

# Herds for the Gods? Selection Criteria and Herd Management at the Mass Sacrifice Site of Huanchaquito-Las Llamas During the Chimú Period, Northern Coast of Peru

Nicolas Goepfert, Elise Dufour, Gabriel Prieto & John Verano

To cite this article: Nicolas Goepfert, Elise Dufour, Gabriel Prieto & John Verano (2018): Herds for the Gods? Selection Criteria and Herd Management at the Mass Sacrifice Site of Huanchaquito-Las Llamas During the Chimú Period, Northern Coast of Peru, Environmental Archaeology, DOI: [10.1080/14614103.2018.1541956](https://doi.org/10.1080/14614103.2018.1541956)

To link to this article: <https://doi.org/10.1080/14614103.2018.1541956>



View supplementary material [↗](#)



Published online: 01 Dec 2018.



Submit your article to this journal [↗](#)



View Crossmark data [↗](#)

---



# Herds for the Gods? Selection Criteria and Herd Management at the Mass Sacrifice Site of Huanchaquito-Las Llamas During the Chimú Period, Northern Coast of Peru

Nicolas Goepfert <sup>a</sup>, Elise Dufour <sup>b</sup>, Gabriel Prieto <sup>c</sup> and John Verano<sup>d</sup>

<sup>a</sup>CNRS, UMR 8096 Archéologie des Amériques (CNRS-Paris1), Nanterre, France; <sup>b</sup>Archéozoologie, Archéobotanique : Sociétés, Pratiques, Environnements (ASSPE), Muséum national d'Histoire naturelle, CNRS, Paris, France; <sup>c</sup>Facultad de Ciencias Sociales, Universidad Nacional de Trujillo, Trujillo, La Libertad, Peru; <sup>d</sup>Department of Anthropology, Tulane University, New Orleans, LA, USA

## ABSTRACT

The discovery of the sacrificial remains of 140 children and 206 camelids sacrificed at the site of Huanchaquito-Las Llamas, on the northern coast of Peru, has provided new data on mass sacrifice practices during the Chimú period. The exceptional state of preservation of the camelids, including the presence of coats and hides, opens new research perspectives on the utilisation of animals in ritual contexts. This article will focus on the results of the zooarchaeological analysis, particularly of mortality profiles and coat colour, to address the criteria used to select the sacrificial victims. Young individuals were exclusively selected, and while there is a majority of brown coats, three colours that are present in modern herds are absent at Huanchaquito. This reveals the preferential choice made by the Chimú officiants for this sacrifice. A spatial analysis did not reveal preferences in the organisation of the deposits. The killing of the youngest cohort of the livestock probably had an impact on the whole livestock. This suggests the existence of large herds that were controlled by the Chimú empire. Our results provide additional insights into the management of camelid herds and show the complexity of pastoralism on the pacific coast during pre-Hispanic times.

## ARTICLE HISTORY

Received 20 March 2018  
Revised 30 September 2018  
Accepted 23 October 2018

## KEYWORDS

Camelids; sacrifice; herd management; Central Andes; Zooarchaeology

## Introduction

Extensive deposits of whole animals or specific animal skeletal parts are known from the Central Andes, from both the coast and the Cordillera. For example, on the southern coast of Peru, 64 whole sacrificed camelids were recovered at Cahuachi (Figure 1), Nasca period (Orefici 1994), and 26 at El Yaral (Figure 1), Chiribaya culture (Wheeler 1996; Wheeler, Russel, and Redden 1995). Many other sites in this area, such as Huaca de la Luna (Tufinio 2006, 63–69), Huanchaco (Donnan and Foote 1978), Batan Grande (Shimada and Shimada 1985, 15), and Tiwanaku (Kolata 1993, 119–121), have also revealed deposits of several dozen camelids. Furthermore, offerings of partial animals, including a minimum of 88 skulls were found at San José de Moro, Mochica period (Goepfert 2011), attesting to the variability of the deposits in these ceremonial contexts.

The discovery of 206 camelids associated with 140 Chimú children and adolescents at the site of Huanchaquito-Las Llamas (hereafter Huanchaquito) (Figure 2), in the Moche Valley, on the northern coast of Peru, is extraordinary on several counts. First, it is the largest sacrificial site in terms of number of individuals known to date for the pre-Hispanic period in the Americas (Prieto et al., forthcoming). Second, the camelids are

exceptionally well preserved, with the presence of fleeces/coats, hides, intestinal contents, faeces and ropes opening up new lines of research through the application of multidisciplinary approaches (including stable isotopes, palaeoparasitology, microscopic study of fibres, and archaeobotany). Third, the radiocarbon dates suggest that the Huanchaquito mass sacrifice took place over a relatively short period of time around cal. AD 1400–1450 (Prieto et al., forthcoming). This was a period of political stability, when the Chimú society reached its peak, before they were conquered by the Inca in 1470. The political context was similar to that at the nearby site of Huanchaco (Donnan and Foote 1978), although this site clearly represents a smaller-scale sacrifice, and to that at Pampa la Cruz, which recently yielded several dozen sacrificed children and camelids (Prieto, unpublished data). In contrast, the Punta Lobos massacre (Verano and Toyne 2011), occurred during a period of political instability marked by territorial conquests to the north and south. Finally, the site of Huanchaquito does not display the usual characteristics of the Chimú: there are no large plaza or platforms and no monumental architecture.

