OSTEOLOGICAL EVIDENCE OF CHANGE IN BUTCHERING TECHNIQUE.

Rita Larje

ABSTRACT

Data on butchering marks can yield information on prehistoric butchering techniques. A selection of cutmarks deriving from the various stages in the butchering process of caribou as conducted by the Nunamiut Eskimo (Binford 1981) is presented. Some examples from bone collections from Neolithic to Medieval times are given. Stress is laid on the importance that any bone collection to be searched for butchery marks should be as unbiased and as unsampled as possible. Systematically analysed and recorded cutmarks provide data which might reveal renewal or conservatism in butchery practice, and, give a basis for a more detailed picture of the use of animal products and greater insight into prehistoric economy.

Animal bone remains from prehistoric settlements usually consist of food garbage and the refuse from the manufacturing of tools from bones and antlers. These remains can yield important information about the fauna on the site and in its surroundings. Besides the basic data on species distribution the archaeological bone collections can provide information about the composition of the livestock and how the domestic animals were utilized as regards production of meat, milk, hides, hair and manure, raw material for tool making or the use of animals for traction or transport. The wild fauna can, apart from the obvious contribution of meat, also give information about hunting and fishing strategies concerning species chosen, time of year and type of catchment area.

Butchery marks on bones from both wild and domestic animals can also reveal how the animal carcass was treated once the beast was slaughtered. Only small animals could be prepared for consumption in one piece. Medium-sized and large animals had to be broken down into parts more easy to handle for the cook and more suitable for the pot. To get information about butchering strategies it is necessary to include a systematic recording of data concerning butchery marks in the analysis of the bone material.

During the last decade considerable attention has been given to morphology, patterning, and behavioral significance of such archaeological traces (Bunn 1981, Binford 1981, Potts & Shipman 1981, Shipman and Rose 1983, Toth & Woods 1989). The identification of cutmarks on fossil and archaeological bones has become an important tool in recognizing butchery or carcass-processing sites. To distinguish hominid-worked specimens from those damaged by other processes it is crucial that the marks found on bones can be verified to be either the cutmarks made with human tools or the marks inflicted on the bones by animal teeth (Sutcliffe 1970) or other non-hominid agencies (Behrensmeyer et al. 1986).

The partitioning of a carcass with tools will give telltale marks. Thus, the evidence for butchering lies with the bones themselves and bones from all parts of the body are important. The frequent occurrence of butchery marks on various skeletal elements can show how the carcasses were divided for meat distribution and consumption. It has to be remembered, though, that all cutmarks are not necessarily due to butchering for meat. Bone and antler also provide good raw materials for the manufacturing of tools and various other objects and, accordingly, will display a variety of cutmarks due to such activities.

The most distinctive feature of cutmarks is the presence of multiple, fine, linear striations which cut into, and orient longitudinally within, the main groove. The use of scanning electron microscopy (SEM) is recommended in order to distinguish cutmarks made by human tools from marks made by other agencies should there be any doubt about the origin (Potts & Shipman

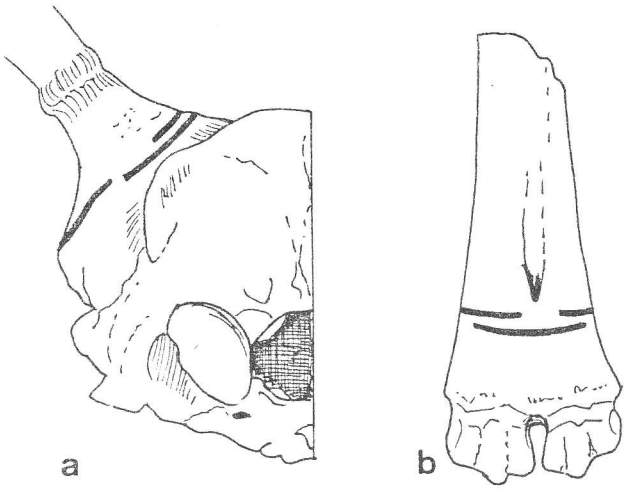

Fig 1. Marks from skinning on caribou bones. a) skull in posterior view b) distal metatarsal, anterior view (Selection after Binford 1981).

1981, Shipman & Rose 1984).

