in my opinion, it tastes good.

Drying the meat would often have been achieved by hanging strips of muscle in the sun. An alternative would have been to dry the strips of meat over a fire which is akin to smoking. Smoking meat has the added preserving effect, apart from surface drying, in that the smoke from the sawdust contains bactericidal agents such as formaldehyde and also inhibits fat oxidation (Lawrie 1979).

Salting meat was probably the principal method of preserving meat in the past and it dates back at least to 1000 B.C. (Lawrie 1979). From this need to salt meat to preserve it have evolved many of the cured products of today, e.g. the various types of bacon, hams and 'continental' type sausage. One can quite easily appreciate the development of York hams as a means of preserving pork in the farmhouses of the past. Whilst on a visit to the South of France I purchased some local sausage which I had hanging in a non-refrigerated space for six weeks (June/July) and it was still perfectly good to eat.

Potassium nitrate (KNO,) is used with salt (sodium chloride, Nad) in many curing recipes. Nitrate is converted to nitrite by bacterial activity and the nitrite has an additional effect in suppressing bacterial activity to that of the salt.

Variations in methods of_ butchery

Using a chopper to remove the flesh from the hanging carcase would have been most probable. Indeed, the intact carcase would be stable enough to chop through the bones as well as the flesh, chopping in a downwards direction, of course. When most of the flesh was removed from the bones, the remainder - bones with some flesh still attached - could have been chopped into pieces suitable for the stewing or soup pot.

Chopping a carcase down through the centre of the spine into two sides would not have become necessary for beef carcases until butchery had developed to the stage of cutting the carcase into separate joints, much as is done today. Evidence indicates that chopping cattle carcases into sides began about the 16th century. This could have been because

butchers had changed their method of butchery to cutting carcases into more clearly prescribed separate joints.

Coarse meat from older cattle would have been another factor in favour of cutting the meat, as it was required, from a hanging carcase, because there is much less variation in the quality of meat from the different parts of the carcase. This lack of variation of quality would be even more the case if the carcases from old cattle were plain (i.e. lacking in fat).

Slaughtering animals

Before the advent of railways, the way that most animals moved about the country (including their journey to a place of slaughter), would have been by being driven on the hoof. For some animals, the journey to the ultimate place of slaughter could have been many miles taking several months e.g. droving cattle from Scotland or Wales to London (Bonser 1970).

Before the advent of the captive bolt pistol, the poleaxe was one method used for stunning cattle. In some of the big slaughterhouses established in South America for the meat export, a 4 lb. hammer was used for stunning cattle (Gerrard 1951). The pig mall was used for stunning pigs. This consisted of a large wooden ball on the end of a long handle, the pig being rendered unconscious by a blow on the head. The purpose of stunning was not only for humane slaughter but also to immobilise the animal so that bleeding was made much easier, especially if the blood was to be collected for food (note 3).

The bleeding of animals would commonly involve cutting into the neck of the animal and severing one or both the jugular veins and carotid arteries. Ritual slaughter (Shehita or Halal) results in the severence of both these blood vessels. The method for bleeding pigs is usually to cut the brachio-cephalic artery at the junction of the carotids.

It has long been the belief in the meat industry that, if the animal was not bled immediately it was killed, the muscles would contain high levels of residual blood that would be conducive to a more rapid rate of decomposition of the tissues. It was also the opinion that the heart needed to continue functioning to pump the blood from the body during bleeding. Research has found that it is the constriction of the blood vessels in the muscles that forces the blood from the muscle tissue and that the method of slaughter has no effect on residual blood in the meat (Warris and Leach 1978) and that there will be no difference in the amount of residual blood in the muscle in animals that are bled and those that are not bled at slaughter (Warriss 1978). It has also been established that the amount of blood removed from an animal will be the same whether the heart stops pumping prior to severing the blood vessels or continues pumping whilst bleeding occurs (Warris and Uotten 1981).

Standards of butchery

It is fairly certain that there would not have been a unified standard of butchery in the past. Even today, with a much higher level of organisation, universal means of communications and greater facilities for training, the difference in standards of skill and variations in methods of cutting are considerable. Marked differences in basic

butchery techniques could have been due to the type of person carrying out the butchery. At those times when the butcher's shop, as such, existed in the towns, the butcher would have developed the highest standards of butchery.

