Totem: The University of Western Ontario Journal of Anthropology

Volume 11 | Issue 1 Article 17

6-21-2011

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Keywords
fossil hominids, cannibalism, methodology

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Introduction

Over the past century, the question of whether or not fossil hominids were cannibals has been a hotly debated topic amongst archaeologists and physical anthropologists. It should be noted that the term "hominid" in this paper refers to the evolutionary systematic classification within *Hominidae*, thus not including the great apes that are classified as *Pongidae*. There has been a resurgence in the field to ascertain whether or not there is sufficient data to support or disprove this theory. This paper will take a broad comparative approach and address what cannibalism denotes, and how to tell the difference between animal carnivore marks on bone, to that of human modification on bones via stone tools. This paper will then look at various archaeological sites and analyze the data in order to discover the plausibility of cannibalism existing within the human lineage, before the appearance of the species *Homo sapiens*.

Defining Cannibalism

A common feature when reading information based on cannibalism among various authors is their lack of a clear definition of what they constitute as cannibalism. According to White (1992), archaeologists must first define how they interpret cannibalism in the archaeological record. This is a challenging first step, since cannibalism can exhibit various definitions;

> There is an absence of a clear definition of cannibalism, a practice encompassing an extremely broad and sometimes ambiguous range of behaviors. Cannibalism can include drinking water diluted ashes of a cremated relative, licking blood off a sword in warfare (Sargan 1974:56), masticating and subsequently vomiting a snippet of flesh (Brown and Tuzin 1983), celebrating Christian communion, or gnawing on entire barbecued limbs as De Bry depicts Caribs doing (1590-95). Accompanying these behaviors is a display of affect ranging from revulsion to reverence and enthusiasm (Meyers quoted in White 1992:8).

White (1992) suggests that for his purposes, cannibalism would be defined as the ingestion of the same species' flesh, or conspecific consumption. This paper will adopt this standpoint, and apply this definition to hominids in the archaeological record.

The next step in defining cannibalism is defining functional types of potential human cannibalism;

1) *Nutritional*
a) *Incidental*: survival (periods of food scarcity or due to catastrophes, i.e., starvation induced).
b) *Long Duration*: gastronomic or dietary (humans are part of the diet of other humans).
2) *Ritual, magic, funerary*: (in relation to beliefs or religion).
3) *Pathological*: [mental disease: parapathic defined by Reverte (1981); for political reasons, as referred to by Zheng Yi (1997), in China] (Fernandez-Jalvo *et al.* 1999:593).

According to White (1992) these areas can then be broken down further into subgroups such as aggressive vs. affectionate (consuming enemies vs. consuming friends and family), or endocannibalism vs. exocannibalism (consumption of individuals within groups vs. consumption of outsiders).

It should also be added that cannibalism in not exclusive to humans. Many species use cannibalism as a means of population control, as a source of food, or a demonstration of strength by a dominant member (Fernandez-Jalvo *et al.* 1999).

Carnivore Modification to Bone

It is important to note the difference in how bone can be modified by both human agency and animal carnivore damage. This fundamental division is not always clear in the archaeological record, but understanding the potential difference will help reduce errors made by anthropologists.

Binford (1981) suggests that variation in cut-marks on bone will not be significantly different between animal species, and that the tactics of large and small animals are similar when attacking bone. According to Binford (1981), animals will primarily prefer to attack the cranium, as well as the atlas vertebra, followed by the front leg, rear leg and concluding with the axial skeleton consisting of the cervical, thoracic, and lumbar vertebrae, sacrum, pelvis and ribs. These areas will be fought over first, and will usually encompass the whole of the disarticulated unit.

Animal modifications to bone are comprised of four characteristics: punctures, pits, scores and furrows (Binford 1981). Punctures (Refer to Figure 1) occur when bone is collapsed under teeth, leaving an imprint of the tooth (Binford 1981). This usually occurs on the distal ends of bone and results from bone gnawing rather than the chewing of meat (Binford 1981). Pitting occurs when animals progress from soft to hard bone trying to extract the marrow inside the cavity. This hard bone will not collapse, but will be marked and scared from the actions of the animal (Binford 1981). Scoring occurs (Refer to Figure 2) when bone turns in the jaw against the teeth, or when the teeth are dragged across the bone. These marks can sometimes resemble stone tool modifications; however, marks from stone tools rarely follow the contours of the bone (Binford 1981). Furrowing results in a hole in soft bone tissue due to repeated jaw action of the canines against cancellous tissue (Binford 1981). Soft tissue is "scooped out" which leaves a hole that continues up to the hard compact bone (Binford 1981). Binford (1981) also suggests

that parallel tooth marks and extensive modification in localized areas, such as the production of "windows" in long bone shafts, further indicate gnawing on bones via animals.