The pitfalls are numerous in the analysis of butchering marks. Bones can be damaged by many other processes some of which yield traces that mimic cutmarks (Shipman & Rose 1984). Special care has to be taken to differentiate those. Some of these alterations could be of geological origin like split-line cracks in dried bones, flaking, acid alteration and polishing (Miller 1975). Others could have biological origin. The bones could, for instance, be punched by the canine teeth or striated through the chewing action of carnivores (Sutcliffe 1970, Binford 1981) or gnawed by rodents or even chewed by ungulates (Sutcliff 1973). They could also be affected by burrowing insect larvae and roots of trees and plants. Striation due to trampling could have the same appearance as cutmarks even on microscopic level and can be hard to tell apart from marks made by cutting tools (Behrensmeyer et al. 1986). Examined under inadequate magnification even vascular grooves can mimic cutmarks (Shipman & Rose 1984).

Various cutting tools will of course make different marks. Stone tools leave marks different from those made by metal tools. Marks from flint knives tend to be short, occurring in groups of parallel stripes with an open cross section. Retouched molluscan shell knives are also feasible butchery tools and produce striations on bone similar to those produced by stone tools (Toth & Woods 1989). Most of the cutmarks made on bones with metal tools are almost hairline in size. They can be hard to see but this depends on how well honed the knife might be. The marks are generally quite long. Chop-marks made with an axe or a chopper occur on the surface of the bone but is also part of a fracture surface. The marks are wider and deeper than cutmarks and always absolutely straight. Traces of sawing have a characteristic appearance of a flat surface on which groups of more or less parallel scratches are present (Lauwerier 1988). The best way to learn to recognize and distinguish betweeen the different marks would be to do some butchering with the actual tools - that is, make a reference collection of cutmarks.

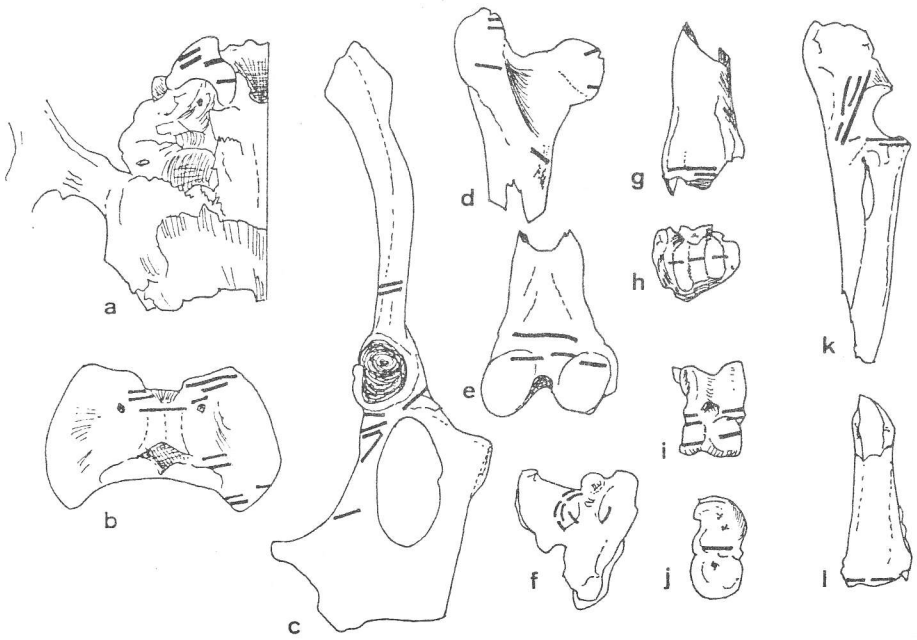

Fig 2. Dismemberment marks on caribou bones. a) skull in ventral view, marks from cutting off the head b) atlas vertebra in ventral view, marks produced when severing the head from the neck c) pelvis, right half in ventral view d) proximal tibia in ventral view e) distal femur in posterior view f) proximal tibia in ventral view g) distal tibia in anterior view h) distal tibia in ventral view i) talus in anterior view j) talus in medial view k) proximal radius-ulna in lateral view l) distal radius-ulna in anterior view (Selection after Binford 1981).

