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Life Histories of Sacrificed Camelids from Huancaco (Virú Valley)

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The practice of sacrifice or ritual killing in ancient central Andean societies has become a topic of increasingly focused study in archaeology and physical anthropology. Much of this research has examined the killing of human victims in a range of geographic and temporal contexts (Andru-shko et al. 2011; Bourget 2001b, 2006; Gaither et al. 2008; Klaus et al. 2010; Sutter and Cortez 2005; Toyne 2008; Tung and Knudson 2010; Verano 2008a; Wilson et al. 2007). There has also been a recent surge in bioarchaeological research, which has allowed investigators to reconstruct the circumstances surrounding the death of these individuals in great detail (Klaus et al. 2010; Toyne 2008; Verano 2008b). Isotopic studies have been employed to some extent for sacrificial victims with the aim of better understanding the life histories of these individuals

(Fernández et al. 1999; Wilson et al. 2007) or to specifically address their geographic origin (Andrushko et al. 2011; Toyne et al. 2014; Tung and Knudson 2010; Turner et al. 2013).

The purpose of this research is to utilize an isotopic approach to reconstruct the life histories of sacrificed llamas from Huancaco in the Virú valley of northern Peru. This line of investigation says less about how these individual animals came to die and more about how they lived—although these two factors may very well be interlinked. Such information is valuable for understanding sacrifice or ritual killing within its larger economic, social, and ritual contexts.

South American Camelids

The South American camelids consist of two wild (vicuña and guanaco) and two domestic (llama [*Lama glama*] and alpaca [*Vicugna pacos*]) species. The llama and alpaca were the only large mammalian species to be domesticated in the Western Hemisphere and were prominent in the economic, social, and ritual spheres of numerous Andean societies (Bonavia 2008; Dillehay and Núñez 1988; Dransart 2002; Miller and Burger 1995; Murra 1965; Shimada and Shimada 1985). From an economic perspective, llamas were utilized for meat and as beasts of burden, being instrumental in long-distance exchange networks (Browman 1990; Dillehay and Núñez 1988; Nielsen 2001). Both llamas and alpacas were utilized as fiber-producers, although the finer fleece of the alpaca made them prized for this purpose (Murra 1962; Orlove 1977). Much of what is known about camelid herding practices in the Andes comes from ethnographic and ethnohistoric accounts of herders in high altitude areas (>3,800 meters above sea level) (Flores-Ochoa 1979; McCorkle 1987; Murra 1965, 1980; Orlove 1977; Tomka 1992).

Some of the more detailed descriptions of historic camelid management practices come from Murra (1965, 1980), who describes Inka herding during the Late Horizon Period (AD 1476–1532), primarily in southern Peru. Within this context, there were distinct herds owned by the state, the church (so-called shrine herds), and the community. The sizes of these herds varied greatly from one region to another, and in some cases certain types of herds (especially shrine herds) appear to have been absent in some areas. In many cases, community herds were of much smaller size than the church or state herds, and several accounts suggest that community-owned animals were not contributed

as sacrifice or tribute (Polo de Ondegardo 1571). There are records that state-owned and shrine herds had access to specifically demarcated pastures that could not be grazed by outside herds (Murra 1965). Moreover, there are numerous indications that the physical attributes of the animals (color in particular) were of some significance with respect to selection for particular types of sacrifice (Murra 1965).

It is problematic to extrapolate ethnohistoric accounts of Inka rule too broadly, but these data do suggest the possibility that sacrificial animals may have been raised differently from non-sacrificial animals and perhaps even perceived in a wholly different manner than animals destined to become food or supply wool. These differences may have been dietary and consistently applied throughout the lives of the animals, or they may have occurred close to the times of the animals' deaths, as in the case of force-feeding llamas *chicha* prior to sacrifice (Webster 1972). More generally than this, we may expect that sacrificial animals were physically segregated from other animals and fed a more specific or less diverse diet in accordance with what was believed to be ideal food—or at least ideal food for an animal destined for sacrifice. Analogous cases for such practices come from Vanuatu in Melanesia, where certain types of pigs with ceremonial importance in prestige-related feasting are fed special diets and kept in houses (Blackwood 1981; Funabiki 1981; Jolly 1984). Such a pattern may be expected to manifest itself in a low amount of isotopic variability for a group of sacrificial animals compared to non-sacrificial animals.

An important question in Andean prehistory concerns whether or not camelids were raised locally in the coastal river valleys or were raised exclusively in high-altitude environments and imported to the coast (Shimada and Shimada 1985). Following European colonization, camelid pastoralism has been predominantly limited to the high-altitude pastures of the Andes, and this is reflected in ethnohistoric and ethnographic accounts (e.g., Flores-Ochoa 1979; Murra 1965; Tomka 1992). Recent isotopic studies of coastal camelids have, however, provided evidence that camelids were indeed raised on the coast beginning at least during the Early Intermediate Period (Szapak et al. 2014) and through to the Middle Horizon (Dufour et al. 2014; Szpak et al. 2014). On the basis of substantially higher amounts of inter-individual isotopic variation and inconsistent amounts of inter-individual variation, Szpak et al. (2014) have argued that coastal camelid husbandry consisted primarily of numerous small groups of animals kept within or around

urban environments by individual households. This pattern stands in contrast to the much larger herds described for high-altitude pasturelands. Despite having local camelid herds on the coast (likely llamas rather than alpacas due to their tolerance of a wider variety of environmental conditions [Topic et al. 1987]), fine wool was still being imported from the highlands to the Virú valley during the Early Intermediate Period (Szpak et al. 2015). A coherent picture of the origins and nature of coastal camelid husbandry is still emerging, but at this point evidence suggests experimentation with keeping animals locally during the Early Horizon (Szpak et al., in press), before the practice was more deeply established during the Early Intermediate period (Szpak et al. 2014).

Animal Sacrifice

Animal sacrifice has been discussed in a diverse array of ethnographic and ethnohistoric texts (Abbink 2003; Christman 2008; Cole 1997; Evans-Pritchard 1956; Hasu 2009; Insoll 2010; Middleton 1987; Pluskowski 2012; Rahimi 2004; Sprenger 2005; Wiget and Balalaeva 2001). Typically, these discussions have focused on the ritual aspects of animal sacrifice and, in turn, reflect the symbolic importance of certain animals or animal species and the larger symbolic significance of these events. There is an array of views concerning exactly what constitutes the *sacrifice* of an animal rather than the *killing* of an animal under “ordinary” circumstances (reviewed by Russell 2012: 88–138).

