Disarticulated and Disturbed, Processed and Eaten? Cautionary Notes from the La Plata Assemblage (AD 1000–1150)

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Introduction

The La Plata River Valley in northern New Mexico has a long history of precontact occupation with the population peaking in the Middle to Late Pueblo II period (AD 1025–1125). In connection with road improvements in the region, archaeologists from the Office of Archaeological Studies out of the Museum of New Mexico conducted testing, survey, and excavation. A report was published that details the analysis and interpretation of 67 burials and 3,542 disarticulated elements retrieved from 17 sites (Martin, Akins, Goodman, & Swedlund, 2001). In addition to this analysis, three disarticulated assemblages from sites LA 37592, LA 37593, and LA 65030 were analyzed by Turner and Turner (1999). The interpretations differ widely regarding these three assemblages, and these differences have been briefly addressed in two publications (Martin, 2000; Toll & Akins, 2012) and one dissertation (Pérez, 2006). In this chapter, a more complete accounting of the taphonomy and context of the three disarticulated assemblages is provided to highlight the complexities involved in the analysis and interpretation of fragmentary, disarticulated, commingled, and poorly preserved bone assemblages.

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Turner and Turner (1999, p. 24) have suggested that six taphonomic changes need to be present on disarticulated remains to be able to conclude that the deposit was created by the act of cannibalism. They state that the "taphonomic signature" of cannibalism includes breakage, cut marks, anvil abrasions, burning, missing vertebrae, and pot polish (although pot polish may be absent in some cases and is not always required). They state that "Although it is theoretically possible that some unknown form of natural, nonhuman taphonomic agency could produce an assemblage of human skeletal remains with these six features, it is unreasonable to believe that such a thing ever happened" (1999, p. 24). For each of the La Plata bone assemblages, Turner and Turner report breakage, cut marks, anvil abrasions (impact scars), and a lower frequency of vertebrae than would be expected for the MNI represented by each assemblage. Burning and pot polish were not found in all three deposits. Regardless, the short report on each of these sites concludes that the bone deposits were the result of cannibalism (1999, pp. 311–318).

A summary of the original analysis by Martin and colleagues (2001) is provided here to show how these two very different interpretations were formed. The LA 37592 assemblage has breakage and other characteristics considered by Turner and Turner (1999) to result from intentional dismemberment and cooking, but the cut marks are only on a few of the bones and some are questionable as to if they were made by natural or human forces. The bones also had less reduction and breakage than reported by other sites with cannibalism (e.g., White, 1992). Some of the disarticulated bones showed intentionality in their placement within the deposit, and this also does not fit the pattern noted by Turner and Turner (1999) for cannibalism. For LA 37593, the breakage is more likely due to the movement of burials in varying states of decomposition and dumping or tossing cobbles into the assemblage causing further breakage. The relocation of burials and bone elements could have occurred during both ancient times and more recent times with construction activities. Attributes of the disarticulated assemblage at LA 65030 are intermediate in frequency compared to the other two sites. Carnivores contributed to the breakage and disarray at that site, and redeposition damage, as at LA 37593, is also likely. Thus, cannibalism is not the most parsimonious explanation for any of these deposits.

Methodological Considerations

Faced with infinite causes of modification, a great deal of caution is necessary when evaluating breakage in a bone assemblage. Even seasoned analysts find it challenging to distinguish perimortem from post- or antemortem breakage. The assumption made by many is that if the fracture is smooth, the bone was fresh and damage occurred around the time of death. This section provides a brief summary of the methods used as taken from Martin and colleagues (2001, pp. 121–123).

Cut marks were examined under a binocular microscope (stereo zoom .7–4.5X) that provided information for distinguishing among marks produced by dental picks and other excavation tools, natural features of the bone such as blood vessel

impressions or indentations, and other marks from deliberate cuts. The following attributes were required before marks were recorded as cuts: (a) a V or V-like cross section and (b) at least two persons agreed they could be cuts. Other marks that resemble cuts but do not meet all these criteria were generally considered abrasions.

Butchering marks generally result from skinning, disarticulation, or filleting (Binford, 1981, p. 47). Cuts made with stone tools tend to be short, occur in groups of parallel marks (Binford, 1981, p. 105; Marshall, 1989, p. 17), and occur in low frequencies on bones of animals processed in replicative experiments (Marshall, 1989, p. 17). Marks closely resembling stone tool cuts can be produced by hoofed animals trampling a sandy substrate (Gifford-Gonzalez, 1989, pp. 192–193). Other agents reported to cause groove-like cut marks or slice-like scratches include excavators or preparators, carnivore gnawing, rodent gnawing, rockfall, water transport, and movement (Marshall, 1989, p. 12). The problematical cuts in the La Plata assemblage were flagged by adding a code to the modification variable indicating difficulty in interpretation of the exact nature of the morphological feature.

Fracture morphology and timing of breaks were also a challenging problem. Distinguishing perimortem from postmortem breakage is difficult, and there are different methods that can be used to aid in distinguishing these (Bonnichsen, 1983; Morlan, 1983). A great deal of consideration was given to whether certain fracture types are strictly human in origin and classified as forms of breakage (Marshall, 1989). Gifford-Gonzalez (1989, p. 188) favors a strictly descriptive typology rather than one imputing cause. She records three major break shapes for compact bone (transverse, longitudinal, and spiral) and notes the texture of the break surface as smooth or stepped. Her data (1989, p. 235) show that impact fractures (indicated by internal and external flaking) can result in almost any combination of shapes and textures.

Spiral fractures often can be found in ancient and fossil human remains (Myers, Voorhies, & Corner, 1980, p. 486). Human percussion, marrow processing, trampling, rockfall, carnivores, water transport, cryoturbation (freezing and thawing), and traumatic accidents have all been reported to cause spiral fractures. Similarly, spalling or bone flake removal has been attributed to human percussion and marrow processing, tool manufacture, trampling, carnivore gnawing, rockfall, water transport, and cryoturbation (Marshall, 1989, pp. 12, 20).