Human Modification to Bone

Human modification varies quite differently to that of animal gnawing according to Binford (1981). Humans use a crack and twist method of bone breakage that produces spiral fractures, as well as breaking long bones longitudinally. Pressure flaking is also evident, as well as polished areas and striations (Binford 1981).

Cut marks from humans usually fall into three categories: skinning, disarticulation and filleting. Skinning usually produces cut marks on the lower legs, phalanges, mandible and the skull. It should be noted that marks left by the skinning of skulls sometimes resembles that of animal scoring (Binford 1981). Disarticulation leaves cut marks along edges of long bone surfaces and/or surfaces of vertebrae or the pelvic region (Binford 1981). Marks that are parallel to the long axis of the bone or to flat pieces (for example the scapula) are usually attributes of filleting (Binford 1981).

Transverse cut marks are relatively rare except when encircling marks could be taken as evidence for skinning activities (Binford 1981). In addition, stone tools produce sawing motions that generate short, multiple parallel incisions on the bone, and as already noted, stone tools rarely follow the contours on the bone (Binford 1981).

It should be noted that these marks are modifications to animal bone by modern human populations; however, this broad comparative look can be applied to the archaeological record when searching for evidence of cannibalism among the Neandertals, or any other hominid species in the record.

Methods of Obtaining Data

Various anthropologists have cited a number of different ways in which archaeologists and physical anthropologists should conduct research so that they may identify cannibalism in the archaeological record. White (1992) suggests that archaeologists should look for surface modifications such as cut marks, percussion damage, fracturing or burning, as well as representation of human remains. Trinkaus (1985) suggests that archaeologists in the past related disassociated and fragmented bones with cannibalism in order for hominids to extract marrow and other soft tissue.

When anthropologists are searching for cannibalism in the fossil record, a site should consist of the following criteria in order to state a valid claim of cannibalistic activities;

1) Undisturbed archaeological context.
2) Precise excavation techniques and records, using three spatial coordinates for all visible objects, plus all fine debris.
3) Need post-cranial bones for butchering practices.
4) Detailed analysis of cut marks and bone breakage to deduce if human agency was the cause.
5) Detailed comparisons between human and animal remains.
6) Local burial practices which are needed to test the plausibility of secondary burial hypothesis as to cannibalism (Villa 1992:95).

There are a few problems with Villa's requirements though, since these are representative of an ideal set. Geological activities can shift artifacts within their primary context; in addition, several sites excavated in the late nineteenth/early twentieth centuries used poor excavation techniques (Harrold 1980). Some fossil remains, such as the Bodo skull and the Circeo I skull have no postcranial remains to continue the study of whether or not cannibalism existed at the site. Lack of faunal remains at a site would also inhibit the way Villa suggests to analyze cannibalism in the archaeological record. According to Harrold (1980), there are three problems when analyzing burials. First, there is generator noise, which implies that not all mortuary practices leave material residues, for example spoken rites. Second, transmission noise is the loss of information over millennia between the burial and excavation, such as soft tissue decomposing or climatic changes that destroy or damage burials. Finally, receiver noise is the loss of information during excavation, such as poor excavation techniques conducted in the past. Thus, Harrold tends to attribute "noise" with the loss of information when it is usually associated with the addition of information that makes certain analyses difficult to interpret.