On the basis of ethnographic evidence of hunter-gatherers and pastoralists, the death of *many* if not *most* animals may be highly ritualized. For instance, in some hunting cultures, the hunt consists of a series of events that incorporate significant spiritual aspects, and the killing of the animal by the hunter is an event with implicit or explicit ritual aspects within a larger set of beliefs about humans, animals, and the environment (Bird-David 1990; Brown 1984; Carneiro 1970; Nadasdy 2007; Willerslev 2004, 2007). Similarly, among some East African pastoralists, every animal slaughter—including those destined solely to produce food—is a highly ritualized event. By most conventional definitions (and as defined by these peoples themselves), it is a sacrifice (Ryan et al. 2000). Additionally, many instances occur among herders in which sacrificial materials are drawn from live animals without the death of the animal, as in the case of ritual bleeding (Abbink 2003; Dransart 2002; Evans-Pritchard 1940).

Therefore, in an attempt to simplify “animal sacrifice,” we focus on animals that are killed under highly ritualized contexts in which the ritualized component is not incidental but is foregrounded. Within archaeological contexts, these types of animal sacrifices may be identified through contextual associations (Cross 2011; Goepfert 2012; Hamilakis and Konsolaki 2004; Lucas and McGovern 2007; Verhoeven 2002), such as in conspicuous displays of animal remains (Lucas and McGovern 2007), the deposition of complete animal carcasses in association with human burials (Cross 2011; Goepfert 2012; Losey et al. 2013), in ritual contexts (Green 1992), or the burning of animal remains (Hamilakis and Konsolaki 2004; Isaakidou et al. 2002). In some cases, where there is no clear evidence of butchery (or even slaughter), it is typically inferred on a variety of evidence that animals deposited in such contexts represent sacrifices (Croft 2003; Goepfert 2012; Russell and During 2006; Sandweiss and Wing 1997; Wheeler et al. 1995; Yuan and Flad 2005). Regardless of the manner in which such animals died, the deposition of entire animal carcasses that may have produced significant quantities of materials in life (milk, wool, traction, fertilizer, transport) and in death (meat, hides, wool, other raw materials) clearly represents a sacrifice in the classical sense (Hubert and Mauss 1964 [1898]).

Drawing primarily on ethnographic literature, two fairly common aspects of animal sacrifice are: (1) the use of domestic animals (largely or exclusively); and (2) the incorporation of the animal sacrifice within a gift economy with ancestors or supernatural entities. The use of domestic animals is significant in the sense that *sacrifice* (rather than simply *offering*) implies the giving of something that is owned by the donor (Firth 1963a, 1963b; Ingold 1987, 1994; Testart 2006). This relationship better characterizes herders and their animals than it does animals that are hunted (Ingold 1994). The notion of sacrificed animals as part of a supernatural gift economy has deep roots in anthropology (Tylor 1889) and, to some extent, is overly simplistic in that it fails to account for the larger symbolic or metaphorical aspects of the ritual event itself (Lienhardt 1961; Valeri 1994) and of the performative nature of the sacrifice (Cole 1997; Hoskins 1993). A more reasonable approach recognizes a complex set of relations that are historically situated in the sacrificial event among several parties: sacrificers and sponsors, ritual practitioners and specialists, victims (in this case animals), spirits or ancestors, and the human audience (Hasu 2009; Hoskins 1993). There may be overlap among these positions in any given ritual.

The distinction between wild and domestic animals in sacrificial events is of further significance. This is by virtue of the different nature of human-animal relations that characterize hunters and those involved in animal husbandry respectively. Specifically, in the case of wild animals, *individuals* selected for sacrifice are unlikely to be familiar with some members of the community (Knight 2005, 2012). Conversely, for domestic animals, it is more likely that some individuals are, to at least some extent, known to the community. Perhaps this line may be blurred in cases where wild animals are captured and held for appreciable periods of time prior to sacrifice (Batchelor 1908; de Sales 1980; Trigger 1990), but these distinct cases likely occupy some liminal state between wild and domestic and are, of course, exceptions to the broader pattern. The significant point here is that the lives of the animals that were sacrificed were shared with members of a human community, with a high degree of mutual familiarity between human and animal. This is particularly noteworthy since, in many instances in sacrifice, the animal is thought to be, to at least some extent, a substitute or proxy for the human sponsor providing the animal for sacrifice (Hamayon 1990; Hasu 2009; Rasmussen 2002). The implication here is that *particular* animals are directly associated with *particular* people or groups of people. This directly ties in to the potential importance of prestige and the competitive nature of sacrificial ritual, where individuals, families, or kin groups provide victims for sacrifice, rather than communities (Gibson 1988; Heesterman 1993). More generally, the sacrifice is situated within a larger spiritual, social, economic, and political context, within which the ritual practitioners conducting the sacrifice represent only one segment. To more completely understand the nature of this event, it is also necessary to examine the lives or biographies of the sacrificed animals, as well as the sacrificial event itself. Such examination is facilitated by an array of techniques utilized in modern bioarchaeology and zooarchaeology.

Camelid Sacrifice in the Peruvian Andes

The sacrifice or ritualized killing of animals played an important role in ceremonial activity in the ancient Andes. On the north coast, Moche iconography depicts the hunting of deer and sea lions in highly ritualized manners (Benson 1995; Bourget 2006; Donnan 1997a). While these activities involved the killing of wild animals and are thus distinct from those

involving domestic animals for reasons discussed above, if we accept the premise that hunters are engaged in some type of gift economy with the animals that they take and the supernatural (Nadasdy 2007), then these hunts could also be viewed as sacrifices. Similarly, articulated skeletons of numerous wild species (particularly birds) have been recovered and interpreted as offerings in Moche burials (Goepfert 2012), suggesting a significant role for the carcasses of these animals in ritual activity associated with the dead and perhaps for the procurement of these animals as well. Nevertheless, domestic animals (dogs, guinea pigs, camelids) are far more prominent in sacrificial and ritual contexts, such as in association with human burials or building construction (Goepfert 2012; Sandweiss and Wing 1997). The primacy of domestic animals as the appropriate substrate for sacrifice is supported in the ethnohistoric literature. Cobo (1990 [1653]:113) recorded that for an object (animal or otherwise) to be appropriate for sacrifice, it must be one that required human labor to produce. While this line of thinking may be largely utilitarian, it aligns well with the notion that the lived interaction between humans and animals is significant within the context of ritual sacrifice.