Experimental studies have demonstrated that bones exposed for about a year can have spiral fractures, longitudinal cracks, concentric flakes, and spalling from the outer surfaces after being stepped on by the experimenters (Myers et al., 1980, p. 488). Another analyst, amazed at finding recent, green-appearing and older dry spiral fractures on the same bone, proposed that the bone had absorbed enough moisture to fracture in a fresh manner and that bone deposited in cold and damp contexts could remain mechanically fresh for some time (Oliver, 1989, pp. 84–85).

In the La Plata analysis, alterations in each bone element were coded as cuts, splits, chops, percussion pits, grooves, impact fractures, spiral fractures, abrasions, snap breaks, scrape marks, peeling, crushing, or drilling (see White, 1992, pp. 119–162 for descriptions and photos of these kinds of alterations). These aspects of possible human processing were used to describe morphology rather than to attribute causation. Longitudinal fractures were coded as longitudinal splits and transverse fractures

as transverse splits based on morphology. To be an impact fracture, external flakes, notches, concentric cracks, or some definite indication was required. Postmortem breakage was noted as such and was not coded as a type of alteration.

Patterns of Breakage and Disarticulation at La Plata

Documenting the full range of taphonomic forces (both natural and cultural) that may have been at work to create disarticulated assemblages is critically important in order to avoid faulty conclusions. Without detailed taphonomic and contextual analyses, it is very possible to misinterpret the nature of the assemblage. Detailed taphonomic analyses of the fragmentary assemblages from the three sites (LA 37592, LA 37593 and LA 65030) demonstrate the complexity and difficulty in establishing and differentiating natural from cultural forces. It also shows the importance of reconstructing the full context of the disarticulated assemblages. The analysis of taphonomic changes in the articulated and mostly undisturbed burials from these sites revealed that it is possible to have some of the kinds of breakage that have typically been associated with perimortem cultural processing (e.g., spiral fractures, spalling, and cracked, broken, and missing bones). Because these taphonomic signatures are found on bones from largely intact burials, no one would suggest that it represents possible cannibalism. Yet, when these same features are found in disarticulated assemblages, they are more quickly assumed to represent perimortem cultural processing. The pattern of missing elements from "normal" burials is also crucial to document for sites where there are both burials and disarticulated remains because it is highly probable that some of these elements ultimately came from the intentional burials.

LA 37593: Ancient Excavations and Modern Construction

As detailed in the site report by Martin and colleagues (2001), the excavation of this site (within the confines of a highway construction project) revealed two room blocks, several large storage cysts, and a pit structure from the Pueblo II/III period (AD 1000–1150). The upper fill of the pit structure had a large disarticulated assemblage of human remains (2,049 fragmentary elements of the 2,204 from the site) (Fig. 1). A waterline passing through the fill of this structure scattered human remains across the site surface. Based on element side and type, the disarticulated human bones represent at least 17 individuals. These range in age from infants to older adults. Adults who could be aged and sexed (aged by maxillary and mandibular dental attrition relative to the burial population and sexed by size and morphology) include a female and a male between 15 and 20 years, a male between 25 and 29 years, a male between 35 and 40 years, and two females over 40 years of age. Other than the adults, elements from children between six and ten years of age are the most numerous (29 %). Elements highly susceptible to loss and movement

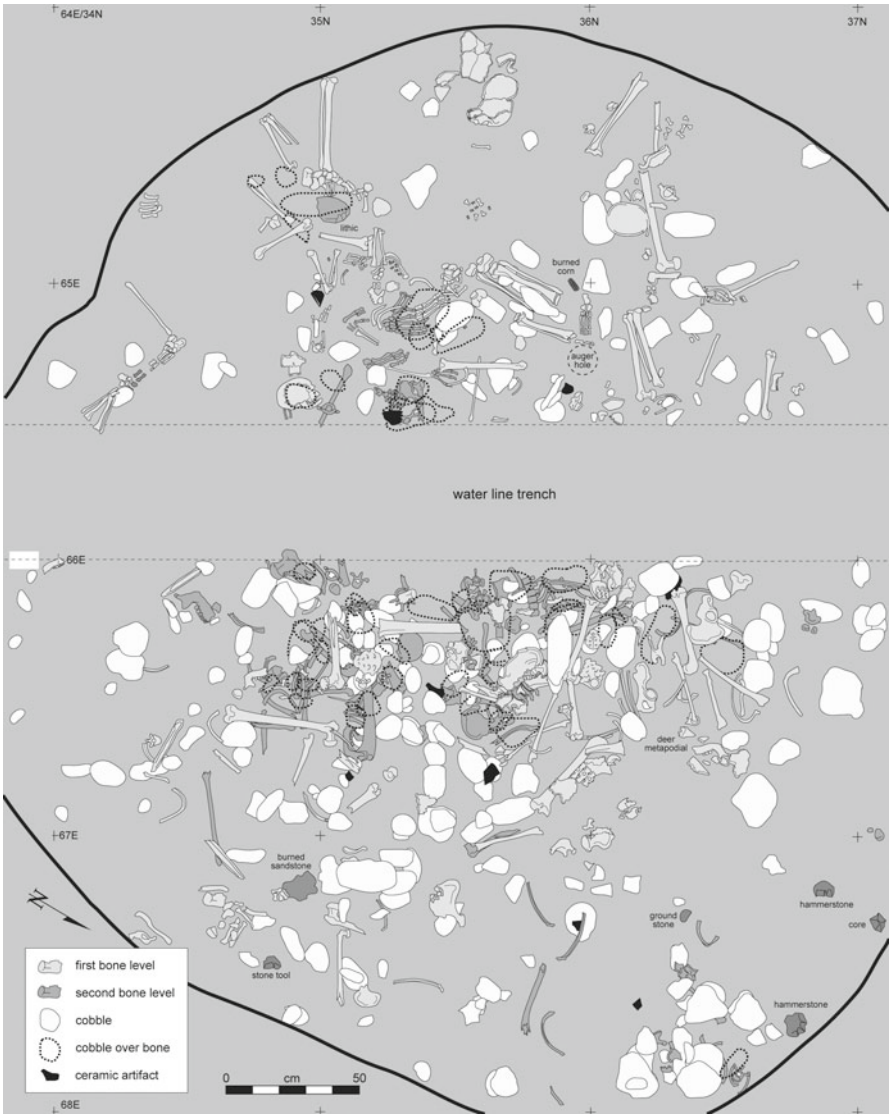

Fig. 1 Drawing of the disarticulated bone deposit located in the fill of a pit structure from site LA 37593. Courtesy Robert Turner, Office of Archaeological Studies, Department of Cultural Affairs, Santa Fe, NM

within a site due to normal taphonomic processes are relatively common in this assemblage. For example, 12 individuals are represented by metacarpals and ten by metatarsals (234 phalanges were recovered).