The sacrifice of a huge number of children and animals during a time with no political troubles raises



**Figure 1.** Map showing the location of the site of Huanchaquito-Las Llamas on the northern Peruvian coast and the maximum extent of the Chimú state. Relevant archaeological sites and modern cities cited in the text are also shown.

questions as to the reasons for the ritual and the symbolic function of the Huanchaquito deposit. Could climatic episodes have been the trigger for the sacrifice? Traces of child and camelid footprints were recorded in a wet, clayey soil near the skeletal remains (Prieto, Verano, and Goepfert 2017). These traces show that the victims were sacrificed during a climatic episode of heavy rains, normally associated with the El Niño Southern Oscillation (ENSO). The El Niño phenomenon is often synonymous with natural catastrophes that dramatically modify the usually dry environment, causing torrential rains, landslides

(*huayco*) and replacement of the local flora and fauna. Were the victims sacrificed to give thanks for the rains? To calm the divinities and limit the consequences of the rains?

This work has two main objectives. The first goal is to elucidate the criteria used to select the camelid sacrificial victims at Huanchaquito. Was the officiants' choice based on the age of the specimens, the colour of their coat, or their sex, or, conversely, was it random? To this end, we determined the slaughter profile and the range and distribution of coat colours. The second objective is to understand whether camelids matching



**Figure 2.** General view of the area excavated and the deposits of sacrificial victims at Huanchaquito-Las Llamas.



different selection criteria were deposited in different locations within the deposit. To this end, core densities were used to describe the spatial organisation within the site. The discussion of the results will provide insights into the management of camelid herds by the Chimú empire. Were some herds devoted to divinities or specific ritual activities? Were particular types of camelids selected for sacrifice? What consequences could the sacrifice of a large number of camelids have had for the sustainability of Chimú livestock?

## Archaeological Context

### *Huanchaquito and the Chimú Empire*

The site of Huanchaquito was discovered in 2011 and is located 1.5 km northwest of Chan Chan (Figure 1), the capital of the Chimú society. Chan Chan, situated 4 km from the present-day town of Trujillo, was an important urban centre of about 18 km<sup>2</sup>, and it was the hub of the political, religious and economic power of the Chimú society (Conrad 1982; Day 1982; Moseley and Day 1982; Ravines 1980; Topic 1982). The Chimú culture developed between AD 900 and 1470 over a 1000 km territory extending from the modern-day border between Peru and Ecuador, to the Chillón Valley, near Lima, in the south, to the Pacific coast in the west, to the piedmont of the Andes in the east. The Chimú conquered and controlled this vast territory through the implantation of large regional centres, such as Túcume, Farfán and Manchán (Moore and Mackey 2008; Figure 1), and the development of a powerful hydraulic network (Farrington and Park 1978; Huckleberry, Caramanica, and Quilter 2017; Ortloff 1981), favouring horticulture, extensive agriculture and camelid husbandry (Keatinge 1975; Pozorski 1976, 1979), and thus probably a centralisation of the means of production.

Huanchaquito is located on a large sand dune 300 m from the ocean, 11 m height above the sea level, and is oriented northwest–southeast. The excavation of Huanchaquito was initially an emergency project. The emergency excavations (2011) were followed by two seasons of planned excavation (2014 and 2016).

A total area of 700 m<sup>2</sup> (50 m × 14 m) was excavated, including zones of looting and disturbance which affected the deposits. The area excavated has a high density of deposits, with more than 300 corpses (140 children and 206 camelids) and additional disturbed specimens. The site presents a shallow stratigraphy, 1–1.5 m deep, composed of a sandy layer covering a mud layer related to heavy rainfall (Prieto, Verano, and Goepfert 2017). The first individuals encountered during excavation lay 50 cm under the surface, and the ones lower down had been deposited on the mud layer. The radiocarbon dates performed on human tissues (collagen and hair), textiles associated with the humans, camelid faeces, and organic artefacts associated with the camelids (textiles, sedge ropes) are coherent around cal. AD 1400–1450 (Prieto et al., forthcoming). Combined, these elements suggest a single, mass sacrificial event of unknown but short duration.

