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Unraveling Animal Sacrifice and Taphonomy

Analysis of Faunal Remains from the Underwater Khoa Reef Sanctuary in Lake Titicaca, Bolivia

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This chapter reports the zooarchaeological analysis of the faunal remains recovered from the various underwater explorations conducted in the Khoa Reef, an underwater sanctuary located in the vicinity of the Island of the Sun in Lake Titicaca, Bolivia (fig. 12.1). Although it has been suspected since the early days of the Spanish conquest of the Andes that there was an underwater shrine near the Island of the Sun, where a major Inca pilgrimage center was established (Bauer and Stanish 2001), its specific location remained unknown for centuries. This changed in 1977, when a team of amateur divers found the remains of stone boxes containing Inca shells and metal miniature offerings (1400–1532 AD) near an underwater reef located between the islands of Khoa and Pallalla, toward the northwestern shore of the Island of the Sun (Ponce Sanginés et al. 1992). Subsequent explorations in 1988–1992 yielded additional findings that included more stone boxes (although most were empty) (Delaere 2022) and remains from Tiwanaku period ritual offerings (650–1150 AD) that included puma-shaped incense burners and gold ornaments (Ponce Sanginés et al. 1992; Reinhard 1992). Notably, dozens of camelid bones were found at the site, which suggests that they were likely deposited as part of animal sacrifices. In June and July 2013, the Proyecto Huiñaimarca (PH12–14) conducted underwater excavations at the Khoa Reef. During this expedition, more costly offerings were recovered, as was a unique assemblage of faunal remains, most of which are associated with the Tiwanaku period ritual use of

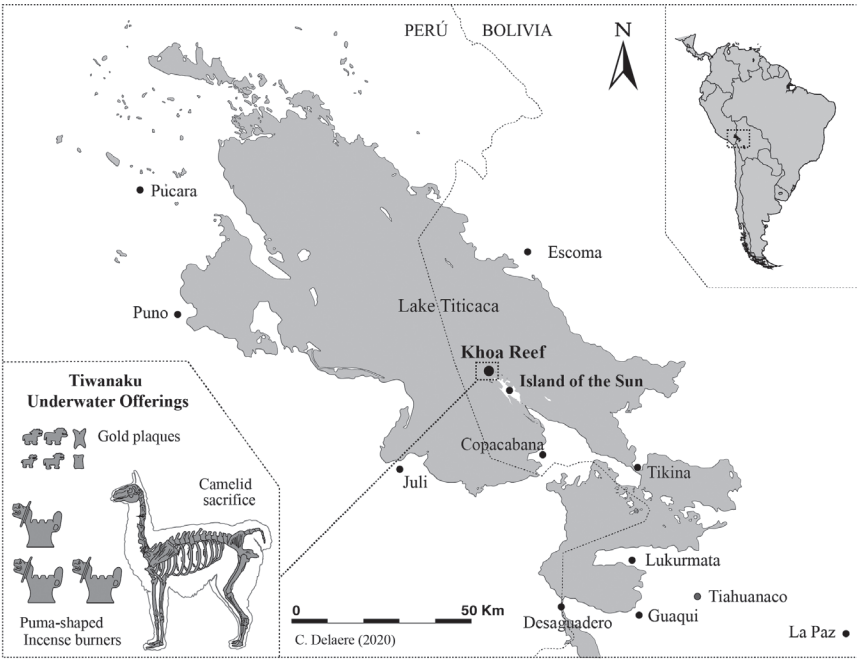

Figure 12.1. Map showing the location of the Khoa Reef in relation to Lake Titicaca and the hypothesized composition of a typical Tiwanaku period underwater offering. Map by C. Delaere.

the site (Delaere 2020; Delaere et al. 2019; see chapter 11). In this chapter, we bring together all information about the faunal remains recovered from the Khoa Reef to reconstruct the animal sacrifice practices that occurred in this site. We also discuss some of the cultural and natural behaviors related to the formation of the archaeofaunal assemblages in the Lake Titicaca Basin.