For the disarticulated assemblage as a whole, a small amount of carnivore damage was noted (2.6 %) indicating an additional source of disturbance at the site.

Complete postcranial elements are relatively common (32.8 %) with a slight majority representing less than half of the element (54.3 %). Unidentified elements account for only 16 % of the assemblage. Partial burning was recorded for three small pieces of bone that may or may not be human. Much of the alteration observed is ambiguous.

Subadults

Alterations on bones of children (individuals less than 15 years of age) are all spiral breaks ($n=5$ incidences). These occur on long bones (humerus $n=1$, femur $n=2$, tibia $n=2$) that tend to normally break in this manner. Alterations of elements from two 16- to 20-year-old females ($n=6$ incidences) are impact breaks of the parietal ($n=3$) and orbit area ($n=2$) for one individual and an impact break in the orbital region and a transverse break of a mandibular body for at least one other individual. For the first female, two adjoining pieces of the left parietal have a circular hole with a concentric crack along one edge. The bevel expands from the endo- to the ectocranial surface, and there is a radiating crack on the interior. The two orbital pieces articulate, with an irregular piece missing. Field photos of the grid demonstrate that this element is face down on a cobble in situ. The right parietal is essentially complete except for a half circle of bone missing from along the suture line. The adjoining piece of the left parietal has a small spall missing along the suture. Other pieces of this same cranium are unaltered. Except for breaks of the left parietal and frontal, it is disarticulated along suture lines (frontal and parietals, parietals, parietals and temporals), suggesting a postmortem natural process. Because the bevels are the opposite of what Milner, Anderson, and Smith (1991, p. 583) consider the result of lethal perimortem blows, the cranial bones quite likely were disarticulated or separated by natural processes. The adjoining levels of the grid from which these were recovered are full of cobbles. Thus, these fractures probably occurred when the bones and cobbles were tossed into the pit structure. The remaining bone elements from older teenagers (16–20 years old) include a mandible with a transverse break and peeling on the interior body just below the teeth and a parietal bone with a transverse break.

Adults

The majority of the alterations were on the adult bone elements. A mandible from an older female has a diagonal break, and an older individual has a transverse break of the mandibular body. The adult male element is a femur with a spiral fracture. Other adult cranial elements have numerous impact fractures. Of the 31 recorded cranial elements, 28 are small fragments (mostly parietal and occipital) often with bevels that expand from the endo- to the ectocranial surface. Two zygomatic arches have diagonal breaks where the posterior portion joins the temporal. Three cranial

elements have marks best described as abrasions. A left parietal has a 6-mm-long mark with a U-shaped profile and step on one edge and a fine parallel line perpendicular to the sagittal suture. Two impact breaks are within a few centimeters. A second abrasion is on a right parietal fragment. Four scratches, the longest 14 mm, again are perpendicular to the sagittal suture. An adjoining piece of the left parietal from the same cranium has fine random striae, concentric and pressure cracks, and at least one impact spall. The third has four small scratches on a frontal just above the orbit. Cracks radiate from a break just above the orbit and almost reach the striae.

Postcranial alteration of adult elements is mainly on long bones. These include impact breaks of the humerus ($n=2$), femur ($n=1$), and tibia ($n=1$); spiral breaks of the humerus ($n=2$), radius ($n=1$), femur ($n=7$), tibia ($n=2$), and fibula ($n=1$); and horizontal breaks of the radius ($n=1$), tibia ($n=2$), and fibula ($n=2$). One humerus with an impact break also has a number of small abrasions on the posterior and medial edge of the shaft above and perpendicular to the distal end. Four ribs have smooth diagonal breaks, a metacarpal has a gash near the distal end, and a calcaneus is missing much of the inferior surface from some sort of impact, possibly mechanical equipment.

The relatively low frequencies and types of alteration are consistent with the excavator's interpretation of the deposit as resulting from precontact human disturbance. The burials may have been encountered by ancient inhabitants while cleaning out an abandoned pit structure for reuse. It is plausible that rather than excavating for a new structure, the fill and contents of an existing structure were removed and redeposited in the upper fill of another abandoned pit structure (Fig. 1). This explanation suggests that the creation of the disarticulated and broken remains was largely unintentional or secondary to human activity involved in construction of a dwelling place.

Additional evidence for this can be found in the excavators' photos and notes that indicated that some of the bodies were still partially intact when moved, while others were not. Intentional removal of individual elements and dumping of these along with cobbles and other debris could account for the breakage and abrasions. Bone would have been relatively fresh so that digging implements and cobbles could have caused the impact breaks and abrasions. Transverse and spiral breaks could have also occurred at that time. Fill in this layer consisted of thin alluvial deposits. The abrasions could result from movement of the bones or cobbles within this layer.

Taken as a whole, the assemblage from LA 37593 appears to be the result of a set of circumstances involving the relocation of human remains across the site. There is little evidence to support a hypothesis of intentional perimortem human processing of individuals represented by fragments and disturbed skeletal elements. Data on site formation processes affecting LA 37593 instead strongly suggest that movement of a number of burials from one place to another during precontact construction activities, low-level carnivore activity, rodents, and modern construction activities can account for the patterning evident in the collection from this site. That at least 17 individuals are represented by bones of the hands and feet suggests that the re-interment process of many of these individuals occurred while limbs were still somewhat articulated. The lack of cut marks or longitudinally split bones rules

out intentional dismemberment of the individuals. Because of proximity to cobbles, the skeletal elements were most likely removed in concert with other debris in the excavation of a formerly abandoned pit structure.