For the large household, like a villa, it was probably the task of one of the servants to carry out the butchery requirements for the household. The meat for such establishments may have been obtained as whole carcases or as live animals. There would also have been butchery carried out by the peasant farmer when he slaughtered one of his own animals; this could have been a somewhat crude form of butchery.

For many periods in the past, the flesh of the animal was a by-product of other uses of the animal such as dairy, wool production or draught. Under such circumstances the supplies would have been inconsistent and the quality generally poor. This would not have been conducive to a high degree of finesse in butchery techniques. Trow-Smith (1957) suggested that, apart from old animals, it was the sheep suffering with sheep pox or sheep scab rendering them unsuitable for wool that went to the butcher.

Simply to remove meat from the carcase and reduce it to pot-size pieces could have given rise to a chop-and-slash approach (not unknown today where hard frozen meat is being cut or meat is destined for a mincing or grinding machine). This approach should not imply a totally indiscriminate method because the butchery would always need to take into account the general structure of the carcase and the joints of the skeleton. Where meat was being chopped from a hanging carcase, it would have been important to keep the skeleton with its ligaments intact until the bulk of meat was removed.

Interpretation of evidence

Interpretation of butchery evidence must be considered carefully, especially in respect of the feasibility or practicability of suggested methods of butchery based on the evidence. I have seen it suggested that chopping through the vertical ramus of the mandible was carried out to remove the tongue. I am sure that the butchers of the past were brighter individuals than to go about the removal of the tongue in the hardest way possible. Simply to cut the tissues on either side of the tongue from under the mandible will enable the tongue to be removed, separating it from the head by cutting through the soft tissues at the root of the tongue and separating the joint between the great cornu and middle cornu of the hyoid bone. This chopping through the vertical ramus of the mandible is often accompanied by chopping through the diastema (Fig. 11). The purpose of this could have been to remove the ox cheek (masseter muscles) with the main part of the mandible, the only significant amount of meat of the head apart from the tongue. Alternatively, this chopping could have been part of the process to chop the head bones (after the removal of the meat) into pieces for boiling for fat extraction, etc.

Distinguishing between cuts in a bone made by a chopper and cuts made by a knife is not always easy. Many light cuts are made by a chopper in bones during butchery, due to a light blow or perhaps when the chopper reaches the bone after cutting through flesh or other bones, having lost much of its force. Cuts made by a knife will be very fine. In many cases where a knife is used to bone out a piece of meat or disarticulate a joint, there will be very little more than knife cuts into the periosteum or the articular cartilages which, of course, will have disappeared from archaeological bones.

The possibility should not be discounted that some of the chopping marks on bone could have been the result of a miss-hit by the butcher or even a less than discriminating application of butchery.

Fragmentation of bones beyond the needs of normal butchery is mostly considered to be the result of fat extraction. The possible alternative is the chopping of bones for soup, broth, etc. (van Mensch 1974). Some of the layers from a site at Southwark (London) yielded a large quantity of cattle bone that was extremely fragmented by chopping. The degree of fragmentation was more extensive than is normally encountered, with the extremities of the bones having been chopped into small pieces and even the calcanea, astragali and central tarsi chopped into three or four pieces. There are many other examples of this process from Roman towns in Britain, Holland and Switzerland.