Materials and Methods

In 2013, three units totaling 16 square meters were excavated in the Khoa Reef. These units were located between large boulders and ended in bedrock. All sediment was sieved through 10 millimeter and smaller screens, depending on the context. Zooarchaeological analysis of these materials was done at the Laboratorio de Zooarqueología of the Carrera de Arqueología at Universidad Mayor de San Andrés in La Paz with the aid of faunal reference collections and osteological guides (Mendoza et al. 2016). Standard techniques of zooarchaeological analysis were used (e.g., Lyman 1994; Moore et al. 2010; Reitz and Wing 2008). Using the excavation units and loci as the minimum units of aggregation, each specimen, which was defined as an archaeofaunal bone,

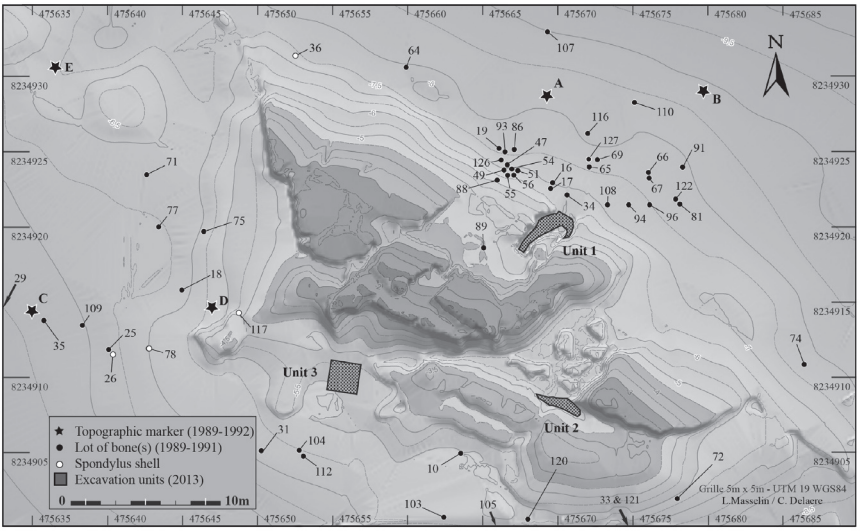

Figure 12.2. Map of the Khoa Reef including the location where ceramics, bones, and metal surface findings were found in 1989–1991 and 2013. Map by L. Masselin and C. Delaere.

a dental fragment, or a shell fragment, was the minimum unit of analysis. We recorded the class, taxa, element, portion, percentage, epiphyseal fusion stage, laterality, and weight of each specimen. We inspected specimens for modifications such as thermal alteration, gnaw marks, cut marks, and weathering. We quantified material based on the number of identified specimens (NISP) and weight in grams. We also did measurements to support intraspecific identification and to facilitate estimations of the minimum number of individuals (MNI). Finally, we took general and detailed digital photographs of all the material we analyzed. To complement this work, we revised and integrated the identifications of all the faunal remains recovered from the Khoa Reef during earlier explorations using similar criteria. Additionally, since 1989, all of the visible faunal remains around the underwater reef have been collected and mapped by trilateration using a series of fixed reference points (Reinhard 1992). We mapped these points with the goal of using them as reference points for the 2013 excavations (fig. 12.2).

Results

The 2013 excavations in the Khoa Reef produced a substantial collection of faunal remains that totaled 993 specimens weighing a total of 3,219.63 grams (table 12.1). A sample of possible camelid hide was also recovered. Most of the

remains correspond to Units 1 and 3; Unit 2 contained only four specimens. We analyzed evidence from at least sixty-seven loci, but several locations did not contain any archaeofaunal remains. Because there were no significant contextual, stratigraphic, or chronological differences between the materials recovered between these units, we report the results aggregated together.

Table 12.1. Taxonomic representation of faunal remains from the excavations at Khoa

	Unit 1		Unit 2		Unit 3		Total		Surface
Class and Taxa	NISP	Weight	NISP	Weight	NISP	Weight	NISP	Weight	NISP
Mammalia									
Camelidae	268	1,833	1	38.13	115	1061.91	384	2933.04	186
Leopardus jacobita	—	—	—	—	1	0.88	1	0.88	—
Unidentified macrofauna	14	3.77			1	1.53	15	5.3	14
Aves									
Phalacrocorax sp.	1	2.5	—	—	6	12.06	7	14.56	—
Anatidae	2	0.25					2	0.25	
Rallidae	—	—	—	—	—	—	—	—	1
Unidentified Aves	11	0.68			19	0.33	30	1.01	
Amphibia									
Telmatobius culeus	42	22.45	6	2.2	68	30.38	116	55.03	20
Anura	51	9.44			27	7.55	78	16.99	
Unidentified microfauna	4	0.06	1	1.19	—	—	5	1.25	
Osteichthyes									
Orestias sp.	256	9.28	—	—	44	2.06	300	11.34	
Trichomycterus spp.	13	4.83	—	—	18	4.42	31	9.25	
Unidentified fish	14	0.05	—	—	4	0.07	18	0.12	
Bivalvia									
Spondylus spp.	1	1	—	—	5	169.61	6	170.61	10
Totals	677	1,887.31	8	41.52	308	1,290.80	993	3,219.63	231

Note: All weights in grams. The surface remains correspond to materials from reanalyzed contexts.