LA 37592: Ritual Processing, Burning, Cannibalism, and Intentional Interment

The description and analysis of this site can be found in Martin and colleague's (2001) site report, but a brief synopsis is provided here. Site LA 37592 was occupied in several phases from the mid-1000s to almost AD 1200. A large deposition of disarticulated bone was placed in the uppermost fill of the only pit structure (or, also referred sometimes as a kiva) during the final phase of habitation (Fig. 2). This disarticulated assemblage (395 bone elements out of the 437 from this site) is very complex. Most of the bones are broken into small pieces, and many of the breaks are typical spiral or impact breaks suggesting that the bones were green when broken (White, 1992, p. 135). Also, many of the elements display a range of surface changes related to burning, and there are indications that flesh was present at the time the bones were burned. The fragments show a broad range of processing and alteration that includes longitudinal breaks, impact breaks, spiral fractures, peeling, cut marks, chop marks, abrasion, and hollowing of the long bones (White, 1992, pp. 146–150). In addition to this, the in situ arrangement of the bones appeared to be intentional and not random.

Excavation of the site revealed three small rooms and an underlying activity surface, a pit structure or kiva, several extramural features, and seven articulated human burials (dated to after AD 1050). The bulk of the bone assemblage (90.4 %) is from deposits dating to the early AD 1200s within the Pueblo III period (AD 1125 to 1300) with a few from Pueblo II (AD 1000–1125) deposits (4.6 %), and the rest undated (5.0 %). Between 7 and 10 individuals ranging in age from infants to adults are represented by the disarticulated remains.

Adult elements represent over half of the sample (58.6 %). Adults (using maxillary and mandibular dentition) include a male between 30 and 35 years of age, a male between 40 and 45 years, and a female over 40 years of age. Unidentified fragments make up a considerable portion of the assemblage (32.3 %). Few postcranial elements are complete (6.3 %) with most (80.0 %) represented by less than half of the bone.

Eighty-three elements show signs of perimortem alterations suggestive of human processing. Collapsed structural remains overlain by a layer of cobbles and dense trash characterize the fill below where the elements were found. While most of the bones were randomly scattered throughout, nestled among these was a carefully arranged broken skull cap with long bones resting or bundled within the skull cap. One other subset of fragmentary bones within this assemblage also seemed to be intentionally arranged (Fig. 2).

Some of the alterations on the LA 37592 bones are those that *can* occur through nonhuman forces (such as longitudinal and spiral breaks), but it is the patterned

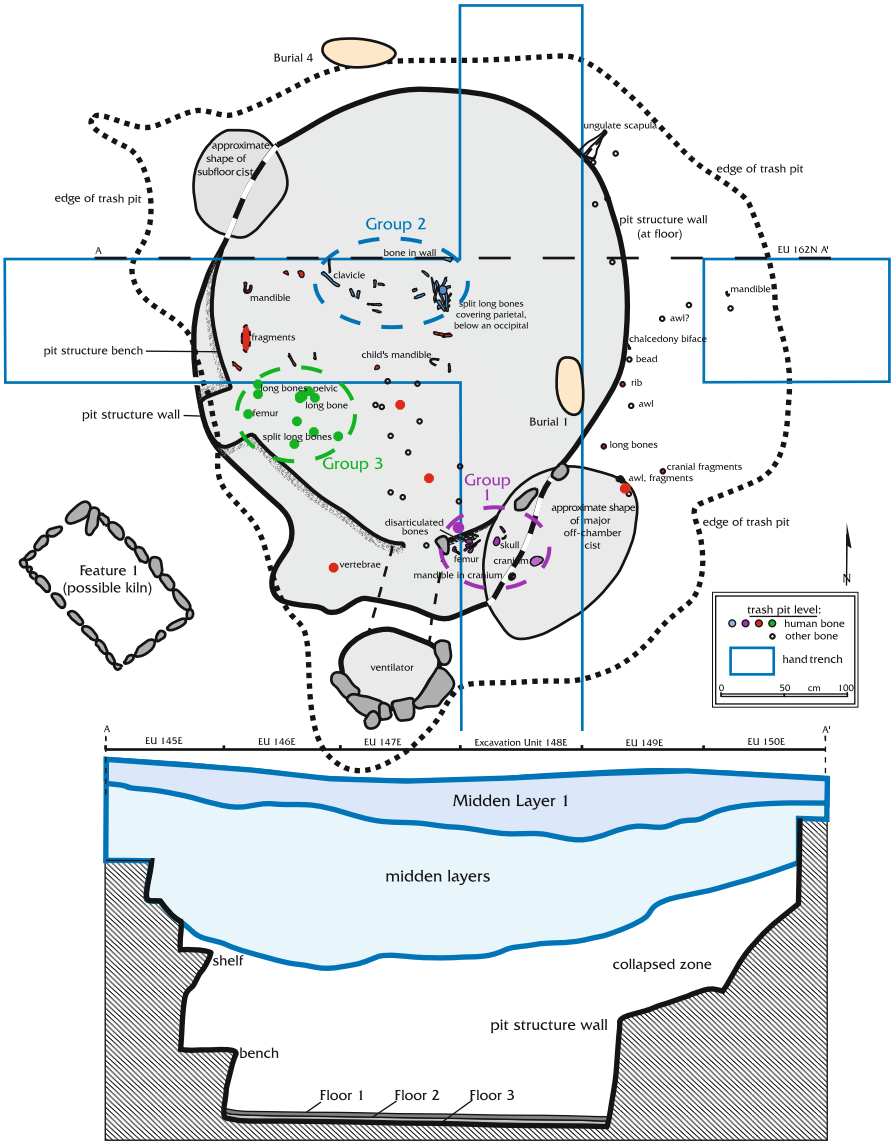

Fig. 2 Drawing of the disarticulated bone deposit located in the fill of a pit structure from site LA 37592. Group 2 shows evidence of intentional arrangement and placement of bones. Courtesy Robert Turner, Office of Archaeological Studies, Department of Cultural Affairs, Santa Fe, NM

location of these on long bones that suggest perimortem human processing. Cut marks, peeling, and abrasion are found on different bone elements, but the cranium and long bones have the most. Many of these bones have more than one kind of processing.

