Incorporation of faunal remains in Kerma to Napatan Period burials from the ASU BONE concession between the Fourth and Fifth Cataracts

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The inclusion of faunal remains within burials is a key aspect of the rites of passage performed by communities around the world to separate the dead from the living and to complete the transition and incorporation of the deceased into the realm of the dead or as ancestors in the community (Bangsgaard 2014b, 354; Van Gennep 1960). Faunal remains may represent a funerary feast among the living or a ritual meal provided to the deceased, or may be provided to accompany them (e.g. a pet) or symbolise certain attributes (e.g. wealth). Systematic analysis of those remains using zooarchaeological methods, however, occurs sporadically. This study examines the faunal remains from excavated cemeteries of the Kerma through Napatan periods dating between approximately 2200-430 BC in the Arizona State University (ASU) Bioarchaeology of Nubia Expedition (BONE) concession between the Fourth and Fifth Cataracts. The goals of the analysis were to identify which animals were selected by the living community members to accompany their dead in these cemeteries, whether preferences for particular animals changed over time, and if patterns exist in their deposition, including their location within a grave, or the age or sex of the individuals with whom they were buried. Because of disturbances to many graves in antiquity and more recently, and the possibility that faunal fragments were accidentally incorporated through backfill, their occurrence with other objects (e.g. beads, ceramics) in the same grave was used as an indication of purposeful inclusion of the faunal remains. Potential taphonomic factors affecting the survival of bone fragments at the sites are tested through comparison to ecological and experimental zooarchaeological data by examining taxon presence, bone breakage, and surface modification of the remains. Zooarchaeological data from contemporaneous sites and Middle Nile Valley sites from other periods are compared to elucidate the roles that faunal remains, as burial accompaniments, may have played in the mortuary rites and how those roles may have changed through time in this area.

Project Area and Fieldwork

The BONE project area is located on the north (right) bank of the Nile River. Its eastern border lies 34km west of Abu Hamed (Figure 1) and extends 30km along the river and nearly 4km into the desert. Sites initially documented in a 2003 survey by a team from the University of California, Santa Barbara, are designated with a UCSB prefix followed by the last two digits of the year recorded and site number in order documented (e.g. UCSB 03-14; Smith and Herbst 2005). Sites subsequently recorded by ASU teams under Baker's direction are designated by an ASU prefix followed by the year and site number in keeping with the practice initiated by UCSB. Thus, ASU 09-30 was the thirtieth site recorded in the 2009 season, while ASU 14-04 was the fourth site recorded in 2014. More than 200 sites are currently recorded in the BONE project area (Baker 2016, 192). Excavated cemetery sites have been radiocarbon dated from the Early Kerma period through to the Christian period (*c.* 2500 BC to AD 1400). Graves from the Kerma through Napatan periods are variable in construction. Most graves from the Early through Late Kerma periods have a circular stone superstructure ranging from 2-5m in diameter. The subsurface shaft, often lined with stone, terminates in a round to oval pit where the body was placed, usually on the granite bedrock. Bodies are typically positioned on their right side (occasionally on the left side) in a tightly flexed or crouched position with variable orientations (Figure 2). Most include remnants of a hide and sometimes also a mat wrapping, with or without accompanying vessels, jewellery, or other objects. Dome and semi-dome graves that incorporate bedrock outcrops are radiocarbon-dated to the Late Kerma and early Kushite periods in the BONE project area, though others contained ceramics suggesting construction into the Napatan period. Most are badly ruined.

Excavations were conducted at five cemetery sites dated from the Early Kerma to Napatan periods. Four of these sites cluster south of Jebel Julud (UCSB 03-14, ASU 09-01, ASU 09-30, and ASU 14-04), and one (ASU 15-11) is southeast of this landmark (Figure 3). Most graves from these sites were disturbed in antiquity or by recent looting, as well

Figure 1. The ASU BONE project area (red star) and surrounding sites (included in later correspondence analysis). Shape denotes site type (square = national parks/reserves, circle = habitation sites, diamond/star = cemeteries), and colour denotes time periods of site activity referenced in later analysis (blue = modern, green = Post-Meroitic, yellow = Napatan, red = Kerma, purple = Neolithic). The BONE project area contains fauna from multiple time periods but is marked red due to the focus of this study. Locations containing multiple sites have marks placed amidst the locations, not to a specific site: 1) modern Wadi el-Rayan; 2) Kerma cemetery (Chaix 1993); 3) Neolithic cemetery R12 (Pollath 2008b); 4) Kerma cemetery H29 (Bangsgaard 2014a); 5) Post-Meroitic cemeteries Hammur, el-Zuma, Tanqasi and New Amri (Osypińska 2008); 6) Napatan cemetery Hillat el-Arab (Chaix 2006); 7) Neolithic habitation at Boni Island (Pollath 2012); 8) Post-Meroitic cemeteries at islands of Saffi and el-Sadda (Osypińska 2008); 9) BONE project area; 10) Neolithic habitation at el-Zakiab, Um Direiwa, el-Shaheinab, and el-Nofalab sites near Khartoum (ElMahi 1988); 11) Neolithic habitation at Kadero (Gautier 2006); 12) modern al-Radom, Sudan/South Sudan; 13) modern Sudd, South Sudan; 14) modern Gambella, Ethiopia; 15) modern Dinder, Sudan; 16) modern Suakin-Gulf of Agig, Sudan; and 17) modern Sawa Lake, Iraq (created in ArcGIS by Alexandra Ptacek).

Figure 2. An Early to Middle Kerma period grave, site UCSB 03-14, Burial 9 (photo Brenda J. Baker).

