Ancient mortuary rituals in a high altitude population in Nepal: cutmarks among shaft tomb burials from Upper Mustang

Jacqueline T. Eng

Dept. Anthropology, Western Michigan University, Kalamazoo MI

Introduction

Exploration of Himalayan valleys in the Upper Mustang *(Lo)* region of Nepal has provided insight into the history of ancient high altitude populations in this region, from questions of settlement and migration, to health, diet, and mortuary behavior (Fig.1). While the region is limited in natural resources, it provided an important node in the trans-Himalayan north-south movements of people (and eventually trade) owing to its location along the upper Kali Gandaki River.[1] With salt trade, animal husbandry, and single season agriculture, the local communities persevered in this extreme landscape. Prior to this region's incorporation into the nascent Tibetan empire in the 7th century AD, the documentary record of early Lo is poor, with indications that the area was a center of pre-Buddhist shamanistic Bon religious practice and a political dependent of the Zhang Zhung polity of western Tibet.[1] Our investigations in this area have uncovered evidence of human activity within shaft tomb complexes that date to this poorly understood time period (ca. CE 200-700). Of note are the shaft tomb burials in the Sam Dzong valley (~4000 m) that have yielded human and faunal remains with evidence of postmortem cutmarks.

Fig.1. Sam Dzong site in Mustang, close to the former capital, Lo Manthang

Fig.2. Sam Dzong shaft tomb complex. Note, SD 2, 3, 9, and 10 are separate from the cluster of SD Complex 1 (SD 1, 4, 5, 6, and 7, though SD 5 is considered separate owing to elite burial treatment).

Sam Dzong Burials

The Sam Dzong (SD) shaft tomb system comprises 10 shafts visible from the exposed face alongside the valley (Fig.2). Tectonic and climate-related processes had eroded the face and exposed the shafts, with some bones having fallen to the valley floor. The shaft tombs were explored by experienced technical climbers who rappelled into the exposed face. While bones were relatively well-preserved, they were loosely concentrated and disarticulated, and the limited representation of some bone types (such as vertebrae and smaller bones) all suggest that this was not a site of primary deposition, but instead a place of secondary burial. The minimum number of individuals (MNI) was determined by assessing the sub-MNI within each discrete area of concentrated bone "piles," found in each of the shaft tombs.[2] The total MNI for the SD site is 33, with the majority adults (70%), though every age category is represented (Tab.1). Artifacts indicate the potential use of wooden platforms or "bunk beds" similar to finds in cave tombs in southern Mustang,[3] as well as an elite burial in SD 5, which included metal items, a burial mask, and numerous glass beads that suggest extensive trade networks. Faunal remains included caprinae (goats/sheep), *Equus*, *Bos* (cows/yaks), and *Lepus* (hare).

Categories	Total SD	SD 1	SD 2	SD 3	SD 5
Total individuals	33	20	10	1	2
Adults (20+yrs)	23	14	7	1	1
Subadults (<20yrs)	10	6	3	0	1
Adult M	10	7	2	0	1
Adult F	11	7	4	0	0
Adult (unk. sex)	2	0	1	1	0
Adolescent (13-19)	3	2	1	0	0
Juvenile (7-12)	2	0	1	0	1
Child (3-6)	4	3	1	0	0
Infant (0-2)	1	1	0	0	0

Tab.1. Demographic profile of human remains from Sam Dzong shaft tomb complex

Methods

The majority of human bones had tool marks on the surface that were the result of purposeful human activity as evidenced by the symmetry, repeated pattern, and location of cuts across common bone regions, as well as the cut morphology, which had sharp edges that were "V" to "U" -shaped (sometimes in clusters of parallel grooves) and less than 1mm in width, indicating the use of a sharp implement. All marks were examined macroscopically and with a 30x loupe, and many also via a Dino-Lite digital microscope (AM4013MT) with maximum magnification up to 220x (Fig.3). Procedures for identifying and recording tool marks followed previous studies (e.g., White 1992).[4]

Fig.3. Dino-lite image of a human right femur with calibrated measurements of cutmarks

Macroscopic vs. Microscopic

Of the 123 human bones with cutmarks, 58 (47%), were examined by both macroscopic and Dino-lite methods. To determine which method was more accurate, comparisons were made to see potential differences in observed bone counts (Fig.4a) and average number of cuts and lengths (Fig.4b).