Subadults

Processing on the infant crania involves a series of four parallel cuts on an occipital fragment. The right lateral edge is broken, and the cuts extend from the break to about the center of the piece (5.6 mm). A small corner along the old break is burned. The burning occurred after the piece was broken and possibly after the bone had dried. The cuts are almost diagonal below the nuchal crest. White (1992, Figs. 19, 20 of Chapter 7) found similar cuts on adults from the Mancos assemblage. A partial mandible from a five-year-old child has an impact spall on the right side and a small peel on the inferior margin of the left side. The inferior and posterior edge is missing from the left side. In addition, the right side is lightly scorched, and a tooth (also scorched) from this mandible was recovered in an adjacent area.

A frontal fragment from a slightly older child (6–7 years of age) has small spalls indicating at least one impact break, striations suggestive of an impact in the area of the sagittal suture, and bite marks on the superior edge. The bites are small dents in both the endo- and ectocranial surfaces and could represent human or animal activity. Two halves of a mandible from a nine-year-old child were also recovered from two separate layers in different quadrants of the kiva. An irregular break separates the two pieces, and both have peels on the interior. A frontal fragment from above the orbits to the coronal suture, consistent in size and thickness with an eight- to ten-year-old child, has one long (29 mm) and series of shorter cuts (8 mm) in the location of the sagittal suture. White (1992, Fig. 6 of Chapter 7) shows nearly identical cut marks on an adult in the Mancos disarticulated assemblage.

A tibia shaft fragment from a child about the size of a 9-year-old has a longitudinal break. Elements from children in the 5–15-year age group, judged by size, surface texture, or unfused epiphyseal surfaces, are mostly small pieces of long bones (3 humerus, 3 ulna, 1 tibia, 1 unidentified long bone) but also include an orbit and a rib. The long bones have a spiral break, longitudinal breaks ($n=3$), impact breaks ($n=3$), and peels ($n=2$ rib and ulna). The orbit fragment has at least one impact break on the medial edge, and the lateral edge is crushed. Elements from the 15–20-year-old group include a femur and at least two tibiae. All have spiral breaks.

Adults

Two bone elements that could be assigned adult female are a fragmentary facial bone (part of the right orbit and the maxillary portion) and an innominate. Based on maxillary dental wear, the age appears to be over 40 years. At the margin of the orbit are a number of shallow rounded abrasions. Some of the marks resemble shallow cuts; others occur in clusters suggestive of an impact abrasion. The innominate has a small peel along a break and a crenulated edge. Other adult elements include small cranial fragments with impact fractures ($n=6$). One, a probable parietal fragment, also has two small cuts. Another is also burned. A parietal fragment has an impact, and a

parietal and occipital fragment has two impact notches and an abrasion, probably resulting from an impact. An orbit has an impact break.

Altered adult male elements include long bone fragments (humerus $n=3$, radius $n=1$, ulna $n=1$, femur $n=11$) (unconjoined) and a calcaneus. A distal humerus has three elongated cuts (7.2 mm, 18.9 mm, and 21.2 mm) just above the distal end and a cluster of diagonal cuts (7.5 mm) below the elongated cuts. The lateral condyle is damaged and mostly missing. The anterior portion has five small transverse cuts (1.4 mm to 4.1 mm) just above the condyle. White (1992, p. 241, Fig. 5 of Chapter 9) found cuts similar to those on the anterior aspect of humeri in the Mancos collection, and he interprets them as disarticulation marks. An adult clavicle has a cluster of small cuts (2.1 mm) on the superior aspect.

A proximal humerus fragment has a spiral break and crenulated edge. Another humerus has a spiral break. Also represented is an ulna with a more ambiguous break. Both the radius and ulna have surface damage on their proximal anterior surfaces and are broken at different locations along the shaft. Two humeri have single instances of impact and spiral breaks. A third has an irregular break at one end and is battered or chewed at the distal end. This configuration could have been caused by a carnivore or could result from human actions. One radius has two impacts and a peel; a second has a longitudinal break. Two metacarpals have a peel and an impact break, and both are burned. One right femur fragment from near the proximal end has three small cuts on the posterior neck, a spiral break, and an impact notch. Three other femur fragments have spiral breaks. A patella has a crenulated edge and is burned. Five unsided and one right tibia shaft fragments have spiral breaks. Two are also burned. One right tibia fragment has a small diagonal mark, possibly a cut, on the posterior shaft, an impact fracture, and a crenulated proximal end. Furthermore, a cylinder of cancellous bone is missing from the proximal end of the shaft. Another right tibia shaft fragment has spiral and impact breaks. Three pieces of a burned left tibia all have spiral breaks, and one has a possible chop transverse to the shaft just above the distal end. Two other left tibia fragments have longitudinal and impact breaks. Finally, a fibula and talus both have impact breaks.

Burning, with and without other alteration, occurs on 40 (9.7 %) elements, largely cranial parts (40.0 %) and legs (37.5 %). All but two of the burned bones are from the deposit containing the altered bone. Seven of the eleven femur fragments are burned (mostly lightly) or scorched, but one has a graded light-to-medium intensity burn. In conjoining, six of these are from the same right femur and two others are from the same left femur. Alteration on a single piece of a right femur includes a spiral break, a longitudinal break, an impact fracture, and crushing. The six pieces from another right femur have spiral breaks and impacts. The left femur has several impacts and a crenulated proximal edge, and the cancellous bone is missing from the central portion of the shaft. The calcaneus has an impact fracture and a crenulated edge.

In summary, using a conservative estimate of the minimum number of individuals represented in the disarticulated remains from LA 37592, there were between seven and ten individuals (2 infants, 2–3 juveniles, 1 teenager, 1–2 adult females, 2 adult males, and up to 2 other adults). Both burning and human alteration occur on elements from all age and sex categories, suggesting that all of the individuals had bone elements that were culturally modified at the time of death or sometime afterward.