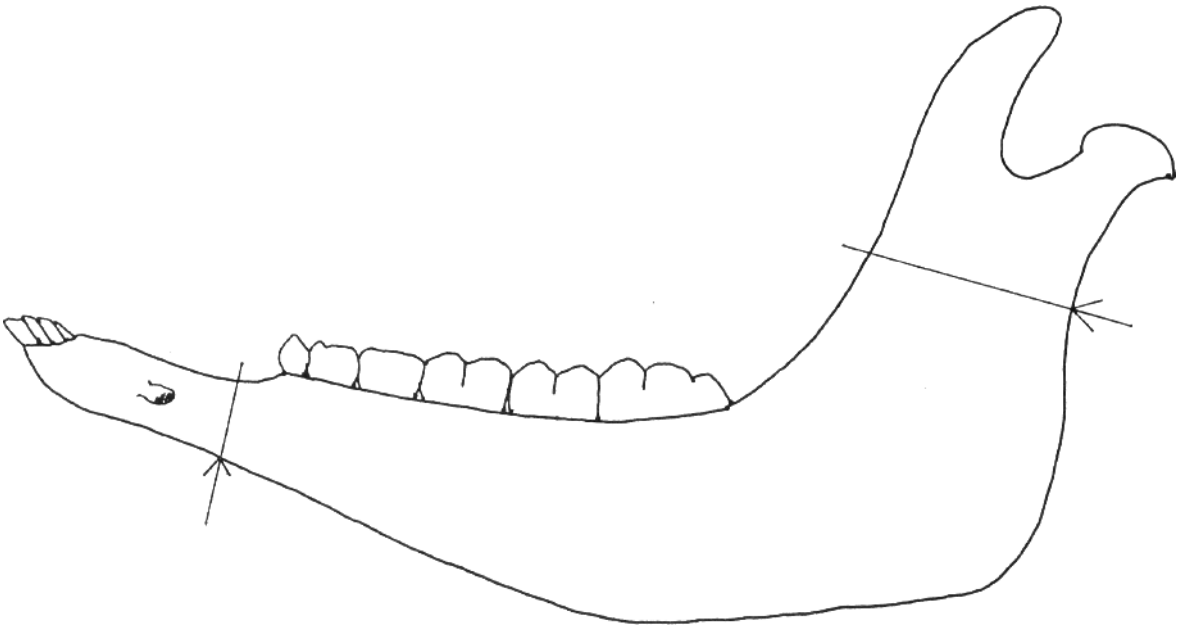


Figure 11. Butchery evidence on a cattle mandible. Chopping across the diastema and the vertical ramus may be the result of the removal of the mandible and of the cheek meat from the skull.

The ends of long bones, tarsals, carpals, ribs, vertebral bodies and sternum would not yield as much fat as the marrow of long bones but would produce a rich broth with a high protein content.

Before a firm conclusion is put forward in a report, the weight of evidence should be significant enough to support such a conclusion. It is always a temptation to try and make too much of a small amount of evidence. The following is taken from a bone report:

> 'The proportions of the different parts of the skeleton are not such as would result from differential preservation. They are consistent with large-scale organised slaughtering such as one would find at a modern slaughterhouse in that (a) the bones represent almost entirely the inedible or less edible parts of the animal; (b) all the horns seem to have been removed elsewhere and (c) there is a very consistent pattern of breakage of leg bones.'

The animal bones from this site represented a minimum of 12 cattle, two sheep/goats and two pigs. What would be described as a large modern slaughterhouse would have a throughput of 200-500 cattle per week.

In another report the suggestion was made - 'knuckle end of shoulder seems to have been the favourite joint'. This was based on the discrepancy between the proximal and distal ends of the sheep humeri and radii excavated, i.e. 17 distal humerus, 2 proximal humerus, 3 distal radius, 17 proximal radius - a somewhat tenuous conclusion from this evidence.

One should also take into account conflicting evidence, e.g. the number of bones that do not conform to the evidence. I have, for example, seen cattle vertebrae from a Roman British Site which were chopped longitudinally, a fact that could be taken to indicate that the carcases were split into sides; these were just the bodies of the vertebrae. There was an even larger number of vertebrae chopped at varying angles to the line of the vertebrae. This variable direction of chopping the vertebrae indicated to me the probability that this chopping was the final butchery, reducing what was left of the carcase to pieces suitable for the pot. This would put this type of butchery into the tertiary category rather than secondary butchery which would have been the case if it could have been concluded that the carcases had been split into sides.

When considering evidence as indicating a slaughter point, it should be borne in mind that the slaughtering process is somewhat obnoxious and causes unpleasant smells. It is most unlikely, therefore, that a slaughter point would be sited close to the better-class living areas. There is also the question of the disposal of the unwanted products of the slaughtering process. The major product that would need disposal is the stomach and intestinal contents, which is about 15% of an animal's weight (e.g. 37.5 kg (82.5 Ibs) of the body weight of a 250 kg (550 Ibs) bovine). The simplest solution would be disposal close to the point of slaughter: a convenient river, for example. The only use for these contents would be as fertilizer. The stomach and intestines may have been used as food, but this would depend on the eating habits of the people and whether meat was plentiful or in short supply. Usually an abundance of meat results in the less palatable products of the animal being discarded.