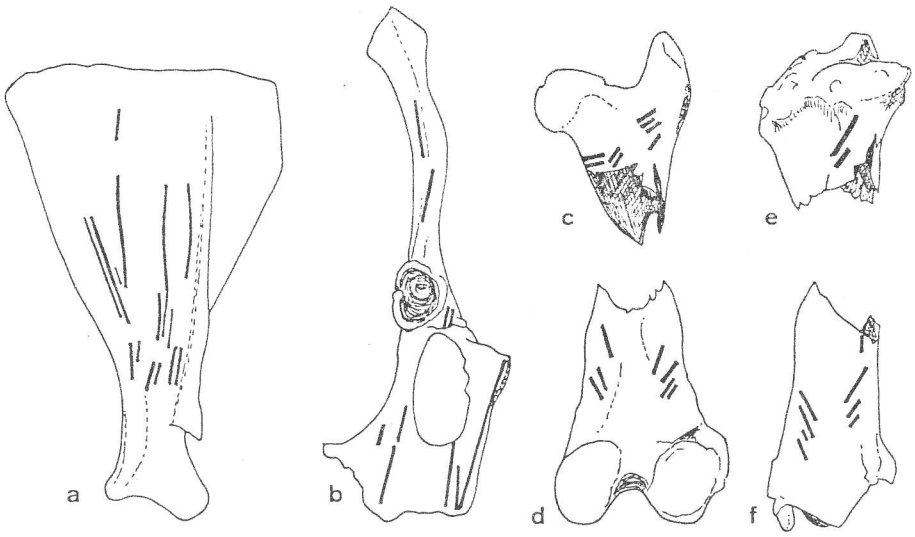

Fig 3. Filleting marks on caribou bones. a) scapula in lateral view b) pelvis, right half in ventral view c) proximal femur in anterior view d) distal femur in posterior view e) proximal tibia in medial view f) distal tibia in anterior view (Selection after Binford 1981).

Carcass-processing marks have been reported and described for many archaeological bone collections and the butchering strategy responsible for such marks has been suggested. However, very little systematic and comparative studies have been undertaken.

Guilday and coworkers (1962) presented guidelines for investigating butchering marks. They applied two criteria: 1. The mark should be repeated on specimen after specimen at the same location on the bone. 2. There should be some anatomically dictated reason why a particular mark should occur in any given spot.

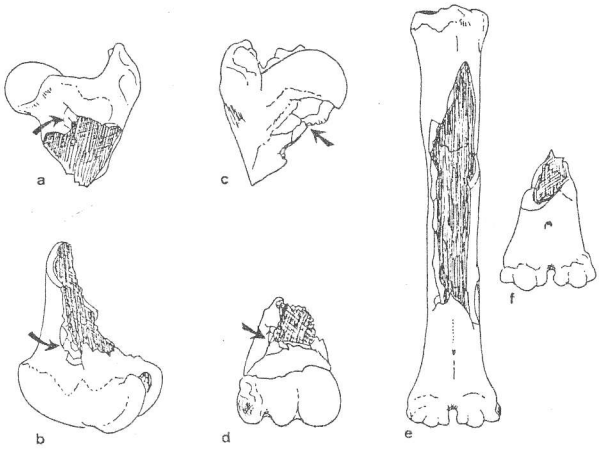

Fig 4. Impact scars and patterns of fracture on long-bone articulator ends. = impact zone. a) proximal femur in anterior view b) distal femur in medial view c) proximal humerus in medial view d) distal humerus in anterior view e) metatarsal in anterior view f) same as e) in posterior view, after impact removal (Selection after Binford 1981).

They also introduced the skeletal silhouettes as a graphic way of presenting data on butchering, highlightening the anatomical "hot spots". Modified silhouettes are often used by archaeozoologists, e.g. by Grant (1975) for the indication of main butchery points of cattle from the Roman context of Portchester Castle.

Binford has been studying the butchering procedures conducted by the Nunamiut Eskimo on caribou and moose and in his book "Bones. Ancient men and modern myths" (1981) describes and illustrates the variable patterns of bone breakage associated with different butchering tactics. He also presents a very useful inventory of described skinning and butchering marks with code numbers and references.

Another comprehensive Butchery Mark Code-Book - with numbered sketches of butchery marks per skeletal element - has been worked out by Lauwerier (1988) for the study of Roman bone collections in the Dutch River Area. The bones of cattle are taken as standard models.