LA 65030: Carnivore Activity and Other Nonhuman Alterations

The description that follows is summarized from the site report (Martin et al., 2001). LA 65030 has the smallest disarticulated remains sample (400 elements) of the three sites discussed here. Most of the commingled and disarticulated fragments are from the fill of one of the eight pit structures at the site. The site was occupied from mid-Pueblo II through early Pueblo III (AD 1000–1150). This assemblage comes from the fill of one of the earliest, mid-Pueblo II structures. Five burials were recorded from Pit Structure 8, three of which were intact. The burned roofing layer contained a large quantity of human bone in varying states of disarticulation. Carnivore damage is extensive, and disarticulation was exacerbated by mechanical trenching but was clearly present before. Some of the burning is heavy, indicating the absence of flesh when burned. Other bone is remarkably sound, indicating minimal exposure to weathering. This bone assemblage shows impacts from being moved during site occupation, supplemented by carnivore activity.

Most of the approximately 300 elements were located in the roof fall layer of Pit Structure 8 (75.0 % of the site total). Carnivore bite marks and gnawing are relatively common (12.6 %). Burned bone is present (4.3 %) which is lower than that found at LA 37592 (9.7 %). The same is true for altered bone (9.7 %) in this structure compared with 22.4 % at LA 37592. Breakage is fairly high; most of the postcranial elements are represented by less than half of the element (79.3 %), and only 6.6 % are complete.

The disarticulated assemblage from Pit Structure 8 represents at least 11 individuals (6 subadults and 5 adults consisting of 3 females and 1–2 males). Most burned elements were adult bones. Burning was light-to-heavy ($n=1$) or heavy/sooted ($n=12$). Burned fragmentary elements include indeterminate fragments ($n=2$), mandible fragments ($n=2$), ilium fragments ($n=3$), humerus fragments ($n=4$), and femur fragments ($n=2$).

Impact breaks and abrasions are primarily located on three of the crania found in Pit Structure 8. Of the 25 elements with alterations, at least 14 (60.9 %) are from a child around 10 years of age, a female 25–30 years of age ($n=7$), and a female 35–40 years of age ($n=2$).

Subadult

Alterations in the youngest group are peels on a rib shaft and a humerus and the impact and abrasions on the cranium from Pit Structure 8. Parts of this cranium were collected as disarticulated elements and parts as a burial that was treated as disarticulated since more than one individual is represented. Unaltered pieces of the cranium include the frontal, left maxilla, zygomatic, right temporal, a piece of the occipital, and the vomer. The right parietal has a small impact fracture along the coronal suture.

It also has three small cracks radiating from the edges and suggesting pressure exerted on the piece. A piece that includes the maxilla, frontal, temporal, and much of the left parietal has at least three pressure-like cracks, a possible impact on the posterior portion of the parietal, and an unusual scrape or abrasion on the temporal and parietal. The scrape consists of numerous very fine and shallow scratches diagonally bridging the parietal-temporal suture. Two other pieces of the left parietal have impact breaks, and one has a series of four small abrasions near the sagittal suture. Two pieces of the occipital have impact breaks. One has a concentric crack around the impact and three small abrasions just off the crack. Given the placement and lack of patterning of these alterations, they could easily have been caused by the bone moving against coarse sandstone or could be an isolated scrape mark.

Adults

Four of the 12 pieces of the cranium from a 25- to 30-year-old female show alterations. Pieces with no obvious alteration include a maxillary fragment, two sphenoid fragments, two pieces of the left parietal, the right temporal, the occipital, and the base. The parietal fragment does have pressure cracks along the broken edge. Alteration of these bones consists of two series of three small abrasions and a single abrasion. These cluster in the same area, but one set is perpendicular to the sagittal suture, and the others are more or less parallel to this suture. The anterior right parietal fragment has an impact break along the coronal suture. It is roughly half circular in shape with the bevel expanding from the endo- to the ectocranial surface. There is no corresponding mark on the frontal. This and the direction of the bevel suggest the impact is postmortem, well after the parietal separated from the frontal. The posterior portion of the right parietal has two small spalls along the break and abrasions. The spalls are probably edge damage but have been considered as resulting from an impact in the tables. A series of four short scratches just off and diagonal to the occipital suture comprise the abrasions. The left parietal has a percussion pit or, in this case, a line or light chop, an impact fracture, and a series of three small scratches that are probably abrasions. Many of the cranial fragments from Pit Structure 8 have both recent abrasions caused by cleaning and movement in the soil matrix. These, and very similar but not obviously fresh scratches, are very difficult to assign a cause. Again, much of the disarticulation is along sutures.

The cranium of an older female (35–40 years old) had two pieces that were altered; 15 have no obvious alteration. Unaltered pieces include two upper molars and a central incisor, the right temporal, three maxilla fragments, the vomer, zygoma, two pieces of the right parietal, two pieces of the occipital, a malar, and sphenoid fragment. The left parietal is missing the portion along the temporal and part of the occipital suture and has two pressure cracks radiating out from this edge. The temporal has numerous recent scratches and abrasions and one that could possibly be old. Breaks on both temporal and zygomatics are well rounded, probably from soil movement as the fill in much of layer 10 is alluvial wash. The frontal has

a small impact depression and crack radiating out to the suture line. The bone still adheres to the interior with an acute bevel from the ecto- to the endocranial surface. An unusual sharp break occurs across the bridge of the nose. The right parietal has a crack along a broken edge that may result from an impact and vessel depressions that could be mistaken for cuts. Disarticulation is mainly along the sutures. Some breakage occurs in the orbital area, at bregma, the left parietal-temporal area, and the base of the occipital.

Two other elements from this site deserve mention. One is an almost complete right ulna with red pigment stains found in Pit Structure 6. Patches of pigment occur on the anterior surface just below the articular processes and scattered around the bottom third to half of the shaft. A black dot is on the anterior about a quarter of the way from the distal end. The pigment coverage is patchy and therefore may not represent a deliberate attempt to coat the element. The other is much of a left temporal from a large child or adult from Pit Structure 8. Small step fractures and polish along the temporal suture edge are suggestive of wear.