Analysis of the Bodo Skull

In 1976, Asfaw discovered the Bodo skull in Ethiopia's Middle Awash Valley (Conroy *et al.* 1978). Both single and multiple cut marks found on the cranium have suggested to Asfaw and his crew that this was a case of cannibalism among *Homo erectus*. The skull is missing its cranial base, which has in the past, led researchers to suggest cannibalism. Cut marks however, are not indicative of cannibalism, which means on their own, cut marks cannot support or disprove this theory (Fernandez *et al.* 1999). Furthermore, a study conducted by White and Toth (1991) suggests that from an osteological point of view, the cranial base is very fragile and is often damaged or missing in the archaeological record. In addition, they also suggest that consuming brain tissue via entry of the cranial base is inefficient due to the covering of the nuchal tissue and associated structures such as the vertebrae (White and Toth 1991). Access to brain tissue would be more expedient if humans went through the cranium at either the frontal or parietal regions of the skull (White and Toth 1991).

There are cut marks however, along the parietal and frontal bones of the Bodo skull, and according to White (1986), the skull shows no sign of carnivore or rodent damage. The lack of postcranial and faunal remains however has led White and Toth (1991) to suggest that there is no clear evidence for cannibalism, but they also suggest that cannibalism cannot be ruled out.

Zhoukoudian Cranium

Another *Homo erectus* fossil that has been suggested as evidence of cannibalism comes from Zhoukoudian, China. This fossil assemblage was lost; however, Franz Weidenreich made several casts, drawings and photographs before this occurred (Campbell and Loy 2000). The composite cranium was pieced together from various fragments although much of the cranial base was missing, as well as the right temporal bone. The lack of the cranial base was suggested to be a result of cannibalism (Teuku 1981); however, as already stated, lack of cranial base does not necessarily denote cannibalism.

Analysis of the Engis II Cranium

The frontal bone of the Engis II neandertal skull has multiple striations in three sections 1-2 cm in length, which has led Russel and LeMort (1986) to suggest that these were continuous striations around 3-6 cm long, and the intermediate sections have eroded away (Refer to Figure 3). There are a number of subparallel lines over the left orbit that are arranged obliquely and measure 1cm long. Furthermore, cross-hatching is visible on the right zygomatic process of the frontal bone (Russel and LeMort 1986). In addition, the lambdoid suture has two groups of 15-20 striations each.

Russel and LeMort (1986) believe that the striations along the frontal bone were caused by human agency, but cannot be sure about the other marks. They believe that the incisions occurred near the time of death, but were not a result of defleshing or cannibalism. No reason was given as to why they did not believe the marks were not caused by defleshing or cannibalistic activities.

Analysis of the Circeo I Cranium

The Circeo I Neandertal skull was found in Italy's Guattari Cave in 1939, and for a number of decades was a symbol of Pleistocene ritual cannibalism which demonstrated spirituality and mortuary practice (White and Toth 1991).

Alberto Carlo Blanc, the man who found the Circeo I cranium, suggested Grotta Guattari was a ritual cannibalistic site;

> The skull bears two mutilations: one caused by one or more violent blows on the right temporal region that has caused conspicuous damage to the frontal, the temporal, and the zygoma. This mutilation points to a violent death, more probably a ritual murder. The other mutilation consists of the careful and symmetric incising of the periphery of the foramen magnum (which has been completely destroyed) and the consequent artificial production of a subcircular opening about 10-12 centimeters in diameter. A careful specific study by Sergio Sergi has resulted in a very definite statement on the artificial and intentional nature of the mutilation on the base of the skull; the technical basis

> for the statement leaves no doubt as to its validity (in White and Toth 1991:118).

The lack of other hominid remains, and the fact that the skull was found in a circle of stones further suggested to Blanc that this was a case of cannibalism. The skull was thought to have been murdered in a similar fashion as to the headhunters in modern Borneo and Melanesia (Blanc in White and Toth 1991).

White and Toth (1991) studied the Circeo I cranium and found no cut marks, no polish, no percussion damage, no conchoidal scarring and no bone peeling. They suggest that the 2.5 mm pit on the inferior orbital margin on the left zygomatic (Refer to Figure 4) was caused by carnivores, and that the pits and scarring on the right temporal region were also carnivore induced. White and Toth (1991) suggest that the marks around the foramen magnum were caused by a carnivore inserting its snout into the base of the skull trying to get at the endocranial tissue.

They also suggested that there is little to no evidence of human occupation at this site, and that the circle of stones that Blanc found was just an irregular cluster of fallen debris. In their opinion, the cave was just a hyena maternity den (White and Toth 1991).