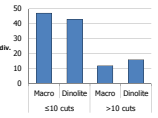
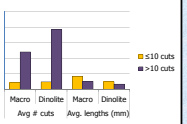


Fig. 4a (L): Comparison of number of bones with lesser than or greater than 10 cuts

Fig. 4b. (R): Comparison of mean cut and lengths



Dino-lite was more sensitive in finding numerous cuts (e.g., bone with >10 cuts), but the difference in mean number of cuts was not significant ($t = -1.393$, $df\ 73$, $p = 0.168$), while mean length of cuts differed significantly ($t = 2.656$, $df\ 64$, $p = 0.01$). Dino-lite could detect details of finer cuts, but since it was limited to a small focal area, it was not as useful for capturing the entire length of long cuts. In the following data results, Dino-lite data (where available) are used for bones with more than 10 cuts and whose average measures were ≤4mm, while measurements with a sliding caliper were used for bones with cutmarks that had an average length ≥4mm.

Results

Of the 308 relatively whole bones observed, 123 (40%) had cutmarks. A few bone categories (sternum, carpals, tarsals, and sacrum) did not have cutmarks, but 14 element types did (Tab.2, Fig.5).

Bone	# Bones	# Cutmark	% Cutmark
Cranium	25	3	12%
Mandible	10	2	20%
Clavicle	5	2	40%
Scapula	7	6	86%
Sternum	4	0	0%
Rib	47	29	62%
Vertebrae	42	3	7%
Humerus	18	14	78%
Ulna	9	6	67%
Radius	8	3	38%
Carpals	2	0	0%
Hand	10	0	0%
Os coxa	20	14	70%
Sacrum	5	0	0%
Femur	38	23	61%
Tibia	20	10	50%
Fibula	13	7	54%
Tarsals	10	0	0%
Foot	15	1	7%
Total	**308**	**123**	**40%**

Tab.2. Human bones with cutmarks

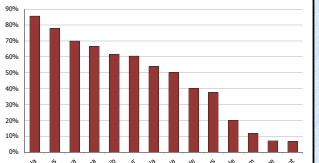


Fig.5. Frequency of cutmarks by element

Distinct bone locations received more cuts: the edge/angle portions of irregular bones such as the scapula, rib, and os coxa; and the proximal section of long bones (Tab.3). The humerus and femur had the highest rates of proximal cuts, while the ulna/radius and tibia/fibula had the highest rates of distal cuts. Left and right sides were roughly equal (left = 64/123, 52%; right = 56/123, 46%, Fisher's exact test $p = 0.698$). The mean number of cuts on a bone was 8.8 cuts (s.d. = 20.5), and the mean length was 6.7mm (s.d. = 7.0mm). There were 20 bones with >10 cuts, 13 bones with cuts ≥20mm in length, and four with cuts ≤1mm (Fig.6).

Tab.3. Location of cutmarks by element type

Long bone	Proximal	Per bone type	Distal	Per bone type	Shaft	Per bone type
Humerus	9	64%	3	21%	2	14%
Ulna/Radius	5	56%	4	44%	2	22%
Femur	18	78%	5	22%	5	22%
Tibia/Fibula	9	53%	5	29%	6	35%
Total (73)	41	56%	17	24%	15	21%

Axial and Irregular						
Cranium	Frontal	Parietal				
	2, 100%	1, 50%				
Mandible	Corpus	Ramus	Gonial			
	2, 100 %	1, 50%	1, 50%			
Clavicle	Superior	Shaft	Medial	Lateral		
	2, 100%	1, 50%	1, 50%	1, 50%		
Scapula	Border, angles	Spine	Fossa			
	5, 83%	4, 67%	1, 17%			
Rib	Ventral	Dorsal	Neck	Angle	Shaft	Sternal
	23, 79%	5, 17%	5, 17%	17, 59%	4, 14%	8, 28%
Os coxa	Ilium	Edges	Iliac blade			
	13, 93%	10, 71%	9, 64%			

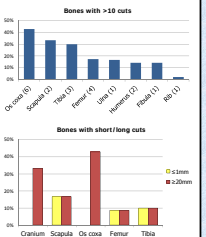


Fig.6. Rate of bones with >10 cuts (top) and ≤1mm or ≥20mm cuts (bottom), per those bones types with cuts

Of the 33 individuals, 25 (76%) had cutmarks, which were found across all age groups (except the lone infant remain) and within both sexes at relatively high rates (Tab.4). Among the shaft tombs, SD 3 and SD 5 had the highest rate of individuals with cutmarks (100%), but had the fewest individuals (n=1 and n=2 respectively), while SD 2 had the "lowest" rate (70%, 7/10), and SD Complex 1 had 75% (15/20).