These code-books on butchering marks are not covering all possibilities - except for the bone collections for which they were created. New locations of cutmarks will most certainly be found and added and such new cutmarks may of course reveal changes in carcass-processing procedures. Below is given a short description of the various stages in the processing of the animal body illustrated by a selection of typical cutmarks from Binford's studies. For a more complete picture of the patterning of butchery marks I refer to the works of Binford (1981) and Lauwerier (1988).

Cutmarks derive from different stages of processing of the animal body. The sequence followed is almost

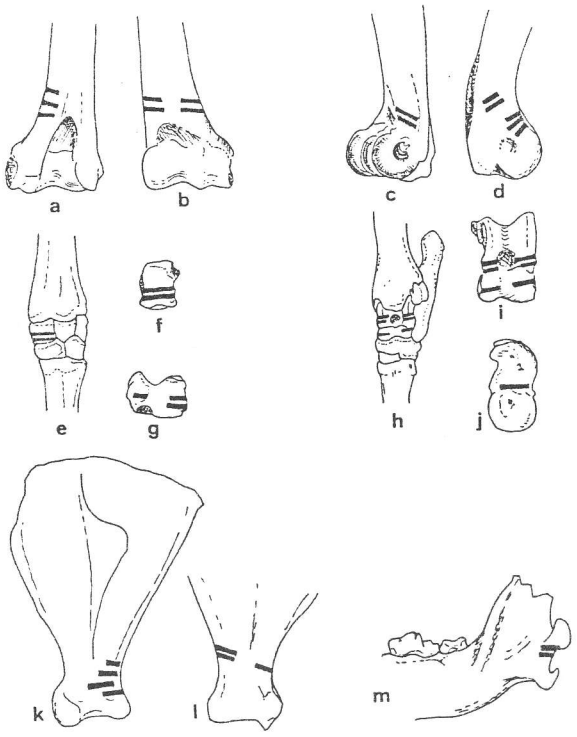

Fig 5. Neolithic pattern of cutmarks on limb bones, shoulder blades and mandible (Paradeisos, Greece). a) distal humerus of sheep in posterior view b) distal humerus of sheep in anterior view c) distal humerus of sheep in lateral view d) distal humerus of sheep in medial view e) the carpal joint in anterior view f) close-up of the great carpal bone (carporadiale) in anterior view g) same as f in medial view h) the hock joint in anterior view i) close-up of talus in anterior view j) same as i) in medial view k) scapula of pig in lateral view l) same as k) in medial view m) mandible of dog in lateral view (ramus broken off) (From Larje 1987).

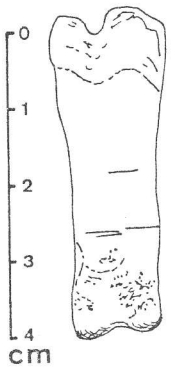

Fig 6. First phalanx of sheep with skinning? marks from Neolithic Paradeisos, Greece.

always:

1. Skinning of the animal body
2. Dismemberment of the skeleton
3. Filleting and/or cutting up in smaller pieces of meat with bone
4. Splitting the bone for marrow extraction

There are mainly two places where the butcher will be likely to cut into bone to do the skinning; the lower legs and the head. On caribous butchered by the Nunamiuts Binford found cutmarks round the antlers and encircling cuts on the distal metapodials (fig 1). Skinning for skins differs from skinning as a stage of butchering. When the skin is destined for clothing manufacture, as much as possible of the animal is skinned out resulting in cuts around the phalanges, on the skull around the

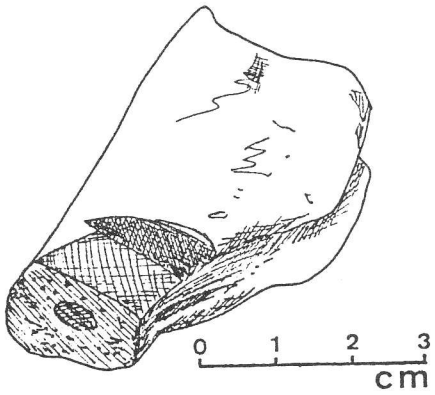

Fig 7. First phalanx of cattle with chopmarks from the Bronze Age fortress of Nitovikla, Cyprus.

antlers or horns and on the upper jaw and particularly along the margins of the mandible (Binford 1981, Grayson 1988).