### *Sacrificial Practices*

The types of burials and animal deposition processes, the orientation of the animal corpses, their association with the children, and the sacrificial techniques have been previously described elsewhere (Goepfert and Prieto 2016; Prieto, Goepfert, and Vallares 2015; Prieto et al., forthcoming). Briefly, the camelids were deposited alone or associated with the children and adolescents. When associated with humans, they were deposited beside, above (Figure 3(a)) or below, and sometimes both below and above the human corpses. When camelids were not associated with the humans, the deposits were either individual (Figure 3(b)) or multiple in number. The sacrificial victims were deposited either directly on the mud layer, in the sandy soil above it, or in prepared pits cut into the mud layer, with humans and camelids buried either separately or together (with up to four camelids in the same pit). The victims were mainly lying on their left or right side, and for many of the victims, the neck had been bent onto the body to accommodate the shape and size of the pit. There was no overlap between adjacent human and/or camelid bodies. Fly pupae on the



**Figure 3.** Sacrificed camelids deposited at Huanchaquito-Las Llamas. (a) camelid deposited above a human individual; (b) camelid deposited alone.

animals shows that they were exposed to the open air during an indeterminate period of time after death (Prieto, Goepfert, and Vallares 2015).

In the absence of injuries other than cut marks on the sternum and the external surface of the ribs, it can be inferred that the animals were killed by cardiectomy (Goepfert and Prieto 2016, 202–203; Prieto et al., [forthcoming](#)). A type of cardiectomy known as *ch'illa* is still practiced by Andean peoples today (Flores Ochoa, MacQuarrie, and Portus 1994; Miller 1977). To sacrifice the animal, the officiant makes a small incision under the diaphragm of the animal, introduces his arm into the chest, and cuts the aorta to extract the still-beating heart (and possibly also the lungs). The sacrifice technique used by the Chimú officiants at Huanchaquito seems to be a variant of the *ch'illa* because the position of the cut marks on the sternum and the ribs (Goepfert and Prieto 2016, 202–203) does not correspond exactly to those reported by Miller (1977) for modern-day practices.

Post-depositional disturbance affected some specimens, resulting in the absence of certain anatomical parts. Considering the state of preservation, we can rule out the hypothesis of a post-depositional Chimú intervention to explain these disturbances, of the kind observed in burials from the Mochica period (Gutiérrez 2008; Millaire 2004). Instead, they are absent due to modern anthropic disturbance, such as looting, and also the modern construction of houses and a road. This road, situated at the periphery of the excavated area, may in fact have been built on the initial extension of the site.

## Material and Methods

A total of 206 whole and semi-complete camelids were analysed. It is possible that a greater number of humans and camelids may have buried at the site initially and that these have since been lost due to modern construction. Species determination of South American camelids (both wild and domestic) using zooarchaeological methods is widely considered to be difficult and a matter of debate. There are different methods based on the presence/absence of anatomical features or measurements of anatomical parts. For the taxonomic determination of the specimens from Huanchaquito, we used the method proposed by Wheeler (1982), which consists of observing the distribution of enamel over the crowns of the incisors. The observations on the enamel indicate that the camelids were probably llamas (*Lama* sp.). An alternative method, developed by Kent (1982) and later revised by Izeta, Otaola, and Gasco (2009), is based on the measurement of the first phalanx. Unfortunately, this method was not appropriate for the immature Huanchaquito camelids (see ‘age estimation’) because it only applies to adults. The determination of anatomical parts was carried out using a llama skeleton

from our reference collection, as well as published data (Benavente et al. 1993; Pacheco Torres, Altamirano Enciso, and Guerra Porras 1979).

We focused on two aspects of the archaeozoological analysis: slaughter profiles and coat colour in order to be able to discuss the selection criteria for the sacrificial victims. To estimate the age of the animals, we used the references for tooth eruption and wear available for domestic camelids (Wheeler 1982). Due to the specific characteristics of this assemblage, individuals were then classified into five age classes: 0–3 months, 3–9 months, 9 months–1 year, 1–2 years and adult. Tooth eruption and wear reference for domestic camelids was established from the modern collection from La Raya, situated at an altitude of more than 3500 masl, in the Cuzco region. The climatic and environmental conditions at La Raya are very different to those along the Pacific coast, which comprises a distinct vegetation and aeolian sand. One of the consequences of the coastal environment is a much faster abrasion of camelid teeth, which means that in some cases there may be discrepancies between the estimated age based on eruption and that based on wear, rendering any precise biological age estimation impossible. Age estimates were used to calculate the slaughter rate per month, which enabled us to weight the relationship between the number of individuals and the duration of each age class. The number of sacrificed individuals was divided by the number of months making up the age class in question: three months for the 0–3 months age class, six months for the 3–9 month age class, etc. In the present study, the slaughter rate was used to infer whether one particular age class was preferred. In theory, it can also be used to infer whether there was a seasonal cycle in animal death, provided that the season of birth for a given population is known. Unfortunately, modern data on the seasonality of birth are only available for the highlands (where birth generally occurs between January and April), but not for the Pacific coast, where camelid husbandry is no longer practised. It was therefore not possible to estimate the seasonality of animal death at Huanchaquito.