Analysis at Krapina

Cannibalism at this location has been "supported" by various sources of information found by the excavation team. According to Trinkaus (1985), fragmentation of cervical vertebrae and occipital bones suggests the removal of brain tissue. Bones were also split longitudinally which suggests marrow extraction. Cut marks were found on several cranial pieces, as well as long bones. Some of the bones exhibited burning, and there were a number of bones disassociated from the individuals.

Due to the type of sediment the artifacts were buried in, the excavation team, which was local workmen and not trained professionals, had to use shovels and dynamite in 1906 in order to get at the material. This, according to Trinkaus (1991), was the reason why many of the bones were fragmented, which obscured the data collected. Cracks in the cranial vault were attributed to sediment pressure in which the fossils were deposited (Trinkaus 1991). Trinkaus (1991) further suggests that the longitudinal splitting of the long bones could be attributed to the orientation of the haversian system. He also stated that the cortical bone did not exhibit conchoidal or radial fracturing which is typical for marrow extraction.

Trinkaus (1991) was unsure about the cut marks, and did not know if they were caused from poor excavation techniques or stone tools; however, he did notice they were on places where modern hunting and gatherers place their cut marks. He also noted that only 6.8% of cranial bones and 0.5% of post-cranial bones were burned (Trinkaus 1991). These bones were only burned on one side of their surface, which he suggests were due to their close proximity to a hearth (Trinkaus 1991).

Analysis of Artifacts at Sima de los Huesos

The Gran Dolina site yielded six individuals along with various stone tools and non- human faunal remains (Carbonell *et al.* 1995). According to Fernandez-Jalvo *et al.* (1999) no complete crania were discovered, along with only limited components of the axial skeleton and long bone fragments.

Cut marks on the (ATD6-16) cranial vault correspond with large muscle attachments, such as the sternocleidomastoid (Fernandez-Jalvo *et al.* 1999). Cut marks and percussion marks were also found on various human fossils. A juvenile bone fragment (ATD6-69) has several strong impact marks along the zygomatic and orbital margin on the left side of the facial region (Figure 5); furthermore, some of these cut marks suggest incisions and sawing motions (Figure 6). Cut marks on the pterion (ATD6-60) show signs of having conchoidal scars (Fernandez-Jalvo *et al.* 1999).

Various rib bones have percussion marks and incisions that could suggest the separation of the intercostal muscles from the inner surface of the rib (Fernandez-Jalvo *et al.* 1999). Peeling and cut marks are evident on the radius (ATD6-43), and the long bone (ATD6-76) has spiral fractures at both ends, as well as percussion marks on both the posterior and anterior sides which could suggest multiple heavy impacts (Fernandez-Jalvo *et al.* 1999).

Fernandez-Jalvo *et al.* (1999) noticed small bones that would have contained very little marrow were unbroken for the most part. This trend was noticed among both fossil hominid bones and faunal remains. Conchoidal scarring was also evident on both human and non-human remains, as well as bone peeling. Cut marks on crania were also very similar and any differences on cut mark location were attributed to

differences in muscle attachments between the two groups (Fernandez-Jalvo *et al*. 1999).

Cut marks on the temporal and nuchal areas of the crania, as well as other facial bones were interpreted as meat extraction. Turner and Turner (1992) suggest that facial cut marks denote exocannibalism; the violence, destruction and consumption of a possible enemy.

Fernandez-Jalvo *et al*. (1999) suggest that there is more conchoidal scarring, adhered flakes and peeling at this site than modern cannibalistic societies (such as Mancos) because of the lack of fire control at this time. Fire helps to make muscle attachments easier to remove, thus reducing cutting and the breaking of bones (Fernandez-Jalvo *et al*. 1999).

Fernandez-Jalvo *et al*. (1999) concluded that cannibalism existed at this site because similar butchering techniques were found on both human and non-human remains. Furthermore, similar bone breakage for marrow extraction between the two groups and a similar pattern of discard between the two groups indicates cannibalism, not to mention butchering techniques that resemble those from modern Neolithic studies.