Some of the more distinctive cutmarks are associated with the dismemberment phase (fig 2). This phase consists in most cases of disarticulation; hence, cutmarks will be found at points of articulation. Cuts on the occipital condyles and the atlas vertebra derive from the removal of the head. Dismembering the rear leg from the pelvis produces cutmarks around the acetabulum socket and the proximal femur. The foot bones are dismembered by cutting in the hock-joint. The result can be marks across the anterior face of the distal tibia or if the movement is somewhat lower the marks can intersect the anterior face of the talus (fig 2i). The knife may also "turn the corner" and mark the medial face of the talus (fig 2j). Dismembering in the carpal joint on the foreleg gives similar marks on the carpal bones (fig 5e-g) and distal radius. Primary butchering traces on the scapula seem to be restricted to marks that encircle the glenoid cavity. Disarticulation in the elbow joint gives marks on the distal ulna and radius as well as on proximal humerus.

Filleting is a second stage activity; animals are first butchered into basic anatomical segments, then filleted and/or cut up. Marks from removal of the meat from the bones are almost exclusively longitudinally oriented with respect to the bones. There are generally two types of cuts; long, bone-exposing cuts and shorter, oblique cuts made to the underside of the exposed bone to free it from the mass of meat and/or sever muscle insertions (fig 3). The most abundant filleting marks are to be expected where the bone is irregular in shape and thus gives problems for the carver. The cutting up can be done with an axe, a chopper or a saw.

To extract the marrow the bone has to be split open. This is done by application of a blow with some heavy

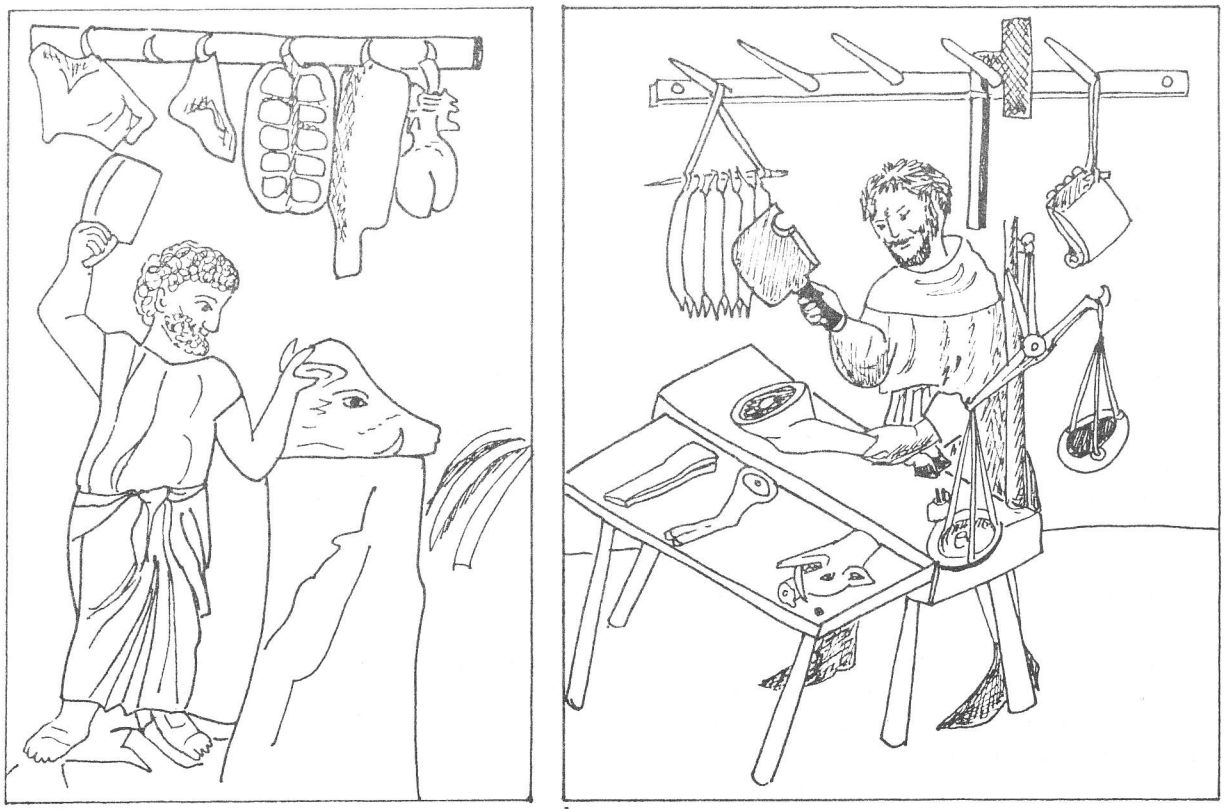

Fig 8. Pictorial evidence of butchering technique. a) Roman butcher from a grave stone relief (Drawing after Goodenough 1979) b) Medieval butcher in his shop (Drawing after Dahlbäck 1988).