We recovered 384 specimens of camelids. This material accounts for 97 percent of the weight of our assemblage, although in terms of number of specimens, they make up only 39 percent. We identified 17 incisors that are typical of llamas and guanacos. These teeth have closed roots and enamel on both the labial and lingual sides. This information plus the size of the bones suggests that most of the camelids were domesticated llamas (*Lama glama*). The representation of elements and the number of fused epiphyses suggests that a minimum number of four animals were present in the assemblage, but perhaps more were present given the dispersion caused by postdepositional processes. Based on epiphyses fusion and teeth eruption sequences, we estimate that one of the animals was a newborn and that three were juveniles under eighteen months of age. Although most of the camelid bones were well preserved and showed very little evidence of fragmentation before deposition, many were fragmented and were affected by postdepositional disturbances, including wave action and rockfall. Only a few specimens had some evidence of possible cut marks. Taphonomic abrasion processes might have produced these marks, judging by their location and shape. Some specimens of camelid vertebrae, which were present in the assemblage in large numbers, had some evidence of possible pathologies. Some specimens had evidence of thermal alteration that was likely produced by exposure to open flames but not necessarily for cooking. A few medial fragments of clean-cut long bones were heavily polished, which suggests that they might have been worked and deposited either as offerings or accidentally as part of fishing equipment.

A feline is represented by a small canine tooth. This is rare and could correspond to an Andean mountain cat (*Leopardus jacobita*), currently a cryptic and rare species.

Most bird remains consist of isolated bones of aquatic birds, including ducks (family Anatidae) and possibly coots (family Rallidae). Three bones of a neotropic or olivaceous cormorant (*Phalacrocorax brasilianus*) were found. Because none of the cormorant bones are repeated and the general age estimation is the same, they could belong to the same individual, but the fact that these bones were located in both Unit 1 and Unit 3 suggest that this is unlikely. These birds fly in flocks and are typically aquatic and piscivorous, so their deposition in the lake is likely the result of natural processes. We found eggshells, which is unusual because no bird could nest in this underwater area today. This confirms that the reef was exposed above the level of the lake at some time (Delaere 2017, 2019).

Amphibian remains are well represented. Most correspond to the Lake Titicaca water frog (*Telmatobius culeus*), apparently many individuals of

enormous sizes. Smaller and different frog species (including *Telmatobius marmoratus*) are also present, as is suggested by the diversity of bones found. Today, at least five different genera of amphibians are present at Lake Titicaca (Vellard 1992). Although various skeletal elements were recovered, most are neurocrania. This suggests that most frogs were relatively complete at the time of burial. The absence of cultural modifications on these bones further verifies that frogs were deposited naturally. The high frequency of anuran remains could mean that the Khoa Reef was an ideal habitat for these amphibians. The Lake Titicaca water frog is critically endangered today due to lake contamination, predation, and overfishing (Ministerio de Medio Ambiente y Agua 2009, 111).

Most fish remains were identified to the killifish genus *Orestias,* locally known as *carachis,* and several specimens of *Trichomycterus* catfish, locally known as *mauri* and *suche.* In both cases, the number of identified specimens was large and the specimens correspond to the larger species of these genera, a likely consequence of both taphonomic and recovery biases. Some of the likely species present include the carachi amarillo (*Orestias luteus*), as suggested by the presence of scales with small protuberances that are characteristic of this species, and *umanto* (*Orestias cuvieri*), as suggested by very large opercula and dentaries. The *umanto* was relatively common in its pelagic habitat before the introduction of the trout, but today it is extinct (Ministerio de Medio Ambiente y Agua 2009, 47). Sizable elements with a high structural density such as opercula and vertebrae are abundant in the assemblage, suggesting another source of taphonomic bias. As in the case of the bird and anuran remains, fish bones were most likely deposited by natural processes, but we do not rule out the possibility that some might have been deposited around the same time as camelid remains through human agency. In fact, a few fish bones were found inside ceramic incense burners and had burn marks. Killifish and catfish were economically and symbolically important species during the Tiwanaku period, as suggested by their frequent representation in iconography and their nearly ubiquitous presence in contemporary zooarchaeological assemblages (Capriles 2013; Capriles et al. 2014).