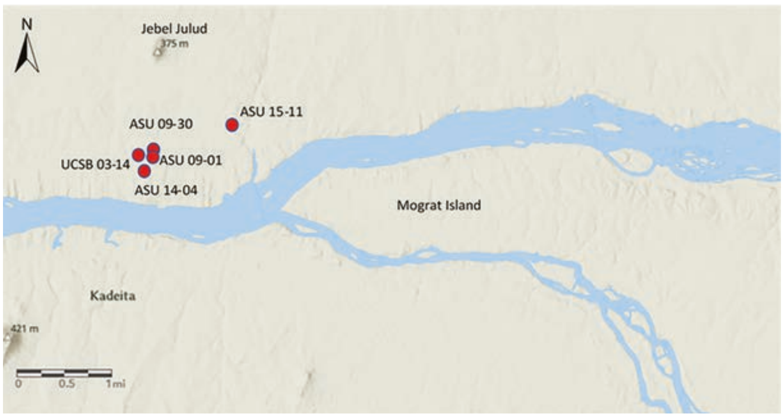

Figure 3. Map showing the location of Kerma and Napatan period cemetery sites with excavated graves analysed in the ASU BONE project area (created in ArcGIS by Alexandra Ptacek).

as by animal burrowing. From these five sites, 50 individuals were recovered, though the graves of only 48 individuals were fully excavated (two additional disturbed graves included only surface collections of artefacts and remains). Sites were dated through a combination of radiocarbon assays, grave styles, and ceramics. At least one burial at each site was successfully radiocarbon dated, with as many as five dates obtained at larger sites such as ASU 09-30 (Baker in prep.). Of the 48 graves fully excavated, 43 were dated to the Kerma period (14 Early/Middle, nine Classic, and 20 Late Kerma), two to the early Kushite phase, and three to the Napatan period. Age and sex estimations were previously recorded using standard methods as outlined in Baker *et al.* (2005), Buikstra and Ubelaker (1994), and White *et al.* (2012). The 48 individuals range from foetal to over 50 years old with 40 adults and eight preadults represented. As preadults lack secondary sex characteristics, no sex estimations are available for these eight individuals. The 40 adults include 15 males, 18 females, and seven of indeterminate sex.

Materials and Methods

The 48 excavated graves included 652 faunal bones or fragments found in their superstructure or shaft. Additional distinction was made for faunal remains found with the body at the base of the shaft. Fragments from surface collection were not included because their association with the graves near the time of burial could not be secured due to the wind-scoured desert landscape. Data collected for the 652 analysed fragments included taxon, bone element, breakage outline and angle, weathering, and surface modification (marks and burning). Breakage outline, angle and weathering were recorded for all possible faunal fragments excavated from the burials to determine post-depositional destruction. Fractures at right angles and transverse outlines are often caused by post-depositional processes, but curved fracture outlines with oblique angles point towards breaks in fresh bone (Villa and Mahieu 1991, 35-37). Weathering was recorded using Behrensmeyer's (1978) stages. All other analyses to identify taxon, bone element, and surface modification were completed as permitted by the bone preservation and fragmentation. Taxon and bone element were identified using the zooarchaeology comparative collection in ASU's School of Human Evolution and Social Change, the Smithsonian's Digital Archive of Ungulate and Carnivore Dentition, and skeletal guides (Osborn and Helmy 1980; Walker 1985). Factors such as the presence of microstriations (present = percussion), cross-section of mark (v-shaped = cut, smooth u-shaped = tooth, rough/non-uniform = percussion), and associated flake scar (tight u-shape = tooth) were used to determine the modification processes for each faunal specimen (after Fisher 1995).

Faunal remains by taxonomic family and skeletal element were recorded for presence/absence within each of the 48 excavated graves. To determine a potential preference for animals and cuts selected, and with whom they were interred, statistical analysis of the data used chi-squared/Fisher's Exact Tests, Cramer's V, and correspondence analysis through Past4.0 and R Studio. Chi-squared/Fisher's Exact Tests and Cramer's V evaluated the following variables: temporal phases, sex estimation, age estimation, presence/absence of beads (as grave inclusions), and location of faunal remains in burial. These tests were used to determine if there was any statistically significant dependence or association among variables. Presence of beads specifically (as opposed to other grave inclusions) was used to determine potential purposeful interment because beads were more selectively interred with the body and were present in fewer graves than ceramics, which were found in nearly all graves and were frequently distributed throughout the grave shaft and within the superstructure. Correspondence analysis of taxon present and their typical diet and habitat (Reed 2008) was used to investigate palaeo-ecological patterns previously reported in the region in order to determine if the local environment may have influenced the selection and/or survival of animals in the archaeological record.

Results

Of the 652 bone fragments analysed, 449 could be identified to taxon. The identifiable sample consisted of 75.1% rodents, 16.0% reptiles, 1.3% osteichthyes (fish), 1.6% aves (birds), and 6.0% artiodactyls (40.7% of which were identified as bovids, specifically, including goat, sheep, and cattle). The remaining 203 fragments were from non-identifiable species, probably mammalian based on size and known fauna of the region. Figure 4 shows the number of identifiable specimens (NISP) for each taxon at each site and temporal phase. Size 1 vertebrates (<23 kg; based on African bovid size classifications from Brain 1981, 114) include reptiles, rodents, fish, and small to medium bird remains. The reptilian and rodent bones include mandibles, maxillae, vertebrae, ribs, and limb bones. The fish were represented only by vertebral fragments. Bird remains included a synsacrum and limb bones. Ostrich eggshell fragments were also included in the superstructure of ASU 14-04 Burial 6, UCSB 03-14 Burial 13, and ASU 09-30 Burials 1, 8, and 14, and in the shaft of UCSB 03-14 Burial 14 and ASU 09-01 Burial 7. Pellets (indigestible material regurgitated by birds) with rodent remains were found in superstructures of ASU 09-30 Burials 1 and 12.

Reptiles and rodents are often considered intrusive in the region (e.g. Gautier 2006). Due to the abundance of axial and appendicular skeletal elements from reptiles and rodents, though disarticulated, their presence was assumed to be the result of burrowing activities and subsequent death within those burrows as was observed at later sites in the project area. This assumption was further supported by the lack of evidence of human modification (cutting, percussion, or burning) and the better preservation of the rodent and reptile remains (mostly whole bones or only broken along one end and intact teeth; see Figure 5). Consequently, those rodents and reptiles as well as the pellets were excluded from further analysis and the interpretation of the results.