Discussion

Though the presence of cut marks on the Bodo skull could indicate a possible example of cannibalism, not enough supporting evidence is present. This argument can also be applied to Peking Man (Zhoukoudian) and the Circeo I skull. Detailed studies and scanning electron microscopy (SEM) examination techniques have failed to verify cut marks on Engis II that would suggest cannibalistic activities (Villa 1992).

The debate whether cannibalism is present at Krapina is an ongoing matter. Many cranial fossils exhibit cut marks on both the parietal and frontal regions; however, poor excavation techniques, the use of preservatives, and the lack of faunal remains obscure the archaeological data (Villa 1992). The presence of burned bone does not necessarily denote cannibalism according to Davis and Wilson, who suggest that bones can be burned in rubbish disposal or by accident (in White 1992). In my opinion, the dynamite used in the excavation process may have also been a contributing factor in the presence of burned bone at Krapina. In addition, Szuter (1991) suggests that cooking meat long enough to char the bone creates inedible food. Further research is needed regarding the artifacts found from this location.

Correlating the data collected at Sima de los Huesos and the ideal set proposed by Villa, cannibalism at this site is a strong possibility. This site was excavated thoroughly, and yielded numerous fossils both human and non-human. The six individuals at this site have been classified by Bermudez DeCastro (in Fernandez-Jalvo *et al*. 1999) as *Homo antecessor*. This species is considered to be a common ancestor of, and thus predates both *Homo neanderthalensis* and *Homo sapiens* (Klein 1999).

Abri Moula in France has also yielded cut marks on Neandertal remains; however, although the authors Defleur *et al*. (1993) suggest this evidence supports cannibalism, cut marks alone are not enough to support the practice of cannibalism at any site (Lyman in White 1992). This "supporting" evidence does nothing but demonstrate the paradigm of Defleur and his colleagues. It also demonstrates how even in modern times limited amounts of data and scientific methodology are being applied when they should not be, as was done in the past.

According to Arens (in White 1992), the discovery of a single incident of cannibalism at a site is interesting but moot. Rather, anthropologists should be interested in the practice if it was carried out repeatedly through time with social acceptance. The reasoning behind this theory is that the single isolated case of cannibalism could have been done out of necessity (i.e. starvation induced). Therefore, even if these sites did have evidence of cannibalism, multiple examples must be found that persisted through time and not just individual cases.

Fernandez-Jalvo *et al*. (1999) are unsure as to how long cannibalism persisted at Sima de los Huesos, or how many people participated in the activity. They suggest that this site should not be a case of starvation cannibalism if it occurred in a brief time span with enough animals to eat; however, if there were enough animals to eat and this activity persisted through time, then it is plausible of gastronomic cannibalism.

Conclusion

Aggressive cannibalism does occur in non-human primates; thus the practice cannot be excluded for ancient hominids (Villa 1992). Although cut marks and various other human modifications have been found among many sites containing hominid fossils, supporting archaeological evidence is not present at those

sites. The one site that does have a strong indication of cannibalism (Sima de los Huesos) is attributed to *Homo antecessor*. Therefore, based on this evidence, cannibalism did occur within fossil hominids, and is not limited to *Homo sapiens*. This is not to say that cannibalism is prevalent among all *Homo antecessor* individuals, only that cannibalism is present before the arrival of *Homo sapiens*. It is plausible however, that sites have yet to be found that further support cannibalism among other fossil hominid species, or that the limited (and possibly flawed) data at Krapina, or any other hominid site is indeed evidence of cannibalism.

Future Research

An individual's diet from when they were very young can be analyzed since dental tissue does not reform itself unlike that of bone tissue (Cox and Mays 2000). Diet habits are permanently documented when teeth are being formed from a very young age, and this cannot be changed as an individual grows older. Oxygen isotope ratios of land animals can be correlated with the oxygen isotopes of local water sources (Stephen 2000). Thus, oxygen isotope analysis of *Homo antecessor* teeth from may give an indication to whether or not endocannibalism or exocannibalism took place at Sima de los Huesos. A control group would be needed to carry out this experiment such as local burial practices or faunal assemblages. By comparing the different ratios of oxygen isotopes in teeth that form while in utero, archaeologists may be able to determine if the individuals who were consumed came from a different location then the indigenous group. Further research is needed on many of the sites discussed in this paper, including Sima de los Huesos.

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