Finally, six *Spondylus* shell items, commonly known as *mullu,* complemented the vertebrate faunal remains. This thorny oyster was ritually and symbolically important from the earliest days of Andean civilization (Murra 2002). Although *Spondylus* habitat rarely extends beyond the warm waters of the Pacific Ocean in coastal Ecuador, its shell was widely traded as a symbol of water, rainfall, and fertility (Reinhard 1992). During the 2013 underwater explorations, the *Spondylus* items recovered included a camelid-shaped zoo-

morphic figurine (L. 52.1), a complete specimen (L. 56), and four fragments of possible ornaments, two of which were perforated. The complete *Spondylus* shell lacks the spines that characterize the genus, but these could have been worn off by postdepositional processes (Delaere 2020).

Eduardo Pareja Siñanis reported 131 findings that were recovered in 1989–1991, of which 49 correspond to bones. Of these, 44 have been identified as camelid bones (with a minimum number of seven individuals estimated by the number of identified tibias), one as lamb, and four as either frogs or birds (Ponce Sanginés et al. 1992, 583–706). He also described four specimens of *Spondylus* shell. He also described five *Spondylus* shell figurines recovered in 1977 and a long bone recovered in 1988. Pareja Siñanis initially identified the latter as human, but a photograph suggests that it is a camelid tibia (Ponce Sanginés et al. 1992, 541). Although he mentioned that divers had found additional bones in 1992, none of these are explicitly reported. In visits to the reef, three camelid bones were recovered in 2000 and six in 2004 (Pareja Siñanis 2000, 2004).

Thanks to the detailed inventory and photographs published from these remains, we were able to reanalyze these identifications. We determined the existence of 185 camelid specimens (including those recovered in 2000 and 2004), fourteen artiodactyls, one bird, twenty amphibians, and ten *Spondylus* shell specimens (see table 12.1). Most of the bones were recovered from the northeast of the reef near Unit 1 or toward the south and west, near Unit 3. Based on various factors, we estimate that the minimum number of camelids in this assemblage was five. Data regarding dental eruption and epiphyseal fusion indicates that most of these specimens were juveniles. However, given the wide dispersion of these bones, many more individuals might have been present. The bird bone is likely the femur of a coot. If that is the case, it would verify the presence of the Rallidae family in Khoa. There is no doubt that the twenty amphibian remains are those of Lake Titicaca giant frogs, given their large sizes. The *Spondylus* remains include five figurines (two females, two males, and a llama), three complete shells, one bead, and one fragment. We were not able to verify the presence of a lamb bone, but one metacarpus seemed considerably smaller, suggesting the presence of either ovicaprids or taruca deer (*Hippocamelus antisensis*). Everything in this assemblage suggests a bias in favor of larger bone specimens. That suggests that either smaller elements were not recovered by the researchers and or that taphonomic processes destroyed them.

Discussion

The water from Lake Titicaca, which has a pH of 7.2–7.4, presents excellent alkaline conditions for preserving bone remains. Thus, it was not surprising to find that the state of preservation of faunal materials was excellent and that a significant proportion of the bones was mostly unfragmented, something that was observed in the previously recovered remains. Indeed, most of the remains analyzed consist of bones with preservation close to 100 percent integrity. Some raw modifications observed in bone remains included blackish or brown staining spots, which were produced by their association with sediments with a strong mineral content and by natural reduction processes. Other bones, especially those of amphibians and camelids, had evidence of gnawing, possibly caused by fish. Despite these alterations, we were able to assign fairly specific categories to most of the bones of both macrofauna and microfauna.