The remaining fauna present within each grave are shown in Figure 6, along with temporal affiliation, age and sex of the individual interred, and location of faunal remains within the grave. Fourteen of the 48 excavated graves (29.2%) included non-intrusive faunal remains. ASU 15-11 contained no non-intrusive faunal bones. Remains of small to medium-sized birds were found in the superstructure of an Early to Middle Kerma child (5-6 years old; UCSB 03-14 Burial 8) and a Late Kerma female (25-35 years old; ASU 09-30 Burial 7), the shaft of a Classic Kerma female (age in the 40s; ASU 09-01 Burial 7), and near the base of a ruined dome grave (Napatan) of an indeterminate adult (ASU 14-04 Burial 3). Fish remains were found in the superstructure for a male (40+ years old) from the Late Kerma phase (ASU 09-30 Burial 14) and the burial shaft of a 35-50-year-old male from the Early to Middle Kerma phase (UCSB 03-14 Burial 7). Artiodactyl species mainly consisting of size 2 animals (23-90 kg; Brain 1981) such as ***Capra*** (goat) were

Taxon	Sites Present	Time Period Present	NISP
Rodent	All	All	337
Reptile	All but ASU 15-11	All but Napatan	72
Osteichthyes			6
	UCSB 03-14	Early/Middle Kerma	4
	ASU 09-30	Late Kerma	2
Aves			7
	UCSB 03-14	Early/Middle Kerma	1
	ASU 09-01	Classic Kerma	2
	ASU 09-30	Late Kerma	3
	ASU 14-04	Napatan	1
Struthio camelus			-
	UCSB 03-14	Early/Middle Kerma	eggshell
	ASU 09-01	Classic Kerma	eggshell
	ASU 09-30	Late Kerma	eggshell
	ASU 15-11	Late Kerma	eggshell
Artiodactyla			27
	ASU 09-01	Classic Kerma	2
	ASU 09-30	Late Kerma	12
	ASU 14-04	Napatan	1
	UCSB 03-14	Early/Middle Kerma	1
Ovis			1
	UCSB 03-14	Early/Middle Kerma	1
Capra			9
	UCSB 03-14	Early/Middle Kerma	7
	ASU 09-01	Classic Kerma	1
	ASU 09-30	Classic Kerma	1
Bos primigenius f. *Taurus*			1
	ASU 09-30	early Kushite	1
			449

Figure 4. Taxon identification and NISP of fauna from Kerma to Napatan period graves at BONE sites. Taxa are confirmed by morphology and distinctive measurements or characteristics. NISP are only provided for bone fragments. Apart from eggshell presence, no other evidence of ostrich (*Struthio camelus*) was found. Rodent and reptile specimens were considered intrusive and excluded from further analysis, so no additional taxonomic breakdown is provided.

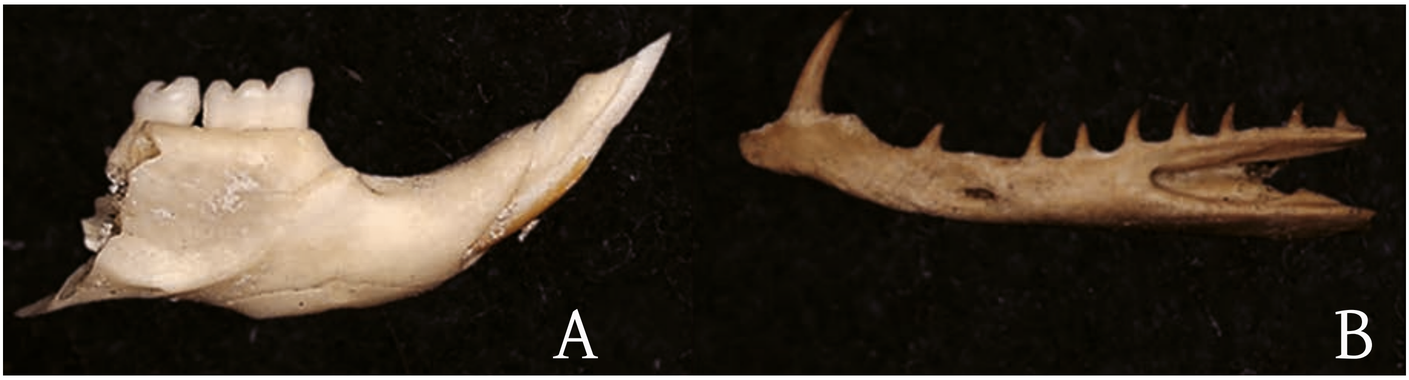

Figure 5. Examples of mandibles from intrusive species: A) rodent right mandible broken behind second molar (in socket) from ASU 14-04; B) snake left mandible from ASU 09-30 (photos taken with digital microscope, Alexandra Ptacek.)

found across all time periods. Specifically, artiodactyl remains were found in the graves of six females (UCSB 03-14 Burial 9, ASU 09-01 Burials 5, 7, and 8, ASU 09-30 Burials 15 and 17), three adults of indeterminate sex (UCSB 03-14 Burial 13, ASU 09-30 Burial 11, and ASU 14-04 Burial 3), and one older child or adolescent (8-16 years old; ASU 09-30 Burial 5). The only evidence of *Bos* (cattle) was a left temporal portion found in the early Kushite grave of an adult of indeterminate sex (ASU 09-30 Burial 11). Metapodial fragments found in UCSB 13-04 Burial 13 were from a juvenile (<2 years old) goat.