tool or hitting against an anvil - but the impact has to be done on the right spot or the bone in question will not break in the proper way to leave a "clean" marrow, free of impact chips (fig 4). Prior to cracking the bone is cleaned of meat and tendons and in the area to be impacted the periosteum is removed - in order to ensure a controlled breakage. Binford also made a comprehensive study of the way the Nunamiuts conducted the bone-breaking. It differs with respect to which skeletal element is to be broken. He also studied the broken bones for marrow cracking marks which involves impact zones with cracks and spiral fractions. The fact that long bone shafts are broken is not evidence enough to imply marrow consumption. Trampling and carnivore gnawing has been reported (Binford 1981) to result in similar bone fragmentation.

It is unlikely that a uniform system of butchering would exist over large areas or long periods of time and the study of cutmarks provides an opportunity to find the similarities and differences. Skinning and dismembering strategies will mainly be determined by body anatomy but filleting and cutting up might have been a matter of available tools or preference of special meat cuts. Marrow-breaking tactics seem to follow a pattern dictated again by the morphology of the bones. In a bone collection it should be possible to differentiate between the use of various cutting tools and butchering strategies through the appearance and distribution of cutmarks. To illustrate the kind of data available in various bone collections I will present a few examples from my own experience.

The Neolithic farmer/hunter from Paradeisos, a site in Aegean Thrace, partitioned the animal carcass with flint knives by dismembering in the joints (Larje 1987). Comparably few cutmarks were found which to some extent could depend on poor bone surface preservation. The scarcity of cutmarks could also indicate the skill of the butcher and his profound knowledge of where and how deep to cut. The illustrated cutmarks (fig 5) were all interpreted to be dismembering marks connected with the severing through muscle attachments, although some obliquely running cuts on a pig's scapula and a humerus of a sheep could be filleting marks. Long bones were fractured in a way that suggested the consumption of bone marrow but any reconstruction of bone cracking technique was seriously hampered by the fragmentation of the material. A phalanx of sheep exhibited marks presumably due to skinning (fig 6).

A chopped off first phalanx of cattle from the fortress of Nitovikla in northern Cyprus (fig 7) is a Bronze Age example of the use of a metal cleaver to cut through bone (Larje 1992).

The Roman food refuse from Carthage (Larje, currently in analysis) gives a striking impression of being very modern concerning the way of butchering and different from the Neolithic bones. Chop-marks are dominating and marks from dismembering the animal body in the joints prior to the partitioning into meat cuts are hard to find. The use of choppers is demonstrated by butchers on Roman paintings where you can also see the different cuts of meat hanging from the wall (fig 8a). The modern feature is demonstrated by chopped off distal humeri which very much resemble the bone refuse of a recent hock of pig. The legs of lamb are chopped off across the distal metapodials leaving the meatier part of the legs to be processed with the pelvis or the scapula. There is a strong resemblance between a Roman shoulder of lamb or pig and the modern equivalences. The modern leg of lamb also seems to have had its Roman counterpart. Many of the vertebrae have cutmarks dividing the vertebral body either vertically or transversely or both. A similar pattern is found in the modern refuse of chops of lamb and pig.

The Medieval butcher, verified by the pictorial records from that time (fig 8b), also chopped away on the animal carcass. The slaughtered animal was probably dismembered or cut up in anatomical parts before arriving at the butcher's and this particular picture shows a cow's rear leg being cut across the distal metatarsal.

Like his Roman colleague the Medieval butcher seems to have split the pig's head in two parts and then also to have split the mandible along the central symphysis. Both Medieval and Roman bone collections contain a high proportion of mandibles which have been cut through the symphysis.