A wealth of archaeological, ethnohistoric, and ethnographic information documents the ritual importance of camelids in the Peruvian Andes and highlights ceremonies in which camelids were sacrificed (for a comprehensive review, see Bonavia 2008). Sources describe the importance of camelid sacrifice in Inka ritual activity, with the ritual killing of camelids being a regular event in herds controlled either by local communities or the religious arm of the Inka state (often referred to as “church herds” or “temple herds”) and the Inka royalty (Flannery et al. 1989; Murra 1965). The scale of these sacrifices ranged considerably from single animals to several hundred individuals of very specific types (e.g., specifically colored camelids that were sacrificed at certain times of the year or were associated with particular deities) (Murra 1965).

On the north coast of Peru, camelid skeletal elements are relatively common items in Moche (AD 100–800) graves, with the most common type of faunal funerary offering consisting of camelid skulls and distal limb elements, typically from all four limbs (Donnan 1995; Goepfert 2012; Gumerman 1994; Millaire 2002). Such remains do not provide direct evidence of ritual killing, and it has been suggested that the bulk of the animals were consumed during funerary feasting (Goepfert 2010). Camelid remains have also been found in association with ritually killed humans on the north coast of Peru, such as at Huaca Santa

Clara in the Virú valley (AD 1100; Millaire 2015; Szpak et al. 2014), Cerro Cerrillos in the Lambayeque valley (AD 900–1100; Klaus et al. 2010), Santa Rita B in the Chao valley (AD 1100–1300) (Gaither et al. 2008), at Túcume in the La Leche valley (Toyne 2011b), Huanchaco in the Moche valley (AD 1400; Donnan and Foote 1978), and the Chotuna-Chornancap Archaeological Complex in the Lambayeque valley (AD 1450–1532; Wester et al. 2010). In some cases, there is clear evidence that these camelids were sacrificed in association with human ritual killing, such as at Huanchaco, where the camelids show evidence of blunt force trauma to the cranium (Donnan and Foote 1978). In other cases, the camelids do not display clear physical evidence of unnatural death, but the deposition of entire, unbutchered camelid carcasses contemporaneous with the human ritual killings is strongly suggestive of unnatural deaths.

Outside contexts of human ritual killing, the sacrifice of camelids specifically is well documented on the north coast of Peru during the late Middle Horizon and beginning of the Late Intermediate Period. The camelid remains analyzed in this study are associated with one such ritual event at Huancaco in the lower Virú valley and is the earliest documented instance of a series of camelid sacrifices (which in some cases included human subadults as well) on the north coast of Peru. In the Virú valley, similar sacrifices occurred at Huaca Santa Clara (V-67), Huaca Negra (V-71), and Cerro de Huarpe (V-313) (Millaire 2015; Strong and Evans 1952; Willey 1953). The number of camelids sacrificed at each of these sites varied from four (V-313) to twenty-eight (V-67), but all were associated with previous occupation centers that had been abandoned for some time prior to the sacrificial event. The association of these camelid sacrifices with previously occupied sites strongly suggests the significance of ancestral places on the landscape, although these sites did not function as ceremonial centers during their occupations (Millaire 2015).

On the north coast of Peru and throughout the central Andean region, the variable nature of camelid offerings that occur on their own or in association with human burials (or ritual killings) makes it difficult to reconstruct any generalized patterns. This may be because camelids were utilized in a diversity of ritual contexts, being sacrificed in different manners (mode of death, color of animal, age of animal, number of animals) depending on the local context. Even within the north coast camelid sacrifices described above there is considerable variation. This

is not surprising in light of the key roles that camelids played in ritual activities as documented in historic and modern times (Bolin 1998; Flannery et al. 1989; Flores-Ochoa 1979; Kolata 1996; Murra 1965; Webster 1972; Zuidema 1992). This is not to suggest that there is direct continuity between any particular camelid ritual over the last millennium, but given the ubiquity of camelids in the region, it is likely that they have played an important role in rituals over that time.

Stable Isotope Variability in the Andes

Stable isotope analysis has been employed with increasing regularity in archaeological studies to reconstruct the life histories of past human and animal populations, including in the Andean region of South America (Finucane et al. 2006; Finucane 2007; Kellner and Schoeninger 2008; Knudson et al. 2007; Slovak and Paytan 2011; Williams and Katzenberg 2012). In the case of human and animal organic tissues, the isotope systems studied can be broadly characterized as either dietary (as in the case of C, N, S) or geographic (as in the case of O, H, Sr, Pb), depending on the biogeochemical processes that primarily impact a particular isotope. Ultimately, however, the dietary isotope ratios will also be influenced by geography because various environmental processes at global, continental, and regional scales can influence the carbon, nitrogen, or sulphur isotopic compositions at the base of the food web (Craine et al. 2009; Murphy and Bowman 2006; Szpak et al. 2013; Tieszen and Chapman 1992). The foci of this chapter are the stable isotopes of carbon and nitrogen, which are routinely analyzed to examine the diet and ecology of past human and animal populations. Because the carbon and nitrogen isotopic compositions of an animal's tissues reflect the carbon and nitrogen isotopic compositions of the foods consumed (DeNiro and Epstein 1978, 1981), it is first necessary to review some of the processes that influence these signatures and what might be expected in northern Peru.

In terrestrial ecosystems, the majority of plants consumed by animals in appreciable quantities are of two photosynthetic types: C_4 plants (mean $\delta^{13}C$ ca. -12 ‰), which are tropical grasses (including maize and amaranth); and C_3 plants, which comprise most other terrestrial vascular plants (including some grasses, mean $\delta^{13}C$ ca. -26 ‰) (Kohn 2010; O'Leary 1981; Smith and Epstein 1971). Relative to C_3 plants, C_4 plants tend to be more abundant in hot and dry locations (Sage and Pearcy 2004). Along the western slope of the Andes, mean daily temperature

tends to decrease with altitude, and mean annual precipitation tends to increase with altitude (Bush et al. 2005). Therefore, C_4 plants are expected to be more abundant at lower altitudes relative to higher altitudes, and this pattern has been observed in several studies (Szpak et al. 2013; Tieszen and Chapman 1992).