More than 60% of the faunal remains were found in the shaft (i.e. in fill above body level). Remains of aves, osteichthyes, and artiodactyls/bovids observed in these cemeteries had a 25.6% frequency of right angle/transverse outline breaks. Weathering, mostly stages 2 and 3 (deep cracking and flaking on bone surface or rough compact bone; Behrensmeyer 1978), was present across all sites along with rodent gnawing (17.5% of nonintrusive fauna fragments). Carnivore teeth marks were visible on 22.5% of the nonintrusive fauna, specifically from UCSB 03-14 (Burials 9 and 13) and ASU 09-01 (Burial 8). Faunal material found at UCSB 03-14 had evidence of cutting (on shaft near epiphyseal ends), percussion, and/or discoloration consistent with burning (Burials 9 and 13). Bone tools were found in ASU 09-01 Burial 7 (reported as distal tibia of a large goat; Baker 2018) and in UCSB 03-14 Burial 13 (caprine metapodial shaft). Figure 8 shows examples of surface modification in the assemblage.

Multiple correspondence analysis of all sites identified potential patterns of association among the variables of location within the burial, faunal taxon and presence, and bead presence. Further analysis of these variables determined no statistical significance except for bovid and bead presence with Pearson chi-square ($p = 0.040174$). With corrections for sample size, this statistical significance did not hold at <0.5 (Yates chi-square $p = 0.10068$; Fisher's Exact Test = 0.0937) but still yielded higher than expected association. Cramer's V analysis found a medium strength association (0.2962) between the presence of bovids and beads in the burials. However, there was no association with other grave inclusions such as leather (Pearson chi-square $p = 0.687295$; Yates chi-square $p = 0.975298$; Fisher's Exact Test = 1).

The taxa present at the BONE cemetery sites were used to investigate habitat reconstruction further, although fauna strictly from cemetery sites may be more limited than the array from habitation sites. Correspondence analysis (Figure 7) used the trophic, substrate, and activity pattern information for taxa present in modern and archaeological sites to attempt to confirm the habitat that would have existed at the BONE project area during the Kerma period. This information was recorded for the site if a species was present regardless of population size. The taxa present include fauna from the BONE project area reported here and previously for Post-Meroitic tumuli (Harris and Baker 2013; 2018) and Neolithic, Kerma, Post-Meroitic, and Napatan period sites as well as seven modern locations in the surrounding regions. Napatan period material for the BONE project area could not be used as the fauna specimens present were not identifiable for trophic, substrate, and activity pattern information. Neolithic sites encompass one cemetery site in the Northern Dongola Reach (Pollath 2008a; 2008b) and settlement sites: four reported by ElMahi (1988) plus Kadero (Gautier 2006) near Khartoum and four at Boni Island in the Fourth Cataract area (Pollath 2012). Two Kerma period cemetery sites were included from the Northern Dongola Reach (Bangsgaard 2014a) and Kerma (Chaix 1993). Two groupings of Post-Meroitic sites were used: four cemetery sites from the Southern Dongola Reach

Burial	Grave	BONE Site	Date Range (BC)	Sex	Age (years old)	Beads	Faunal Remains		
							Superstructure	Shaft	Body Level
1	412	UCSB 03-14	2450-1750	M	25-30	Absent			
2	404	UCSB 03-14	2450-1750	M	20-25	Absent			
3	409	UCSB 03-14	2450-1750	M	21-26	Absent			
4	407	UCSB 03-14	2450-1750	F	Adult 50+	Present			
5	411	UCSB 03-14	2450-1750	F	20-24	Absent			
6	410	UCSB 03-14	2450-1750	M	25-30	Absent			
7	408	UCSB 03-14	2450-1750	M	35-50	Absent		O	
8	405	UCSB 03-14	2450-1750	I	Child, 5-6	Absent	A		
9	401	UCSB 03-14	2450-1750	F	35-49	Absent		B	
10	402	UCSB 03-14	2450-1750	F	30-35	Present			
11	403	UCSB 03-14	2450-1750	M	Y Adult	Absent			
12	406	UCSB 03-14	2450-1750	F	Mid-Adult	Absent			
13	1403	UCSB 03-14	2450-1750	I	Adult	Present	E	B / T	
14	6051	UCSB 03-14	2450-1750	I	0.5-1	Present		E	
1	301	ASU 09-01	1750-1500	M	35-40	Absent			
2	304	ASU 09-01	1750-1500	I	Child, 2-4	Absent			
3	305	ASU 09-01	1750-1500	I	Adult	Absent			
4	306	ASU 09-01	1750-1500	I	8-14 / 6-10	Present			
5	303	ASU 09-01	1750-1500	F	25-35	Absent		B	
6	302	ASU 09-01	1750-1500	F	35-50	Absent			
7	309	ASU 09-01	1750-1500	F	40s	Absent		A / E	T
8	307	ASU 09-01	1750-1500	F	20s	Present	B		
1	310	ASU 09-30	1500-1000	M	30-35	Absent	E		
2	315	ASU 09-30	1500-1000	I	Adult	Absent			

Figure 6. Details for individuals from each grave incl. location of faunal remains (excl. intrusive rodent and reptile remains) in the grave. Faunal remains are listed with presence of taxon (A = Aves, O = Osteichthyes, B = Bovids/Artiodactyls, and E = Eggshell (ostrich). T in ASU 09-01 Burial 7 indicates a bone tool probably made from distal tibia shaft of a large goat (Baker 2018) and in UCSB 03-14 Burial 13 indicates a bone tool from the metapodial shaft of a caprine. Minimum number of individuals (MNI) of each faunal taxon present was 1 in each location. ASU 14-04 Burial 4 and ASU 15-11 Burial 3 have not been excavated; only surface collection of disturbed bones has occurred, so they are not included in subsequent analysis.