The very informative Bayeux Tapestry describing the battle of Hastings in 1066 also has a food preparing sequence. Duke William and his followers will be served fowl on spits from the barbecue - heads and feet cut off. But before the bird they will get the fish which in this case are small enough to be served undivided (Setton 1966).

Lauwerier (1988) has found that in bone collections from Dutch Roman sites, vertebrae of cattle/horse size show a high frequency of cutmarks as opposed to those of sheep/pig size. He also recorded more than three times as many butchery marks on ribs of larger animals compared to smaller ones. To carry out a thorough investigation of butchering technique and processing of animal products it is obvious that all skeletal elements should be included in the study and use be made also of fragmentation data. Historical written and pictorial sources and old handbooks for butchers and bone-workers provide sources of valuable information. A comprehensive study of butchering techniques can provide data for a more detailed picture of the use of animal products and thus give us greater insight into the economy of investigated settlements.

References

Behrensmeyer, A.K., Gordon, K.D. & Yanagi, G.T. 1986 Trampling as a cause of bone surface damage and pseudo-cutmarks. *Nature* 319, 768-771.

Binford, L.R. 1981 Bones. Ancient Men and Modern Myths. *Studies in Archaeology*. Academic Press, New York.

Bunn, H.T. 1981 Archaeological evidence for meat-eating by Plio-Pleistocene hominids from Koobi Fora and Olduvai Gorge. *Nature* 291, 574-577.

Dahlbäck, G. 1988 *I medeltidens Stockholm*. Stockholms medeltidsmuseum.

Goodenough, S. 1979 *Antikens Rom. Dagligt liv för 2000 år sedan*. London, Solna.

Grant, A. 1975 The Animal Bones. In *Excavations at Portchester Castle I: Roman*, ed. B.W. Cunliffe, 378-408. Society of Antiquaries, London.

Grayson, D.K. 1988 Danger Cave, Last Supper Cave and Hanging Rock Shelter: The Faunas. *Anthropological Papers of the American Museum of Natural History* 66, Part 1. New York.

Guilday, J.E., Parmalee, P. & Tanner, D. 1962 Aboriginal butchering techniques at the Eschelman site (36LA13), Lancaster County, Pennsylvania. *Pennsylvania Archaeologist* 32, 59-83.

Larje, R. 1987 Animal Bones. In Paradeisos: A Late Neolithic Settlement in Aegaean Thrace, ed. P. Hellström, *Medelhavsmuseet, Memoir 7*, 89-118.

Larje, R. 1992 The Bones from the Bronze Age Fortress of Nitovikla, Cyprus. In G. Hult: Nitovikla Reconsidered. *Medelhavsmuseet, Memoir* 8, 166-175.

Lauwerier, R.C.G.M. 1988 Animals in Roman Times in the Dutch Eastern River Area. *Nederlandse Oudheden 12 / Project Oostelijk Rivierengebied I.*

Miller, G.J. 1975 A Study of Cuts, Grooves, and Other Marks on Recent and Fossil Bone: II Weathering Cracks, Fractures, Splinters, and other Similar Natural Phenomena. In *Lithic Technology. Making and Using Stone Tools*, ed. E. Swanson, 211-226,10 Plates. Mouton Publishers, The Hague, Paris.

Potts, R. & Shipman, P. 1981 Cutmarks made by stone tools on bones from Olduvai Gorge, Tanzania. *Nature* 291, 577-580.

Setton, K. M. 1966 900 Years Ago: The Norman

Conquest. *National Geographic Magazine* 130:2, 206-251.

Shipman, P. & Rose, J. 1983 Evidence of Butchery and Hominid Activities at Torralba and Ambrona: An Evaluation Using Microscopic Techniques. *Journal of Archaeological Science* 10, 465-474.

Shipman, P. & Rose, J.J. 1984 Cutmark Mimics on Modern and Fossil Bovid Bones. *Current Anthropology* 25:1, 116-117.

Sutcliffe, A.J. 1970 Spotted Hyena: Crusher, Gnawer, Digester and Collector of Bones. *Nature* 227, 1110-1113.

Sutcliffe, A.J. 1973 Similarity of Bones and Antlers gnawed by Deer to Human Artefacts. *Nature* 246, 428-430.

Toth, N. & Woods, M. 1989 Molluscan Shell Knives and Experimental Cut-Marks on Bones. *Journal of Field Archaeology* 16, 250-255.