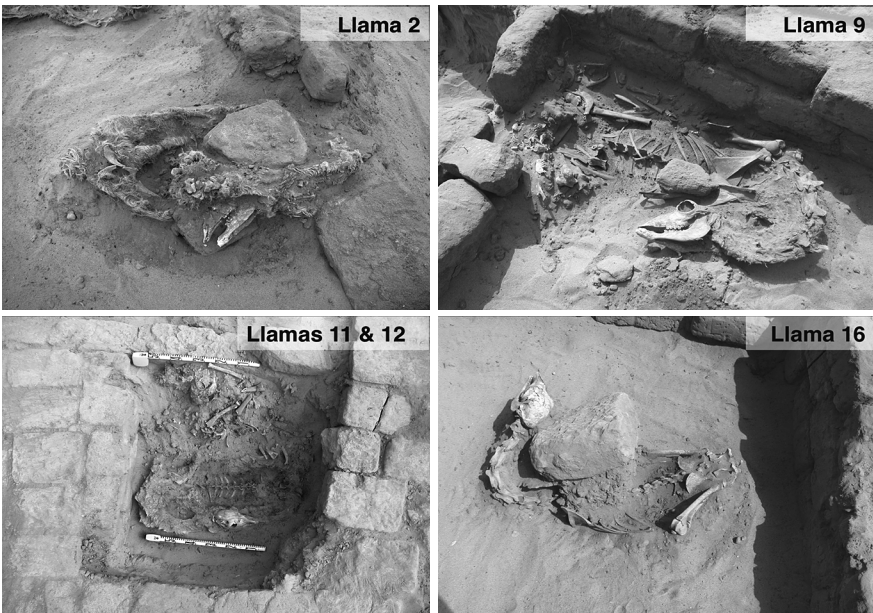
The regional significance of altitude in influencing the isotopic compositions of plants extends beyond the relative distribution of C_3 and C_4 species. The extremely arid conditions characteristic of most low-altitude and coastal locations in northern Peru result in a trend toward relatively high $\delta^{15}N$ values in plant tissues relative to higher-altitude locations that are relatively more moist (Szpak et al. 2013). This effect has been observed throughout the world and is driven by the fact that hot and arid ecosystems tend to be fairly “open” and prone to various processes that lead to the loss of nitrogen (these processes favor the loss of ^{14}N) and, concurrently, the relative enrichment in ^{15}N (Handley et al. 1999). Significantly, these effects are passed on to herbivores (Murphy and Bowman 2006). In northern Peru, these aridity effects may be dampened or absent for agricultural plants relative to wild plants growing on the coast due to the supplementation of agricultural plants with irrigation water (Szpak et al. 2012).

Overall, there is a trend toward higher carbon and nitrogen isotopic compositions in plants growing in low-altitude and coastal locations relative to high-altitude locations. In addition, there is a trend toward increasing baseline isotopic variability at coastal and low-altitude locations (Szpak et al. 2013). Besides the potential effects of irrigation water discussed above, there are also significant numbers of nitrogen-fixing plants known to have grown extensively along the coast, for instance: peanuts, various types of beans, and a number of different pod-bearing *Prosopis* trees (Beresford-Jones et al. 2009; Pozorski 1979). This is significant because nitrogen-fixing plants are characterized by lower $\delta^{15}N$ values relative to plants that obtain their nitrogen from mineralized nitrogen (nitrate and ammonium) in the soil (Virginia and Delwiche 1982). Thus, coastal vegetation is extremely diverse in terms of carbon and nitrogen isotopic compositions, with all of the following being present (or at least plausible): low $\delta^{13}C$ /low $\delta^{15}N$ (nitrogen-fixing plants, C_3 cultigens grown under irrigation), low $\delta^{13}C$ /high $\delta^{15}N$ (wild C_3 plants, fertilized C_3 plants), high $\delta^{13}C$ /low $\delta^{15}N$ (cultivated maize grown under irrigation), and high $\delta^{13}C$ /high $\delta^{15}N$ (wild C_4 plants, fertilized maize) (Szpak et al. 2013).

Archaeological Context

The site of Huancaco (V-88 and V-89; Willey 1953) is located in the lower Virú valley, approximately 8km from the coast and 5km east of the Gallinazo Group (figure 12.1). Initially, this site was believed to have been occupied during the Early Intermediate Period, functioning as the paramount Moche regional administrative center of Virú (Fogel 1993; Willey 1953). Excavations at Huancaco by Bourget (2003, 2010) document the occupation between AD 550–680¹ and demonstrate an absence of evidence for the presence of Moche administrators. Instead, the site was occupied by a group of elites characterized by a distinct but related style of material culture (Huancaco)—one of several regional material culture traditions on the north coast (Chapdelaine 2008; Donnan 2009; Millaire 2009a). Fourteen of the camelids analyzed are associated with the Early Intermediate period occupation of the site.

Ten of the camelid remains analyzed in this study postdate the abandonment of Huancaco and are associated with a ritual that involved the



12.1. Images of select camelids from the post-abandonment ritual sacrifice at Huancaco. Photos by Steve Bourget.

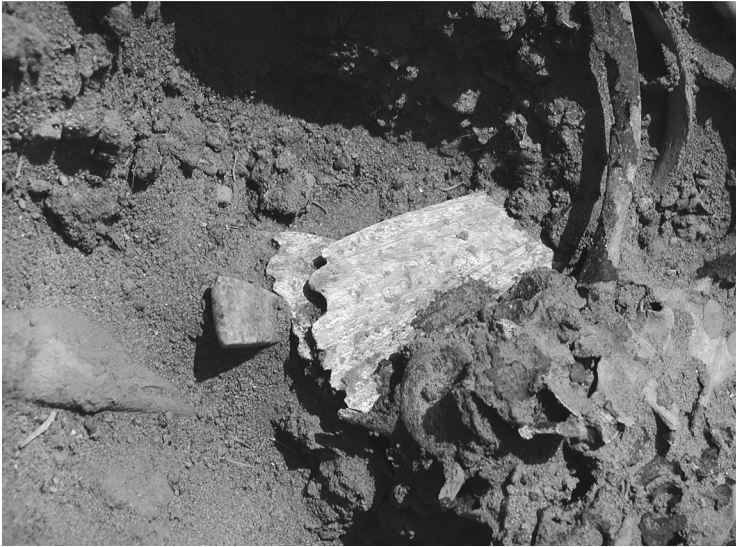
sacrifice of 15 immature llamas atop the abandoned site (figure 12.1).² Following the abandonment of the site (ca. AD 700), there is no evidence for its reoccupation aside from the material associated with this ritual. The llamas were recovered from shallow pits dug into two rooms associated with the earlier occupation. The ritual appears to have occurred sometime between AD 778–979 on the basis of a radiocarbon date on a cord used to bind one of the llama's legs (Millaire 2015). Such reuse of abandoned *huacas* and deposition of ritual offerings occurred regularly on the north coast of Peru.