The disarticulated assemblage from this site differs from that at LA 37592 and LA 37593. Burning occurs but is largely complete burning or sooting, a pattern typical of discard and one rare in the LA 37592 assemblage. For the most part, the breakage is more like that from LA 37593 with less long bone damage. The break on the older female could be perimortem, but the impact breaks and the abrasions are reminiscent of those caused by rocks from site LA 37593.

Assemblage Comparisons

Burials disturbed by carnivores or heavy equipment in modern times show the full range of breaks (smooth, transverse, spiral, green), spalling and flaking, cuts, splits, abrasions, scrape marks, and peeling. For example, at La Plata, a backhoe produced not only a green fracture but peeling as well on cranial and postcranial fragments (normally considered breaks indicative of fresh bone). Midshaft erosion in several of the burials due to natural causes closely resembled a condition attributed to “roasting” (White, 1992, pp. 162–163). The pattern of rib breakage in intact burials from La Plata was identical to breakage patterns attributed by White (1992, p. 224) to the human activity of removing ribs in slabs, presumably for roasting and consumption.

At LA 37592, the human bone is high in the pit structure fill above a dense trash deposit. Located in three clusters (see dashed-lined circles in Fig. 2), Cluster Two had a series of split long bones covering a parietal bone and an occipital bone. The patterned nature of this deposit suggests deliberate and intentional placement of the long bones and cranial vault pieces. The LA 37593 deposit is also high in the fill of a pit structure, but there is virtually no trash in that structure with the bones. Fill is a combination of windblown and ponded sediments and an abundance of large river cobbles. This deposit is likely the result of ancient activities involving the redeposition of human burials, probably as a result of clearing out a previously abandoned structure which had been used for burials (Charles Hannaford, Personal

Communication, 1993). At LA 65030, the human remains were just above the floor in the roof fall layer. Again, trash was sparse, and fill was windblown and ponded sediments. Both the LA 37593 and LA 65030 assemblages are incomplete. It is important to keep in mind that a waterline trench bisected the LA 37593 deposits. Likewise, an exploratory backhoe trench made by archaeologists in the course of excavation at LA 65030 removed an undetermined amount of skeletal material from that sample as well (Stephen Lent, Personal Communication, 1994).

The LA 37592 assemblage has many characteristics considered by White (1992) and others (Turner II, 1993) as attributed to intentional dismemberment and cooking. Assemblages from the other two sites have some of these same patterns but can be better explained by other kinds of ancient human behavior, taphonomic processes, site formation processes, and modern activities (Table 1). Comparing the amount of postcranial breakage (crania are not included because cranial bones were coded to reflect completion), LA 37592 has the most breakage and LA 37593 the least.

LA 65030 falls in between in the degree of human modification but has by far the most carnivore damage. Considering that much carnivore damage goes undetected because it lacks actual punctures or furrows, carnivores probably contributed substantially more to the breakage. In the LA 37592 assemblage, the parts that have the most breakage are long bones. All of the femur fragments and most of the tibia (96.3 %), humerus (84.6 %), radius (62.5 %), and rib (85.2 %) fragments represent less than half of the bone. In the LA 37593 and LA 65030 assemblages, the elements with the most breakage are ribs (88.7 and 94.1 %) and vertebrae (52.0 and 38.9 %).

Burning, like breakage, is more common in the LA 37592 assemblage (Table 1). Burn intensity also differs in LA 37592 and LA 65030. Burning in the LA 37592 assemblage tends toward light-brown patchy and incomplete burns while that at LA 65030 is heavily and completely burned (sooted or smoked). Heavy burning occurs when flesh has been removed (Gifford-Gonzalez, 1989, p. 193). Buikstra and Swegle (1989, p. 252) found it was impossible to incinerate a fleshed bone until it was deeply and uniformly smoked. Burning of flesh produced calcination of some areas before all parts were smoked. This suggests that most of the burned bone from LA 65030 lacked flesh when it was burned, while that from LA 37592 may have had flesh still present.

Altered bone was relatively common at LA 37592 and less so at the other two sites. It also has the greatest variety of alteration. Cuts, crenulated edges, and hollowing (for marrow extraction) occur only in this assemblage, and elements were more likely to have more than one type of alteration on a single piece.

Comparison of element representation for the three sites shows important differences for bones such as the ribs, hands, and leg bones (Fig. 3). LA 37592 (solid black line) is somewhat similar to the Mancos assemblage (see White, 1992, p. 307), but not for all elements. The Mancos assemblage represents a relatively uncontested interpretation of cannibalism in the ancient Southwest (see Osterholtz, 2013). For Mancos, crania, ribs, and large leg bones are the most represented parts. LA 37593 differs, in that except for ribs, there is a more even representation of all bone

Table 1 A comparison of dates, location, MNI, element frequency and alteration types for the sites LA 37592, LA 37593 and LA 65030

Sites	LA 37592	LA 37593	LA 65030
Dates	Puedblo III	Late Pueblo II	Middle Pueblo II
	1125–1300	1075–1125	1000–1075
Location	Kiva upper fill	Pit structure upper fill	Pit structure just above floor
Deposit	Above Midden	Cobbles in clean sandy fill	Alluvium, cobbles and burned roof material
Individuals	7–10	17	11–12
Males	2	3	1–2
Female	1–2	3	3
Children	4–6	10	7
All elements	395	2,049	300
Post cranial bones	304	1,559	227
% Complete	2	32.8	6.6
% >50 %	18.1	12.9	14.1
% <50 %	79.9	54.3	79.3
% Carnivore damaged	1	2.6	12.6
% Light burn	5.8		
% Light to medium burn	2.3	0.1 (Human?)	0.3
% Heavy burn	1.3		4
% Calcine	0.3		
Total burned	9.7	0.1	4.3
% Longitudinal breaks	4	0.3	
% With transverse breaks		0.2	
% With diagonal breaks		0.4	
% With spiral breaks	9.6	0.2	
% With impact breaks	8.9	0.8	5.7
% With peels	2	0.1	1.3
% With chops	0.3		0.3
% With cuts	1.7		
% With scrapes or abrasions	1.0	0.3	2
% With crenulated edges	1.5		
% Hollowed	0.5		
Total altered bone	22	3.8	9.7

elements. LA 65030 has many ribs and cranial parts but a fairly low representation of other bones.