Burial	Grave	BONE Site	Date Range (BC)	Sex	Age (years old)	Beads	Faunal Remains		
							Superstructure	Shaft	Body level
3	309	ASU 09-30	1500-1000	I	1-3	Present			
4	303	ASU 09-30	1500-1000	F	Mid-Adult	Absent			
5	307	ASU 09-30	1500-1000	I	8-16	Present	B		
6	308	ASU 09-30	1500-1000	M	35-50	Absent			
7	306	ASU 09-30	1500-1000	F	25-35	Absent	A		
8	302	ASU 09-30	1500-1000	M	Adult	Absent	E		
9	305	ASU 09-30	1500-1000	M	15-19	Absent			
10	304	ASU 09-30	1500-1000	M	Adult	Present			
11	301	ASU 09-30	1000-800	I	Adult	Present		B	
12	300	ASU 09-30	1000-800	I	Adult	Absent			
13	314	ASU 09-30	1500-1000	F	20s	Absent			
14	311	ASU 09-30	1500-1000	M	40+	Absent	O / E		
15	316	ASU 09-30	1750-1500	F	30-45	Absent		B	
16	312	ASU 09-30	1500-1000	M	40s	Absent			
17	313	ASU 09-30	1500-1000	F	20-25	Present		B	
18	323	ASU 09-30	1500-1000	I	Foetal/Infant	Absent			
1	323	ASU 14-04	1500-1000	M	35-44	Absent			
2	322	ASU 14-04	1500-1000	F	30-45	Absent			
3	310	ASU 14-04	800-300	I	Adult	Absent			A / B
4	311	ASU 14-04	800-300	-	-	-	-	-	-
5	309	ASU 14-04	800-300	I	Adult	Absent			
6	312	ASU 14-04	800-300	F	Mid-Adult	Absent			
7	1489	ASU 14-04	1500-1000	I	1.5-3	Absent			
1	551	ASU 15-11	1500-1000	F	18-20	Present		E	
2	531	ASU 15-11	1500-1000	F	44-49	Absent			
3	529	ASU 15-11	1500-1000	F	Adult	-	-	-	-

Figure 6. Details for individuals from each grave, continued.

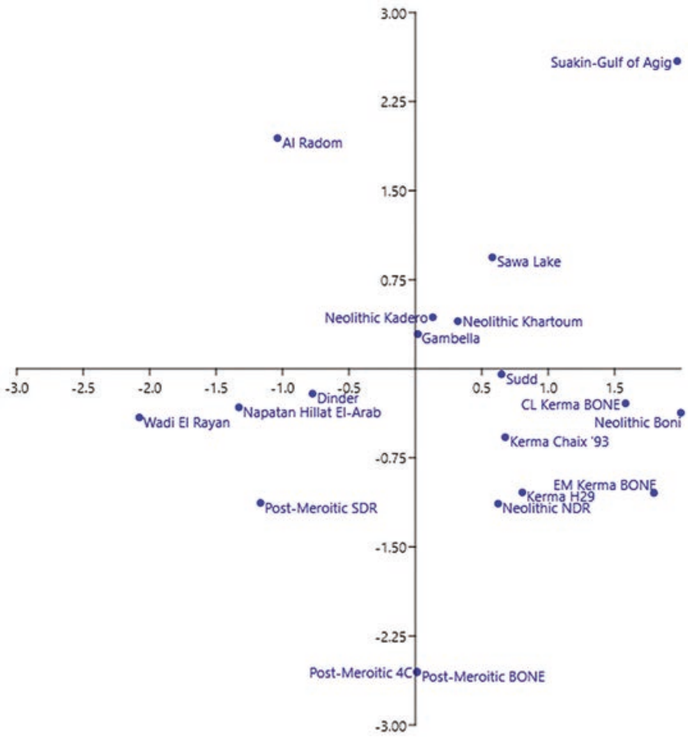

Figure 7. Correspondence analysis of ecological diversity. Data of species presence with trophic, substrate, and activity pattern information was taken from fauna analysed here for the BONE project area (EM Kerma BONE = Early/Middle Kerma period; CL Kerma BONE = Classic/Late Kerma period into early Kushite period) and previously analysed Post-Meroitic material (Post-Meroitic BONE, Harris and Baker 2013, 2018); four Neolithic sites near Khartoum (Neolithic Khartoum, ElMahi 1988), one at Kadero (Neolithic Kadero, Gautier 2006), and four at Boni Island in the Fourth Cataract (Neolithic Boni, Pollath 2012); one late Neolithic cemetery in the Northern Dongola Reach (Neolithic NDR, Pollath 2008a, 2008b); two Kerma cemetery sites (Kerma Chaix '93, Chaix 1993; Kerma H29, Bangsgaard 2014a); four Post-Meroitic cemetery sites from the Southern Dongola Reach (Post-Meroitic SDR) and two from the Fourth Cataract (Post-Meroitic 4C; Osypińska 2008); a Napatan necropolis from Hillat el-Arab near the Fourth Cataract (Napatan Hillat el-Arab, Chaix 2006); and seven modern locations: Sawa Lake (dunes/plains/wetlands in Iraq), Wadi el-Rayan (desert/oasis in Egypt), al-Radom (wooded savannah/shrubland in Sudan/South Sudan), Dinder (woodland/grassland/riverine forest in Sudan), Sudd (tropical wetlands/floodplains in South Sudan), Gambella (woodland/savanna/marshes in Ethiopia), and Suakin-Gulf of Agig (mangrove forest/marine coastline in Sudan). Refer to Figure 1 for location of sites (created by Alexandra Ptacek).

and two from the Fourth Cataract area (Osypińska 2008). The Napatan period data come from one cemetery site near the Fourth Cataract (Chaix 2006). The data from seven modern locations (national parks/reserves) were added to represent different environments in the surrounding regions (see Figure 1 for the locations of sites used in analysis).

While the Kerma, Napatan, Post-Meroitic, and BONE sites all contain fauna from cemeteries (not habitation sites), Figure 7 shows the general clustering of the BONE Kerma and early Kushite period sites with the two Kerma period sites from the Kerma core (Chaix 1993) and Northern Dongola Reach (Kerma H29, Welsby 2018) as well as the Neolithic Northern Dongola Reach cemetery and Boni Island settlement sites at the Fourth Cataract. After these archaeological assemblages, the next nearest association to the Kerma and early Kushite fauna at the BONE cemeteries are two modern sites of wetland/floodplain (Sudd) and marshy wetland (Gambella) habitats, environments also found in Neolithic habitation sites to the south. The separation of the Post-Meroitic cemeteries upstream of the Fourth Cataract and in the southern Dongola Reach reflects a lack of birds or fish recorded at the sites.