On the basis of skeletal and dental development (Wheeler 1982), the age range of the llamas was very restricted: ten animals were between 1 and 3 months old, four were between 5 and 6 months old, and one was between 6 and 9 months old. While a specific age range of the llama population was targeted, there was considerable variation in the treatment of the llamas in this ritual and their subsequent burial. Of the 15 llamas, nine were buried individually and six were buried in pairs. Some llamas, but not all, had their feet bound. Of the three paired llama burials, a younger individual (1–3 months) was found below an older individual (4–6 months). This may be coincidental or may represent a preference to position the animals in this way. Alternatively, this may be caused by a punctuated temporal sequence, with burials taking place over a longer period of time. There is, however, no evidence to support this latter possibility. The stomachs and esophagi of all of the undisturbed animals recovered contained trapezoidal pieces of *Spondylus* shell and rectangular pieces of turquoise (figure 12.2). There are no cut marks on the ribs suggesting that these objects were force-fed to these animals immediately prior to their deaths. While it is possible that force-feeding these objects caused the animals to asphyxiate, there is no definitive evidence to this effect.

Materials and Methods

Bone collagen was extracted using a modified Longin (1971) method as described in detail elsewhere (see Szpak 2013). Hair samples with adhering skin were manually cleaned and sampled in 1cm increments. Hair was cleaned by sonication in deionized water and subsequently treated with 2:1 chloroform: methanol. Hair samples were air-dried and finely chopped prior to isotopic analysis.

Isotopic and elemental compositions were determined using either



12.2. Detailed image of Llama 2 with turquoise and *Spondylus* objects force-fed to the animal at or around the time of death. Photo by Steve Bourget.

a Thermo Finnigan Delta V or a Thermo Finnigan Delta Plus XL continuous flow mass spectrometer coupled to a Costech Elemental Analyzer at the Laboratory for Stable Isotope Science at the University of Western Ontario. Samples analyzed on the Delta V were calibrated to VPDB and AIR with two glutamic acid standards: USGS40 (accepted values $\delta^{13}\text{C} = -26.39\text{‰}$, $\delta^{15}\text{N} = -4.5\text{‰}$) and USGS41 (accepted values $\delta^{13}\text{C} = +37.63\text{‰}$, $\delta^{15}\text{N} = +47.6\text{‰}$). Samples analyzed on the Delta Plus XL were calibrated to VPDB with IAEA-CH-6 (sucrose, accepted $\delta^{13}\text{C} = -10.449\text{‰}$) and NBS-22 (oil, accepted $\delta^{13}\text{C} = -30.031\text{‰}$) and to AIR with IAEA-N-1 (ammonium sulfate, accepted $\delta^{15}\text{N} = +0.4\text{‰}$) and IAEA-N-2 (accepted $\delta^{15}\text{N} = +20.3\text{‰}$). In addition to these calibration standards, internal (Keratin, average $\delta^{13}\text{C} = -24.04\text{‰}$, $\delta^{15}\text{N} = +6.4\text{‰}$) and international (IAEA-CH-6 and IAEA-N2 where USGS40 and USGS41 were used as calibration standards) standards were analyzed to monitor analytical accuracy and precision. Ten percent of samples were analyzed in duplicate with a mean difference among five duplicate pairs of 0.04‰ for $\delta^{13}\text{C}$ and 0.03‰ for $\delta^{15}\text{N}$.

Results

Carbon and nitrogen isotopic compositions for camelid bone collagen are presented in table 12.1 and figure 12.3, along with modern animals

TABLE 12.1. Carbon and Nitrogen Isotopic Data for Huancaco Camelids

Sample ID	% Collagen	C:N Ratio	$\delta^{13}\text{C}$ (‰, VPDB)	$\delta^{15}\text{N}$ (‰, AIR)
Sacrificed llamas				
Llama 1	2.8	3.38	-14.50	+6.5
Llama 4	4.1	3.11	-17.08	+10.1
Llama 5	1.3	3.19	-18.55	+6.7
Llama 6	7.4	3.02	-17.10	+7.2
Llama 7	7.7	2.99	-13.97	+8.6
Llama 8	3.9	3.04	-16.42	+8.7
Llama 9	10.9	3.00	-16.15	+7.2
Llama 10	16.9	3.22	-15.99	+6.7
Llama 11	5.8	3.22	-15.71	+6.5
Llama 13	3.6	3.26	-16.75	+4.9
Occupation-associated camelids				
AIS 1214	22.1	2.93	-15.00	+6.6
AIS 1221	20.3	2.96	-18.46	+6.6
AIS 1222	17.3	2.95	-14.14	+7.9
AIS 2131	12.7	3.14	-12.00	+7.2
AIS 2133	7.2	3.14	-13.15	+7.0
AIS 2134	15.0	3.15	-12.05	+8.5
AIS 2136	16.8	3.16	-15.81	+5.0
AIS 2137	1.9	3.37	-18.11	+10.7
AIS 2138	4.1	3.14	-10.83	+5.7
AIS 2140	16.8	3.16	-15.98	+7.3
AIS 2142	15.0	3.17	-14.76	+6.1
AIS 2147	10.3	3.16	-10.64	+4.6
AIS 2148	5.7	3.18	-11.64	+6.7
AIS 2149	8.8	3.22	-15.48	+6.1