Although LA 37592 resembles Mancos, the La Plata assemblage has far less evidence of violent perimortem battering and mutilation than Mancos. The percentage of elements with cuts (1.7 %) is at the low end of that reported by White (1992, p. 327) which ranges from 1.0 % at Grinnell (another disarticulated site from the Southwest thought to demonstrate cannibalism) to 11.7 % at Mancos.

Breakage patterns at LA 37593 are best attributed to ancient movement of burials from one place to another. In addition to this movement, there were cobbles mixed

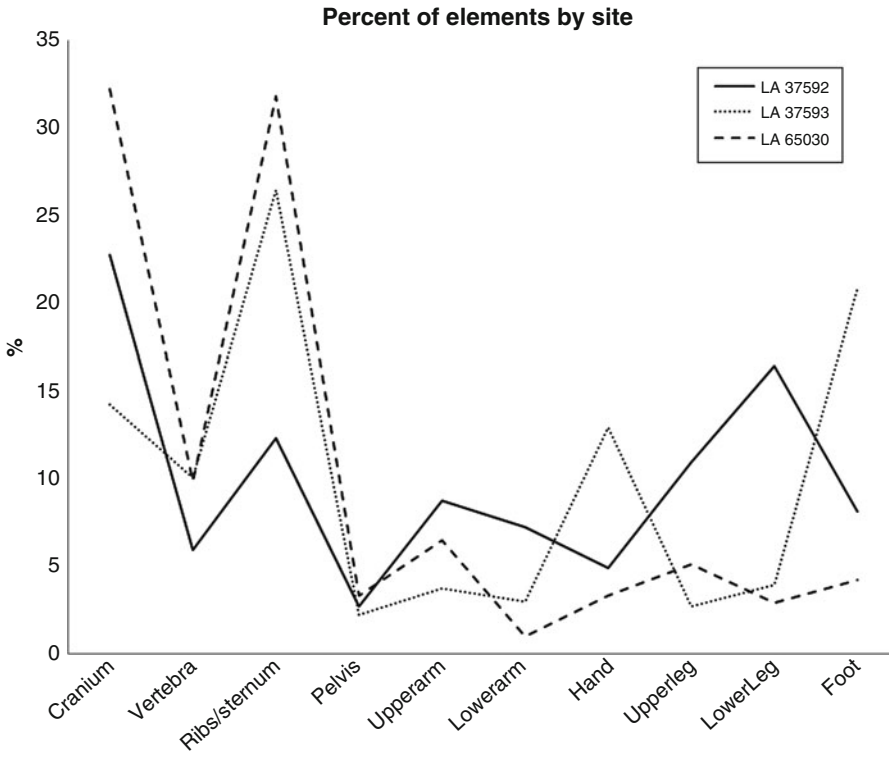

Fig. 3 Graph showing the percent of bone elements by site for LA 37592, LA 37593 and LA 65030

in when the burials were relocated, and these likely contributed to some of the impact fractures and other kinds of alterations of the bones. Modern construction activities and the waterline trench (see Fig. 1) also likely contributed to bone movement and breakage.

The explanation for the disarticulated assemblage at LA 65030 is less straightforward, but that is because there may be multiple causations. Carnivores certainly contributed to the breakage and disarray in the assemblage (Table 1). The burned elements and broken crania may be the result of secondary disposal unrelated to the filling of Pit Structure 8.

There is little question that assemblages containing altered, modified, burned, and broken human bone exist throughout the Southwest during the Pueblo II–III period as White (1992) and Turner and Turner (1999) have demonstrated. However, as the La Plata Valley sites illustrate, while there may be superficial resemblances across all disarticulated and commingled assemblages, not all are the result of similar activities. Overzealous inclusion of deposits like that from LA 37593 and LA 65030 can obscure any real patterning and hamper attempts to understand the conditions that produced the disarticulation and breakage.

The La Plata Valley study presented here demonstrates that three seemingly similar bone assemblages (LA 37592, LA 37593, and LA 65030) were the likely products of several very different processes. Without contextual information on taphonomic and site formation processes and curation and laboratory handling of the material, the case for cannibalism cannot be made. One of the innovations suggested in this study is to also include an analysis of the burials from the same site. Missing elements from burials can be sometimes found in the disarticulated deposit as was seen in the analysis of LA 65030.

That the remains from LA 37592 were modified and altered around the time of death is clear; the behaviors that produced the remains are not so clear. Cannibalism is only one of several possible competing hypotheses for modified and altered remains. Witchcraft and an associated ritual is a conceivable alternative working hypothesis. Likewise, warfare, conflict, "headhunting," and ritualized dismemberment are others.

The methodology used here is applicable to all disarticulated human remains that are suspected of showing human processing. Turner and Turner (1999) attributed cannibalism to the interpretation of the bone alterations from all three sites. Yet, for two of the sites (LA 37593 and LA 65030), the taphonomic forces were shown to not be that of humans culturally modifying the bones with dismembering, fracturing, and cutting. Rather, the data strongly suggest movement of burials in ancient times, damage from modern construction activities, and carnivore and other natural agents. For example, peeling, smooth spiral, and longitudinal breaks were produced by a backhoe; spiral breaks were produced by a utility line; and crushing and warping of human bone were caused by mechanical equipment. Finally, carnivore damage is only sometimes distinguishable from other kinds of damage; at other times, it produces patterns of dispersal, breakage, and changes in appearance that could be mistaken for other causes.

In summary, documentation of the full range of variability demonstrates that any number of agents can produce alteration in human remains that resemble changes attributable to perimortem modification by humans. This study highlights the need for such baseline data, particularly for project areas that contain both articulated burials and disarticulated assemblages. The contrasting of bone elements and alterations across the three sites (Table 1) and the comparison of bone element frequencies with others such as Mancos (Fig. 3) revealed subtle but crucial variation in patterning. This provided a more parsimonious interpretation for each of the assemblages.

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