Both human agency and natural processes of accumulation produced the archaeofaunal assemblage recovered from the underwater Khoa Reef. The exogenous taxa (consisting of juvenile llamas, *Spondylus* shells, and possibly an Andean wildcat) were definitely deposited as ritual offerings. Fish, frogs, and aquatic birds are all common in archaeofaunal assemblages from sites around Lake Titicaca (Capriles et al. 2014; Moore et al. 2010), and most endogenous taxa became embedded in the record as part of natural processes. The relative abundance of all these aquatic taxa makes it possible to reconstitute the natural environment (including changes in the reef over time) and the ecosystem services (the natural resources available) they provided thanks to the identification of many species that are now extinct or locally absent.

The fact that the camelid remains were largely unfragmented and complete strongly suggests animal sacrifice. Moreover, some fragmented remains suggest that some meat consumption and discard took place along with the deposition of complete animal offerings. The spatial, stratigraphic, and contextual associations of the exogenous taxa suggest postmortem deposition and indicate that a total minimum number of nine immature camelids were sacrificed during a similar number of offering events. We note the intriguing finding of at least six stone anchors (Delaere 2020). These may have been used to anchor the boats handled during the rituals but they may also have been used to weight down the sacrificed camelids. More important, there is a positive direct association between the camelid remains and a large proportion of costly puma-shaped incense burners, gold laminae, and lapidary ornaments (Delaere et al. 2019). The incense burners are typical of the classic Tiwanaku period, as are some of the gold laminae, including a series shaped like

camelids that are known as *wariwillka* (Janusek 2003; Reinhard 1992; Ponce Sanginés et al. 1992). Some of these ornaments and other ritual objects may have been attached to the sacrificed camelids as ritual regalia (Delaere 2020). The sacrificed llamas recall the burials of dozens of mostly complete camelids that were deposited in a series of structures near the top of the Akapana Pyramid (Manzanilla 1992; Webster and Janusek 2003). There too sacrificed animals were often deposited with offerings of exotic goods such as metal laminae and figurines.

Eight radiocarbon dates from Units 1 and 3 provide further evidence for the characterization of these offerings and of their temporal and cultural association. Four of these were direct dates on the bone collagen of three camelid specimens and one fish (Delaere et al. 2019, 8236). Together with associated charcoal dates, seven of these dates place the offerings between 794 and 964 AD. The fact that one of the dated specimens was a fish bone further suggests that immediately after animal sacrifices were deposited, other biological agents quickly became deposited with this assemblage. However, one camelid bone yielded an anomalous date of 355–148 BC, suggesting this reef could have been in use much earlier than has been assumed. *Spondylus* was another exogenous taxon that was deposited either as whole shells or as transformed figurines and ornaments. While the sacrifices of llamas are associated with Tiwanaku contexts, there is evidence that *Spondylus* shells were deposited during both the Tiwanaku and Inca periods. Camelid-shaped figurines were made and offered during both periods, and the same is true of beads and other ornaments, but whole shells were likely placed during the Tiwanaku period. Human-shaped figurines were deposited during the Inca period, always in stone boxes (Reinhard 1992). At least two large stone boxes were recovered from the sacred rock located in the northwest of the Island of the Sun and likely contained offerings presented in the plaza area built by the Inca (Bauer and Stanish 2001). A recent discovery of an Inca stone box containing a *Spondylus* llama figurine and a gold cylinder in an underwater reef near the northeastern shore of the lake suggests that these offerings were also deposited in other locations (Delaere and Capriles 2020).

Conclusions

In this chapter, we have integrated the results of the zooarchaeological identification of over 1,000 archaeofaunal specimens recovered in the period 1977–2013 from the underwater Khoa Reef near the Island of the Sun in Lake Titicaca, Bolivia. Compared to present-day faunal assemblages of inland sites, the variability associated with the behavioral and taphonomic histories of the

faunal remains recovered from Khoa suggest some markers of ritual behavior. The taphonomic background and paleoecology of this material can inform future research in the Titicaca Basin. This study also highlights the social importance of animals in ancient societies and the utility of zooarchaeology in helping to separate behavioral from natural processes in the formation of the archaeological record (deFrance 2009; Russell 2012). Human agency, including ritual activity, was directly involved in the deposition of whole immature llamas, *Spondylus* shells, and a possible wildcat in a social context of sacrificial offering and ritual consumption carried out in a ceremonial context. The zooarchaeological data also suggests the Khoa Reef was an essential habitat for various aquatic vertebrate species. Fish were likely the prey of birds, and the abundance of giant frogs suggest that reefs such as Khoa are places that should be emphasized in conservation efforts.

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