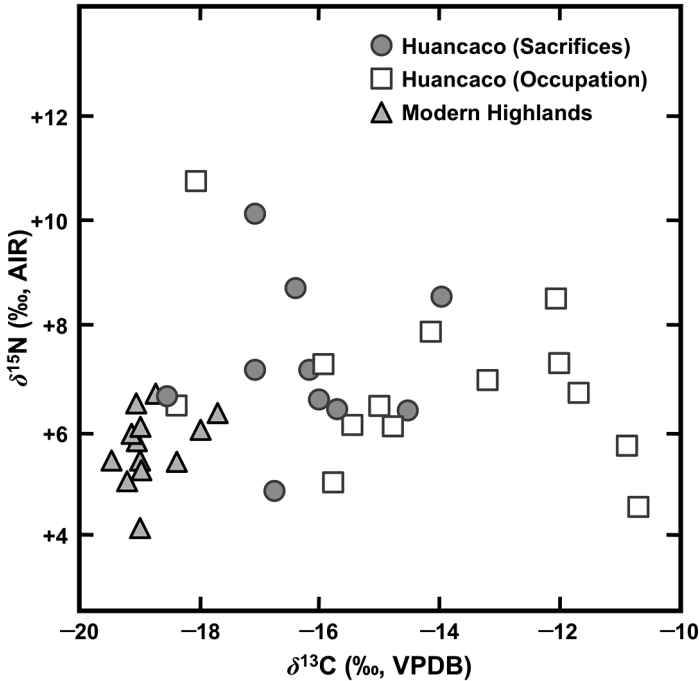
Data from Llama 2 not included as it is considered unreliable (see text).

raised in the highlands for comparison. For bone collagen, only samples that met the following criteria were included in subsequent analyses: (1) collagen yield >1%; (2) C:N ratio between 2.9 and 3.6; and (3) %C > 13%, %N > 4.8% (Ambrose 1990; DeNiro 1985).

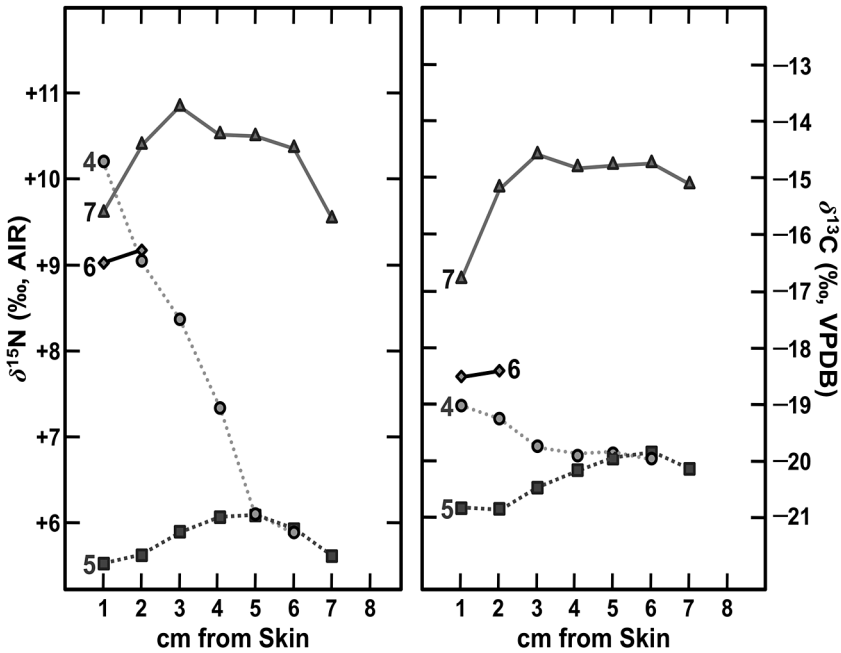
The carbon isotopic compositions for the sacrificed camelid bone collagen ($n = 10$) ranged from -18.55 to -13.97‰; nitrogen isotopic com-

positions ranged from +4.9 to +10.1‰; there was no correlation between $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$. The carbon isotopic compositions for the Early Intermediate Period occupation camelid bone collagen ($n = 14$) ranged from -18.64 to -10.64‰; nitrogen isotopic compositions ranged from +4.6 to +10.7‰. While the turnover rates of bone collagen in camelids are not known specifically, the isotopic signature of bone collagen represents the weighted average of dietary intake over the last years (or decades) of an animal's life (Wild et al. 2000); bone formed early in life during periods of rapid growth may be disproportionately represented (Hedges et al. 2007). Because the sacrificed llamas analyzed in this study are all less than 9 months old, it is reasonable to simply state that the isotopic composition of their bone collagen represents lifetime average diet.

Carbon and nitrogen isotopic compositions for serially sampled hair from the sacrificed llamas are presented in figure 12.4. For serially



12.3. Carbon and nitrogen isotopic compositions of Huancaco camelid bone collagen. Modern camelid bone collagen data ($\delta^{13}\text{C}$ adjusted by +1.5‰; Yakir 2011) from high-altitude contexts are shown for comparative purposes (Schoeninger and DeNiro 1984; Szpak 2013; Thornton et al. 2011). Image by Paul Szpak.



12.4. Carbon and nitrogen isotopic compositions of serially sampled hair from Huancaco llama sacrifices. Numbers to the left of each segment line correspond to the llama specimen. Image by Paul Szpak.

sampled camelid hair, there were no consistent patterns leading up to the time of death, with some individuals (e.g., Llama 5) having very low variation over time (range of 1‰ for $\delta^{13}\text{C}$, 0.6‰ for $\delta^{15}\text{N}$), and with other individuals (e.g., Llama 4) having much larger variation over time (a range of 0.9‰ for $\delta^{13}\text{C}$, 4.3‰ for $\delta^{15}\text{N}$). Moreover, there is no consistent direction in the dietary change leading up to the time of death, with individuals variably having increasing, decreasing, or largely stable $\delta^{13}\text{C}$ or $\delta^{15}\text{N}$ values.

The sacrificed Huancaco camelids had significantly lower $\delta^{13}\text{C}$ values relative to the Early Intermediate Period non-sacrificed camelids (*t*-test, $t_{[22]} = 2.37$, $p = 0.03$), although there was considerable overlap between the two groups. The $\delta^{15}\text{N}$ values did not significantly differ for the sacrificed and Early Intermediate period camelids (*t*-test, $t_{[22]} = 0.73$, $p = 0.47$). Although the sacrificed juveniles were characterized by higher $\delta^{15}\text{N}$ values than the occupational camelids (most of which were mature), the difference was small ($+7.3 \pm 1.5\text{‰}$ compared to $+6.9 \pm 1.5\text{‰}$). This is

surprising, considering the restricted age range of these camelids and the potential impact of nursing on $\delta^{15}\text{N}$ values. Today, most llamas are weaned by 6 months of age (Fowler 1998). On this basis, we would expect that these animals present a fairly strong “suckling effect,” causing higher $\delta^{15}\text{N}$ values than would be expected in adult animals (Balasse et al. 2001). By way of comparison, a larger group of immature sacrificed camelids from Huaca Santa Clara in the Virú valley also had $\delta^{15}\text{N}$ values that were only marginally higher than a group of butchered animals (primarily mature) from the same site ($+7.2 \pm 1.3\text{‰}$ compared to $+6.7 \pm 1.4\text{‰}$) (Szpak et al. 2014). That there is not a more pronounced suckling effect may be related to the very young age of these animals, most of which were less than 3 months of age at death. Extremely young animals tend to have tissue nitrogen isotopic compositions that are similar to the mother, acquiring the isotopic suckling effect after a prolonged period of nursing (Fogel et al. 1989; Schurr 1997). Therefore, these animals may not have lived long enough to record a substantial nursing signal in the nitrogen isotopic composition of their bone collagen.