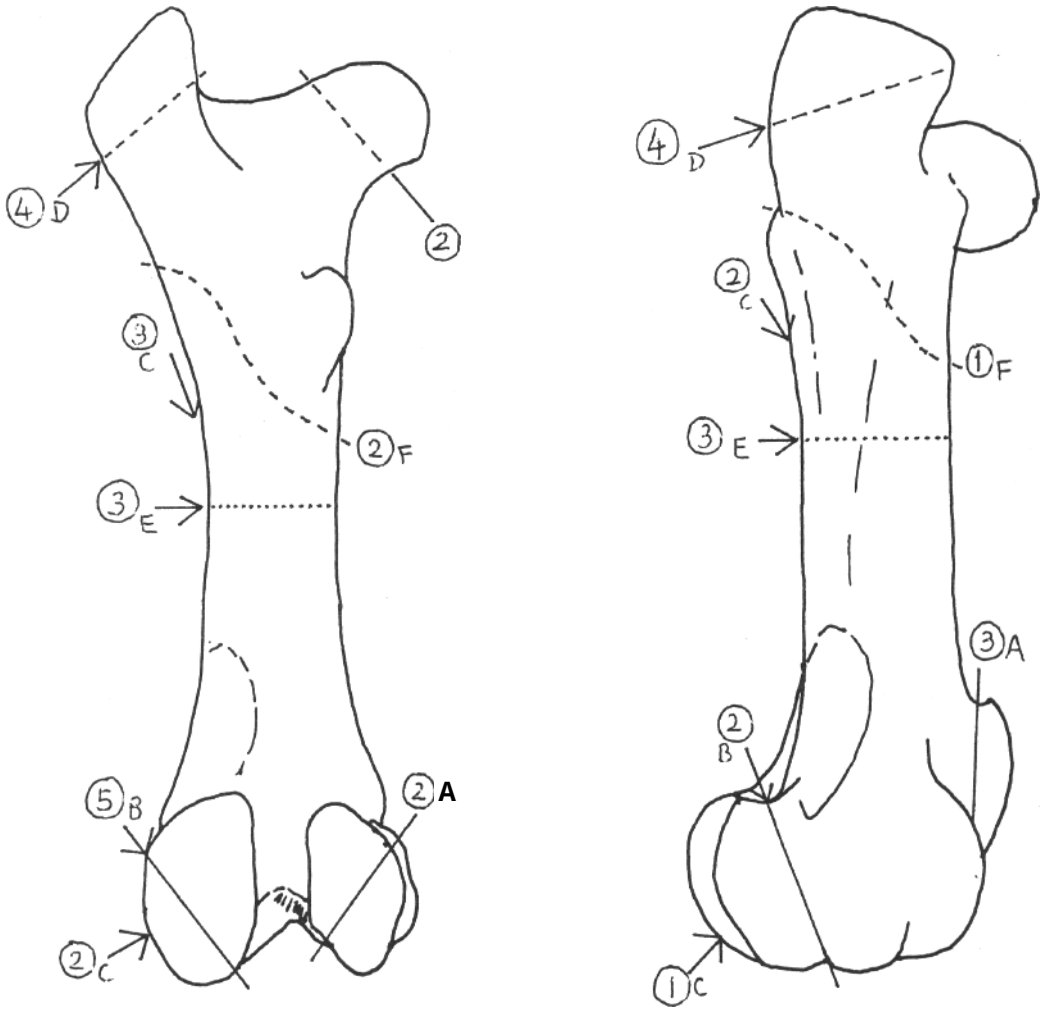
> During the 14th century in London it was a practice to cart offals from the St Nicholas Shambles to a jetty on the Thames called 'Butchers Bridge' where Beadles of the Butchers' Company supervised the dumping of these offals into the river (Hammett and Mevell 1929).

Stomachs and intestines may have been used to contain food preparations, e.g. intestines used as sausage casings or stomachs as containers for haggis. Sometimes stomachs and intestines along with other less popular offals would be used to feed carnivorous animals kept for hunting, sport etc. During the reign of Edward III, butchers providing entrails for feeding the king's bears were granted a piece of land near the Fleet Ditch (London) where entrails could be washed (Harnmett and Nevell 1929).