Tab.4. Demographic distribution of cutmarks

Age / Sex	# Indiv. w/ cuts	Rate
Total individuals	25 / 33	76%
Adults (20+yrs)	18 / 23	78%
Subadults (<20yrs)	7 / 10	70%
Adult M	9 / 10	90%
Adult F	8 / 11	73%
Adult (unk. sex)	1 / 2	50%
Adolescents (13-19)	3 / 3	100%
Juveniles (7-12)	2 / 2	100%
Child (3-6)	2 / 4	50%
Infant (0-2)	0 / 1	0

Faunal Cutmarks

Of the 40 faunal remains in the shaft tombs, 15% had cutmarks (Tab.5, Fig.7). The caprinae, *Equus*, and *Bos* remains had relatively similar rates of cuts, with the long bones (usually humerus), the most often cut.

Tab.5. Distribution of faunal cutmarks

Animal	N	# Cut	% Cut	Cranium	Mandible	Long Bone	Axial	Os coxa
Caprinae	25	4	16%	0/16	1/14, 7%	4/12, 33%	0/3	-
Equus	6	1	17%	1/4, 25%	0/3	0/11	-	0/1
Bos	8	1	13%	0/2	0/1	1/7, 14%	0/1	-
Lepus	1	0	0%	0/1	-	-	-	-
Total	**40**	**6**	**15%**	**1/23 4%**	**1/18 6%**	**5/30 17%**	**0/4**	**0/1**

Fig.7. Cutmarks on caprine mandible and distal humerus

Discussion: Cutmarks as Mortuary Ritual

Cutmarks on the Sam Dzong bones were made by deliberate human actions, possibly not long after death as the color of the cut surfaces was the same as that of unaffected surrounding bone and the removal of periosteum may have resulted in scrape marks seen.[5] Bones with the most processing were the scapulae and os coxae, while long bones typically had cutmarks at proximal and distal regions, suggesting disarticulation, and also clustered cutmarks around areas where tendonous fascia formations or tough ligaments are found, suggesting defleshing (Fig.8).[6,7] The locations of cutmarks on the faunal remains also suggests dismemberment.

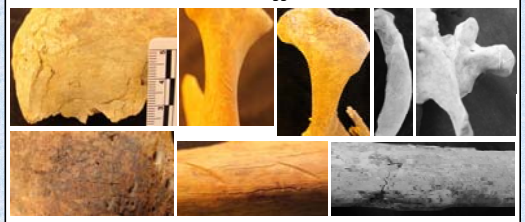


Fig.8. Human cutmarks: (top L-R) frontal; mandible; scapula; rib; thoracic; (bottom L-R) ilium; humerus; femur

The context of the burial treatment and deposition of disarticulated bones suggest that these were secondary burials, with postmortem defleshing as part of a mortuary ritual, although other scenarios must be considered. The SD remains lack many of the key taphonomic signatures of cannibalism including: extreme perimortem fragmentation, percussion/anvil breakage, and evidence of burning (e.g., pot polish).[4,8] The distribution of cutmarks across the age groups from children to older adults, and equally among adult males and females argues against the use of remains for trophy taking of the defeated or for ancestor worship. It does suggest relatively equal mortuary treatment across age and sex. The relatively intact nature of the bones and the care in which the deceased were deposited in hard to access shaft tombs, with the inclusion of grave goods and the remains of animals that were possibly sacrificial also suggest mortuary ritual versus the use of this space for cannibalism or the deposition of victims of warfare.

There is potential sample bias as the tombs show under-representation of the very youngest and oldest age groups. The incomplete remains of individuals may also suggest that more bones may have cutmarks, or that only those remains that had been processed were included in these tombs.

Tibetan sky burials began in the 11th c. and post-date the SD burials, but there may be links between the Tibetan ritual and earlier Zoroastrian practices of defleshing and gathering bones to place within a chamber or vault, which spread eastward beginning in the 1st century CE.[9,10] Thus, there may have been knowledge of these practices in the SD community. The mortuary ritual associated with the SD finds may be associated with the adoption of cultural practices from outsiders, or may be the product of more local practices that later evolved into the form of sky burials practiced in the region today. Further examination of the other shaft tombs within Sam Dzong and comparisons to cemeteries from nearby locations and from a contemporaneous period can better illuminate this question.

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Contact: jacqueline.eng@wmich.edu