Discussion

Geographic Origin of Camelids

Carbon and nitrogen isotopic compositions of animal tissues are, by themselves, not sufficient to definitely determine the local nature of an individual or group of individuals. As discussed previously, on the coast there are more plants with high $\delta^{13}\text{C}$ values (C_4 plants) and high $\delta^{15}\text{N}$ values (due to the arid conditions). These plants, however, do not make up the entirety of the local plant biomass, and numerous species with low $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values are common; therefore, animals with low $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values are not necessarily foreign. Conversely, plants with high $\delta^{13}\text{C}$ and high $\delta^{15}\text{N}$ values are rare or absent at high altitudes typically associated with camelid pastoralism (Szpak et al. 2013). This is evident when isotopic data from modern camelids living in high-altitude locations are considered (figure 12.3). These data are characterized by low $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values, with no individual $\delta^{13}\text{C}_{\text{collagen}} > -17.7\text{‰}$ (after adjustment for the Suess Effect; Yakir 2011). Similarly, archaeological data for camelids from high-altitude sites are consistent with a strong or complete reliance on C_3 plants (DeNiro 1988; Thornton et al. 2011). It is therefore reasonable to suggest that animals with high $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values are not likely to have been raised in the high sierra, or *puna*.

Along these lines, it is likely that at least some of the camelids involved in this sacrificial event were raised locally on the coast. It is possible that those with low $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values were imported from elsewhere for the explicit purpose of this sacrificial event, but this scenario is unlikely given the restricted age range of these camelids. Based on modern and historic accounts of long distance caravan travel by camelids in the Andes, the caravan animals were exclusively castrated males older than two years of age (Browman 1990; Nielsen 2001); there are no records of juvenile camelids making these long treks from the highlands to the coast. The most reasonable explanation for the presence of juvenile animals is that these animals were drawn from a *relatively* local population. If these sacrificed camelids were adults, this assertion would be much more problematic. This is certainly not to imply, however, that the local inhabitants maintained large camelid herds that were quantitatively or qualitatively similar to what has been described in the highlands (Flores-Ochoa 1979; McCorkle 1987; Murra 1965, 1980; Orlove 1977; Tomka 1992). Rather, a more likely scenario would see a smaller scale camelid pastoralism along the coast and in the lower stretches of the coastal river valleys that were largely subsidized by agricultural and marine food sources (Szpak et al. 2014). Several authors have proposed the herding of camelids outside of the highlands on the basis of isotopic information (DeNiro 1988; Goepfert et al. 2013; Thornton. 2011) and other lines of evidence (Goepfert 2012; Pozorski 1976; Shimada and Shimada 1981, 1985). While the isotopic data in and of themselves do not solidify the origin of these animals as local, the age structure of this group of animals is strongly suggestive of this possibility.

Life Histories of Sacrificed Camelids

Although these animals were most likely born at or around the same time (probably within 6 months of one another) and eventually killed at this location (probably simultaneously), there is no apparent consistency in their diets based on bone collagen and hair isotopic data. This may be because these animals were either from different locations or were managed in different ways. Given the existing isotopic data, it is not possible to definitely suggest one as more likely. Irrespective of geographic origin, however, the isotopic data do indicate that there was some variation in the management of these sacrificial animals. If these

sacrifices represented the culling of individuals from a single large herd, we would expect to see more consistency in the isotopic variation in camelid hair sampled over time (similar diets leading up to the time of death reflected in the hair), as well as less isotopic variation among individuals (similar diets averaged over the life of the animal reflected in the bone collagen). While there is less variation in carbon isotopic composition in the sacrificed camelids relative to the Early Intermediate period camelids (figure 12.3), this may be driven by the smaller sample size of the sacrificed camelids, their extremely restricted age range, and/or their restricted temporal range relative to the Early Intermediate Period camelids. There is no indication that these sacrificed animals spent any appreciable time together prior to being killed as part of this ritual. If these animals were part of a single herd and were grazing together prior to the sacrificial event, then a pattern of more limited isotopic variation (comparable to that observed for the modern highland camelids) would be expected.

The similarity of isotopic compositions between the occupation and sacrificial camelids is significant when considering the selection of these specific camelids to be sacrificed. Common themes in animal sacrifice include the surrogacy of *individual* animals for *individual* people, as well as the importance of some degree of ownership of the animal being sacrificed. In this case, the isotopic variation that existed among individual camelids sacrificed at this site may very well be driven by differences in animal management by specific herders. The inclusion of animals derived from different herds (and possibly distinct locations) may reflect the contributions of distinct people or socioeconomic collectives to this ritual event.

The possibility exists that these animals were acquired from numerous herders prior to the sacrifice (through exchange or some form of tribute) and that the sponsor of the sacrificial event was divorced from the life histories of the camelids. In other words, the people involved in the rearing of the animals appear removed from the sacrificial event, and the selection of these particular individuals may be incidental. Instead, the driving force behind the sacrificial event, in the broadest sense, may have been the selection of a particular location to bury these animal offerings. The subjectivity of the camelids was largely removed, with their primary purpose being for visual effect during the performance of the ritual or for serving as materializations of the spiritual purpose of the event.

Camelid Sacrifice in Broader Context

Goepfert (2012) has suggested that the pervasiveness of immature camelids in sacrificial contexts on the north coast is evidence of the existence of large local herds. A large size was required to buffer against the effects of culling these animals for sacrifice. While this is a possibility, evidence for the existence of large corrals on the coast is lacking, although some smaller corrals have been noted (Bawden 1982; Shimada 1994a; Toyne 2008; Wilson 1988). The lack of corrals on the coast is significant given the lack of large pastures on the coast that are comparable in size to those in the *puna*; the large agricultural fields in coastal river valleys would certainly not have fared well with large camelid herds grazing freely. An alternative scenario—large numbers of small camelid herds distributed throughout coastal river valleys—seems more plausible given the nature of the coastal environment and is more consistent with the isotopic data (Szpak et al. 2014). In this context, a relatively large local population of camelids could be maintained, although their management would occur at a much smaller scale, with small numbers of individuals being kept by families or other small social units (Szpak et al. 2014).