Discussion

Skulls of cattle, sheep, and/or goats or even complete *Caprinae* (sheep/goat) skeletons were frequently found with Kerma period burials near the Kerma core in the vicinity of the Third Cataract (e.g. Eastern Cemetery at Kerma; Chaix *et al.* 2012) and at contemporaneous C-Group cemeteries near the Second Cataract (e.g. Scandinavian Joint Expedition sites; Bangsgaard 2014b). Sheep or goats were typically placed at the body level and bucrania (cattle frontal bone with horns) along the perimeter of the earth tumulus (Adams 1977, 197-198). Kerma period cemeteries in the Fourth Cataract region (e.g. al-Widay; Emberling and Williams 2010) similarly contained horns or full Caprinae remains with some burials, specifically graves of adult males. Faunal remains from the Napatan period were found mainly outside of mortuary contexts (Chaix 2019), but typically contained cattle, horses, and dogs (Chaix 2006).

In contrast, the Kerma through Napatan period cemeteries of the BONE project area contained fewer and more fragmentary faunal grave accompaniments, with no evidence of complete animal interment, compared with contemporaneous sites. Sites in the Fourth Cataract region, however, show more fragmentary remains in more recent cemeteries (e.g. the Post-Meroitic cemetery at el-Sadda; Osypińska 2007).

Additionally, analysis of fauna from Kerma to Napatan graves in the BONE concession show alternative (though statistically insignificant) trends in their incorporation with certain individuals of the community. Fish appeared only in burials of male individuals, while bovid and aves bones were found only in graves of females or individuals of indeterminate sex. Contrary to the cemeteries at al-Widay (Emberling and Williams 2010) near the Fourth Cataract and other contemporaneous sites (e.g. Bangsgaard 2014a), no bovid remains were found in the burials of identifiable males. As at Kerma (Chaix and Grant 1987), there is evidence of juvenile bovids being included in the BONE graves, though not as whole skeletons. Unfortunately, age could not be estimated for most recovered faunal remains. There are no statistically significant patterns in the interment of particular animals with specific sexes or age groups, possibly due to the small sample size.

Some temporal patterns in faunal accompaniments are evident in the BONE project area. Artiodactyls (sheep, goat, cattle, and unidentifiable species) appear to be present across all time periods. None of the Late Kerma nor Napatan period remains could be identified to species, though it seems reasonable to assume the artiodactyl remains were probably domestic bovids. The *Bos* fragment from the early Kushite phase (ASU 09-30 Burial 11) is a portion of temporal and not a fragment of the frontal bone that is typical in Kerma period burials downstream. This fragment is the only evidence of cattle in these BONE cemeteries. This appearance of cattle, though based on a single fragment, occurs only after the end of the Kerma period. The lack of cattle remains in all Kerma period BONE graves contrasts with the Kerma core area. At the site of Kerma, reliance on cattle was an important part of the economy for subsistence and trade during the Early Kerma period (Chaix 2017; Chaix and Grant 1992), with isotopic analyses revealing a decrease in cattle consumption by the Classic Kerma period (Iacumin *et al.* 1998; Thompson *et al.* 2008, 379). In the BONE area, cattle appear to have been rare.

Within the BONE project area, faunal remains were rarely found at the base of the grave. A bone tool was found *in situ* along the back of the ASU 09-01 Burial 7 adult female. At ASU 14-04, faunal remains were recovered near the base of a highly disturbed dome grave (Burial 3), consisting of two fragments: an unidentifiable artiodactyl species and another from a small-sized bird similar to that found in a child's grave at UCSB 03-14 (Burial 8). Because of the substantial disturbance to this grave, intentional placement of this faunal material at its base is not secure, although later Post-Meroitic graves at the nearby Qinifab School site (Baker 2014) frequently had faunal remains near the body (Harris and Baker 2013; 2018). It is possible that this practice may have only begun in the BONE area during the Napatan period, despite the frequent placement of faunal remains at body levels elsewhere in this region during earlier periods.

Birds at the BONE cemeteries were present across the periods so they do not appear to have any specific temporal pattern, though they were more commonly included in graves here than elsewhere. Birds also may have been incorporated as burial accompaniments in a grave at H29 in the Northern Dongola Reach, although they are noted to be uncommon in cemetery contexts (Bangsgaard 2014a, 20-21; 2018). Fish bones are found in only two BONE graves from separate Kerma period phases. Though the presence of fish is recorded at most Kerma period sites, their frequency is low (e.g. Nile perch (Chaix 1980), tilapia (Chaix 1995), and catfish (Chaix 1993) were present at Kerma). There is no evidence of fish in the later BONE sites examined in this study, nor in Napatan (Chaix 2006) nor post-Meroitic (e.g. Osypińska 2008) cemeteries, indicating they were not selected as burial accompaniments.