The evisceration of animals would have produced large amounts of valuable fat (gut fat - e.g. mesenteric and omental fat). This was probably the chief source of animal fat apart from bones. There are indications that, during many periods in the past, animals would have been on a low plane of nutrition and this would have resulted in very little fat covering the carcase or between the muscles.

Some of the by-products of animal slaughter would have provided the raw material for other industries, e.g. horns, hides and skins, metapodials for bone-working. This could have extended to such items as intestines for catgut, depending on the technology and requirements of the period.

Figure 12. Examples of composite diagrams showing the location (position of line), type (nature of line), extent and frequency (number in circle) of butchery marks observed on cattle femora.



A - sheared through the bone with no indication of the direction of the chopping (shear indicated by continuous line);

B - sheared through the bone with the direction of chopping determined by marks on the bone and indicated by the arrow;

C - chopping marks on the bone resulting in chips on the surface but not having sheared or broken the bone;

D - chopping causing the bone to break. Arrow indicates the direction and point of impact of chopper. Broken line indicates the line along which the bone breaks. Part shear indicated by continuous line followed by broken line;

E - bone sawn through. Sawing indicated by dotted line and direction of saw-cut shown by arrow;

F - break of the bone as a result of butchery or working, but no signs of chopping.

When writing conclusions for a report arising from evidence of butchery or bone working, the words used should be correct. It seems to be common in bone reports to write 'this was due to' or 'the reason for this chopping was', as if reporting fact rather than proposing a hypothesis. As true research workers, bone processors should only use such words as 'possibly the result of[1] or 'may have been due to', when writing conclusions or suggesting hypotheses. The most positive a conclusion can be proposed is in the words

'this was probably due to'. When setting out hypotheses in a bone report, all reasonable alternative hypotheses should be put forward for the reader to consider.

Recording butchery or bone-working evidence

To describe butchery evidence in words will often result in something complex and not readily understood by the reader. The most effective way is to show the position and direction of cuts, chopping etc. on a diagram of the bone (Fig. 12). By having sets of diagrams of the bones (two views of each bone and right and left limb bones), butchery or bone working evidence can be marked on the diagrams for each bone group of a site. The evidence could then be amalgamated on to one set of diagrams for larger groupings. In this way patterns may emerge giving clearer indications of methods of butchery practiced or, indeed, that no clear pattern exists.

Conclusion

The object of processing and producing reports on archaeological bones is to increase the knowledge of the animal husbandry and utilisation of animal carcases and their by-products in antiquity. To this end the bone reports can contribute most by the accumulation of data. The ultimate aim should be that the data amassed be as comprehensive as possible in covering all periods over the widest possible geographical area.

For all the data from all the reports to be statistically valid, there must be a commonly accepted method of processing and obtaining data and a universal method of recording and reporting those data. This would enable archaeological researchers to make comparisons between different periods or different types of site. It would also be reasonable to amalgamate certain items of data from a large number of separate reports.

Any method of recording and reporting needs to be:

(i) uncomplicated - otherwise it will increase the mistakes made by those using it or, if the method is very complex, many workers will not adopt it;

(ii) capable of recording the required data accurately,

(iii) relatively easy to read and comprehend.

Data that are readily understood and not misunderstood or ambiguous by all in archaeology, not just the few specialists, will contribute more to furthering archaeological knowledge.

Notes

(1) Concerning which animals will gnaw bones, I found some pig bones in a wood that were extensively gnawed and chisel-like marks indicated that the gnawing had to be done by a

squirrel. Cattle also have been known to chew bones to obtain calcium, and pigs, given the opportunity, would turn a midden over.

(2) Souring of meat can occur if there is not a free air flow over the surface of the meat while the temperature is still high after slaughter.

(3) Blood from slaughtered animals is highly nutritious and is used in the manufacture of products such as black pudding. The Scottish drovers were reputed to have mixed blood with the oatmeal and onions they carried as their main victuals; this blood coming from animals in their herd (Bonser 1970). The practice is still employed by the Masai herdsmen of Kenya.

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