This smaller-scale management of camelids is significant in terms of the inclusion of animals for sacrifice. As discussed above, the isotopic differences observed among individuals, as well as the varying patterns in isotopic compositions within individuals (hair), may very well represent the involvement of numerous people (or groups of people) donating camelids for this ritual. The structuring of the sacrifice in this respect may have been necessitated by the relatively small size of herds outside of prime camelid pastureland, with no single herd being large enough to sustain the sacrifice of more than a dozen (or in some cases, dozens) individuals in a given season. Aside from these practical considerations, the ritual event itself may have been significant as a unifying mechanism for the larger community, potentially to honor and communicate with ancestors, to articulate with ancestral places on the landscape, and as a spectacle (Hoskins 1993). The isotopic variation in these sacrificial camelids may very well represent the bringing together of animals raised under different circumstances by different people; it is not unusual in cases of animal sacrifice for particular animals to be closely associated with the people who raised them, with some degree of animal-person substitution involved (Küchler 2002).

That the animals sacrificed were juveniles is undoubtedly significant. Llamas may have been utilized for their meat, but the value of their secondary products was extremely important. These products most notably include fiber for textile production (Splitstoser 2009) and dung for use as fertilizer and fuel (Szpak et al. 2012; Winterhalder et al. 1974). These animals were sacrificed prior to being shorn, and they were not consumed. Considering sacrifice in terms of a gift economy with the supernatural, this may signify a more extravagant offering given to the ancestors relative to an aged, infertile animal (Hoskins 1993) or body parts with low meat value—a common occurrence in Moche funerary contexts (Goepfert 2012).

It is important to bear in mind that sacrifices are not events confined to the ritual sphere. In discussing Old World camel sacrifice, Rahimi (2004: 452) points out that “the performance of the rituals draws attention to an inventive socio-religious hybridization process between practices of heterodoxy and canonical-clerical interpretations, forming a ritual space that essentially overlaps with the political sphere.” This would certainly have been true of these camelid sacrifices on the north coast of Peru, which emerged after the collapse of the large Early Intermediate Period polities (possibly the earliest states in the region) at a time when there was receptiveness to new cultural traditions, both internal and external (Millaire 2015). One of the key elements of these north coast camelid sacrifices is that the isotopic data suggest continuity in the manner of animal husbandry for the llamas that were sacrificed versus those that were raised and butchered during the occupation of these sites (Szpak et al. 2014), which may well represent the melding of local camelid husbandry traditions with new ritual practices.

Conclusion

The llama sacrifices at Huancaco represent one ritual event in a larger regional tradition of sacrifice involving llamas and, in some cases, human children on the north coast of Peru. The carbon and nitrogen isotopic data suggest that the animals used in the ritual were drawn from a fairly local range, probably from within the valley. The isotopic variation observed within the sacrificed group of camelids is inconsistent with these animals consuming similar diets for any significant amount of time, suggesting that they were managed separately prior to the ritual event. Additional studies of this nature on other sacrificed camelid

groups on the north coast would be useful in documenting regional variability in this practice. Additionally, where humans and camelids occur together in these contexts, there may be some interesting geographic connections between people and animals. Were the humans involved in the ritual drawn from a similarly local area? Are the isotopic patterns similar for rituals involving only camelids versus those involving both camelids and humans? Are there any geographic connections between humans and camelids that are directly associated with one another (i.e., those buried in the same pit)?

With respect to animal sacrifice, if our goal is to understand these events within a broader social and cultural context, then it is important to better understand the lives of these animals in addition to reconstructing the circumstances surrounding their deaths. Stable isotope analysis offers one means to better reconstruct the life histories of animals, both at the individual and supra-individual levels that ultimately speak to a previously unknown range, process, and structure surrounding animal offerings on the north coast of Peru. There is a suite of other techniques, besides those described here, that would aid in the reconstruction of the lives of these animals. Additional isotopic markers ($\delta^{18}\text{O}$, $\delta^2\text{H}$, $^{87}\text{Sr}/^{86}\text{Sr}$) that more specifically address habitat and mobility, rather than diet, have the potential to document the geographic origin of animals that were part of ritual activities, including sacrifice. For example, Knudson et al. (2012) used strontium and oxygen isotope analyses to examine the geographic origin of camelids consumed during feasting at Tiwanaku. Such studies are dependent upon knowledge of local isotopic baselines, as well as sufficient isotopic variation among regions (i.e., two locations may be geographically isolated from one another but may share similar oxygen, hydrogen, or strontium isotope signatures). While not in sacrificial contexts, the examination of pathological lesions on camelid bones has documented the presence of cargo animals in southern Peru (deFrance 2010) and northern Chile (Labarca and Gallardo 2012). The development and advancement of next-generation DNA sequencing technologies make it possible to attain genomic-level perspectives of ancient organisms (Knapp and Hofreiter 2010). Although methodologically difficult at this time, it is theoretically possible to use these data to reconstruct various phenotypic traits, including externally visible characteristics (Fortes et al. 2013).

These analyses could allow various aspects of an animal's appearance to be reconstructed, as well as identify genetic relationships to other

animals involved in ritual events. Taken together, these techniques allow for a much more detailed understanding of the lives of animals involved in ritual killings. When interpreted alongside detailed contextual information, these lines of evidence have the potential to reveal a great deal regarding the ritual killing of animals on the ancient north coast of Peru.

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NOTES

1. All dates are calibrated using IntCal09 (Reimer et al. 2009).
2. While llamas and alpacas are notoriously difficult to distinguish on the basis of postcranial skeletal remains, differentiation between the species is possible on the basis of dentition and when soft tissue is present (Wheeler 1982; Wheeler, et al. 1995). In the case of Huancaco, butchered animals from the Early Intermediate Period occupation of the site cannot be identified to species and are simply referred to as “camelids.” Conversely, sacrificed animals from the later ritual context are complete, have retained soft tissue, and can be classified as llamas specifically.