Bones present in Kerma to Napatan period graves are mainly the densest elements with lower meat utility index (metapodials, compact bones, shaft fragments, and distal ends). Teeth marks are the most prevalent surface modification (Figure 8), though evidence of carnivores is only present in the earlier Kerma phases at sites UCSB 03-

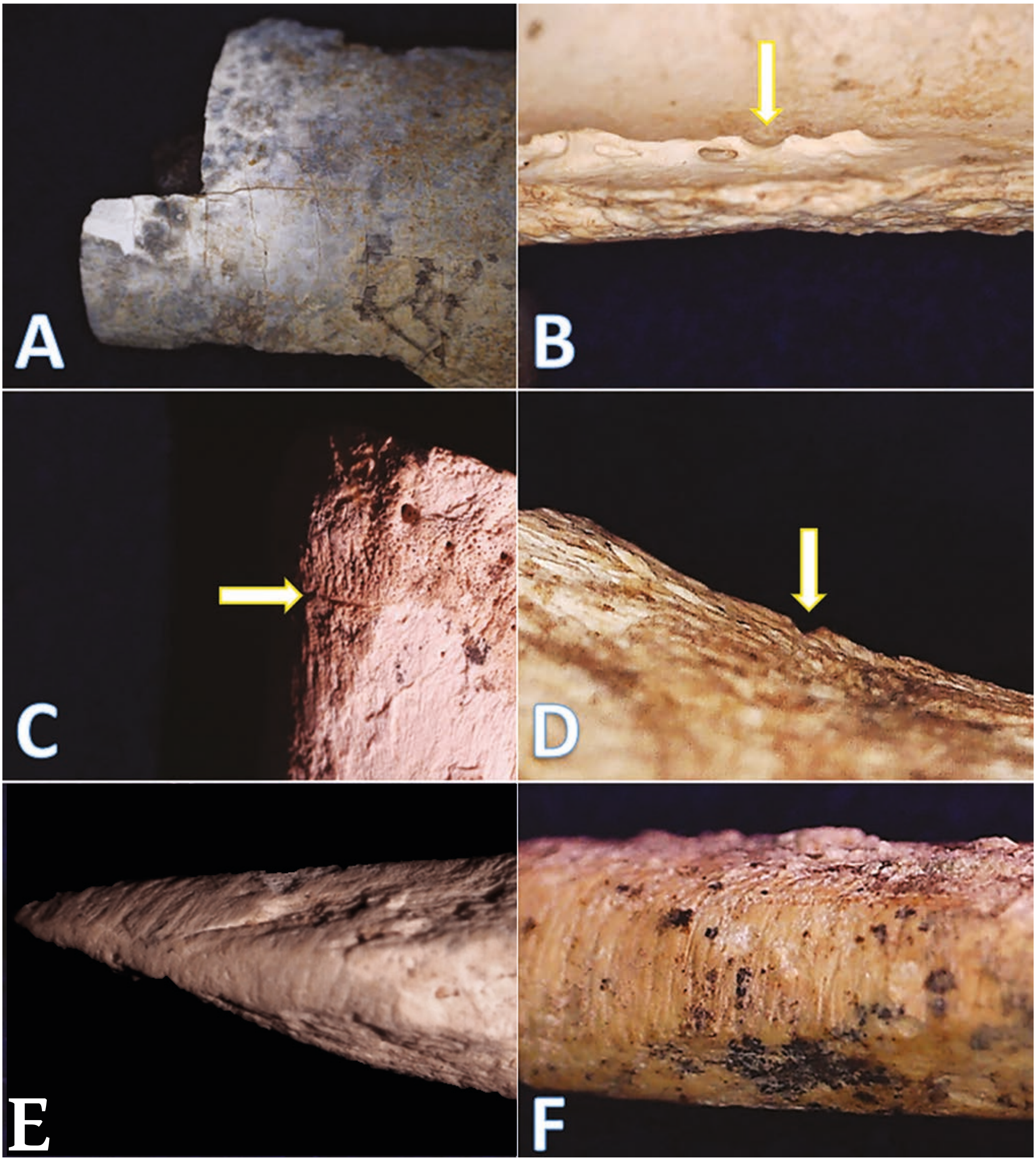

Figure 8. Examples of surface modification: A) discolouration consistent with burning (calcined) on tibia shaft fragment from UCSB 03-14 (Burial 9); B) tooth mark u-shape in split metapodial shaft fragment from UCSB 03-14 (Burial 13); C) cut mark near proximal epiphysis of metapodial fragment from UCSB 03-14 (Burial 13); D) cross-section of same cut mark as C to show V-shape; E) striations at point of bone tool from UCSB 03-14 (Burial 13); F) striations along shaped edge of bone tool from UCSB 03-14 (Burial 13). Arrows indicate cut and tooth marks (photos taken with digital microscope, Alexandra Ptacek).

14 and ASU 09-01. Typical signs of human modification (e.g. burning and cutting) are observable only in the remains from two graves in UCSB 03-14 (Burials 9 and 13) and with the two bone tools from ASU 09-01 Burial 7 (probably used for pottery crafting; Baker 2018) and UCSB 03-14 Burial 13 (more pointed tool; oblique striations from a twisting motion while piercing or simply from the shaping process if never used; see Figure 8 E, F). Where present, teeth marks imply that carnivores may have had some access to the faunal remains after disturbance of the graves or that these remains were incorporated as part of the backfill in the grave shaft rather than placed purposefully as part of the grave assemblage.

To address whether the faunal remains were purposefully placed in the burials, presence of beads as grave inclusions and presence of faunal remains were investigated. Burial of artiodactyl remains had the strongest association with beads (Cramer's V = 0. 2962) but were not statistically significant dependent variables at <0.5 (Fisher's Exact Test p = 0. 0937). The association that is found between beads as burial accoutrements and artiodactyl remains, however, still suggests purposeful interment. Thus, the domestic bovids (goat, sheep, and cattle) were specifically selected for inclusion with the deceased in the burial and not accidently included as backfill. However, it is unclear why we do not see the same association with other grave inclusions. All other faunal remains were not associated with presence of beads as grave furnishings, although their purposeful incorporation cannot be excluded.

Post-depositional disturbance of the faunal material has occurred at these sites. To address this issue, taphonomic alteration on extant faunal bones was examined. When compared to the experimental data from Marean *et al.* (2000) on the frequency of right angles resulting from fresh breaks (5%), the right angle/transverse outline breaks in the faunal material from the Kerma and Napatan period burials was observed at five times (25.6%) the expected frequency. This observation points toward non-nutritive breakage that occurs on dry bone from post-depositional damage rather than from butchering for meat consumption (Marean *et al.* 2000, 208). While there is clearly damage that affects the survivorship of faunal bones in these sites, it does not fully explain the appearance of so few faunal remains in the material record, particularly when compared to contemporaneous and nearby sites.

As previously suggested elsewhere in the region (e.g. in the north for fauna found from a town midden near the Nile (Chaix 1993), poor preservation of the faunal material may be partially due to greater exposure to environmental effects near the Nile (subject to flooding and wind erosion). The cemeteries investigated, however, are on the desert terrace above the floodplain but adjacent to large wadis or tributary khors. While human and faunal remains found in the tombs of the necropolis east of Kerma (farther from the Nile floodplain than the town) are well preserved and even naturally mummified (Chaix and Grant 1993, 28), the remains in the BONE project area are significantly more fragmentary and weathered. Although there were fewer faunal remains present in BONE project area burials, the identifiable taxa were consistent with those reported across the Middle Nile Valley during these time periods.

Desiccation in the region transformed marshy wetlands that were present earlier in the Neolithic (e.g. ElMahi 1988) into tropical semi-desert and grasslands with some savanna and a portion of montane forest across the region by 5,000 years ago. The taxa present in the graves of the BONE project area include fauna that favour wetlands, which would have been present immediately along the Nile, and species that would have preferred surrounding shrub- and grasslands in addition to the areas of rocky terrain present today. While taxa selected for burial inclusion are likely limited compared to the faunal representation at habitation sites (accumulated through human and carnivore activity), the climate did not appear to alter substantially in the BONE project area based on the taxa represented at these cemeteries between approximately 2200 and 430 BC (see Figure 7). The presence of fewer faunal remains in these burials, thus, is probably not due to changing climate over this time span, though presence of the cemeteries near the Nile and higher rainfall over this time would have allowed for greater moisture damage than at more recent sites.

The Kerma period cemetery of H29 is located approximately 7km east of the modern Dongola Nile in the Northern Dongola Reach south of the Third Cataract and was associated with rural communities outside of the large necropolis and town of Kerma, which lies almost 50 kilometres to the north (Bangsgaard 2014a; Welsby 2018). During the use of H29 in the early Kerma period, it would have been located immediately along the Seleim Nile palaeochannel and exposed to increased moisture before a period of drying that began at the start of the Late Kerma period (Macklin *et al.* 2013). Similar trends are evident at H29 and the Kerma period BONE cemeteries. Most faunal material is found in the fill instead of at body level, with generally poor preservation of the bones and evidence of ancient and recent disturbance. In addition to similarities in the appearance of birds in the graves, a greater frequency of size 2 artiodactyls, specifically caprines, is present at H29 (Bangsgaard 2014a; 2018), especially compared to the predominance of cattle found at Kerma (e.g. Chaix 2017). The communities that buried their dead at H29 also appear to have incorporated only select portions of the fauna (Bangsgaard 2014a; 2018), as opposed to the complete animals frequently found at other Kerma period sites in the Dongola Reach and northward (e.g. Chaix *et al.* 2012) or even downstream near the Fourth Cataract (e.g. El-Tayeb and Kołosowska 2005, 54-56; Emberling and Williams 2010).

The similarities between H29 and the BONE project area cemeteries probably reflect their use by rural communities. The greater presence of caprines in both settings is probably due to their suitability for the environment (Chaix and Grant 1993), with higher reproductive capacity (Otte and Chilonda 2002, 62) compared to cattle, which may also face greater mortality risks due to disease (Gifford-Gonzalez 2000; 2015). At H29, the presence of only partial remains with some cases of human modification was interpreted as the remnants of a meal or feast (Bangsgaard 2014a, 23; 2018). A similar pattern is present in the Kerma period cemeteries in the BONE project area, although it contrasts with later practices in the area, where unconsumed food offerings of the highest meat utility index are found in the post-Meroitic burial chambers at the Qinifab School site (Harris and Baker 2013; 2018). The inclusion of only portions of artiodactyl remains that have evidence of human modification in the earlier Kerma phases of the BONE cemeteries, however, may provide evidence symbolic of a feast as part of the funeral rites, as suggested by Bangsgaard (2014a; 2018) for the Early Kerma cemetery at H29.

Conclusions

Analysis of faunal material from excavated Kerma to Napatan period cemeteries in the BONE project area found evidence of a bird and unidentifiable artiodactyl during the Napatan period, *Bos* during the early Kushite phase, and birds, fish, and domestic bovids throughout the Kerma period. Unlike fauna buried with later Post-Meroitic individuals in the project area (Harris and Baker 2013; 2018), no canid remains were found, and the remains that survived for analysis were mainly those with the lowest meat utility index as opposed to the 'choicest cuts' interred with the Post-Meroitic individuals. Despite these differences and the presence of carnivore teeth marks on a limited selection of fauna in three of the 14 graves (21.4%) with faunal remains, the possible association of artiodactyl remains with beads as grave inclusions within the same burial implies they were more likely purposefully placed and later disturbed, rather than carnivore discards that were accidentally included in the backfill of the grave.

The incorporation of bovids within burials is consistent with reports from other Kerma period cemeteries, though fewer animal remains appear to have been selected for inclusion with burials or survived in the BONE project region. Post-depositional damage to the assemblages appears to have been caused partly by erosion due to cemetery locations along the Nile, where the environment would have been wetter in the past and habitats would have consisted of wetlands (along Nile floodplain) with shrub- and grasslands surrounding. This damage would have been exacerbated by the ancient disturbance evident in many of these graves. Yet, some of the surviving bone shows evidence of human modification, so clearly only portions of the animals were interred in these graves. The artiodactyl remains from the Kerma and early Kushite phases of the BONE project area cemeteries, thus, appear to have been purposefully interred either as remnants of a funerary meal or feast or as symbolic of such rites of passage. Once excavation of additional cemeteries in the BONE project area, or the publication of extant faunal remains from sites excavated in other parts of the Fourth Cataract region, provide more data on these time periods, further investigation could expand on possible trends identified here for temporal shifts in the role of animals in funerary ritual.

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