The description of coat colour pattern faces various issues that render an accurate colour classification difficult to make. The use of a chromatic chart would have resulted in the definition of multiple colour categories. For this study, we decided to use ‘simple’ ones: white, beige, brown, grey and black. The colours are diverse and different colours can be present on the same coat. The distribution of colour patches on the animal’s body parts varies from one individual to another. This results in an almost infinite number of combinations (Figure 4). In the case of animals with a mixed-colour coat, whatever colour extended over two-thirds or more of the body surface was considered to be dominant. For example, animals with a brown body and beige head, neck and limb extremities were



**Figure 4.** Skeletal parts of Huanchaquito Las-Llamas camelids showing different mixed coat colour patterns. (a) two metacarpals with a dominant beige coat and brown patches; (b) fragmented skull with a brown coat and beige patch; (c) left hemimandible with beige and brown coat; (d) fragmented skull with beige and brown coat.

categorised as ‘mixed with dominant brown’. Note that this categorisation only takes account of the dominant proportion of a colour and not of the anatomical distribution of this colour.

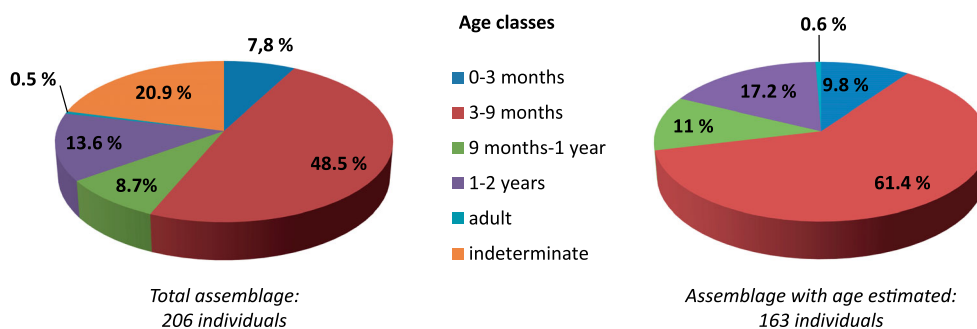
Lastly, we also aimed to identify whether there was a preferential spatial distribution of camelids depending on their age and coat colour. In order to do so, an analysis of core densities was performed using the Kernel density tool of the software package ArcGIS (10.5).

## Results

### Estimation of the Age of the Sacrificed Animals

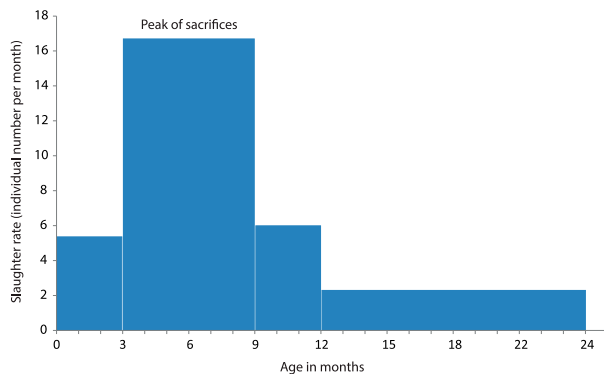
We were able to estimate the age of 163 individuals out of a total of 206 (79.1%), providing a very good overall

representativeness of the assemblage (Figure 5; Table 1 Supplementary data). The remaining 43 individuals are animals with missing or fragmented teeth, or for which there is a discrepancy between the age estimate based on eruption and that based on wear. Although a precise age could not be determined for these specimens, we were able to establish that they are all immature. If we exclude them and only consider specimens with an estimated age, the camelid assemblage at Huanchaquito is almost exclusively made up of individuals less than two years old (juveniles). Only one adult, aged 2 years and 9 months old, was recorded. Juveniles are largely dominant, and the rest of the corpus corresponds to young or very young individuals. Of the 163 individuals with a precise age estimate, 71.2% are less than 9 months old (Figure 5). If we take into account that



**Figure 5.** Pie charts showing the proportion of camelids by age class at Huanchaquito-Las Llamas. The left pie chart comprises all individuals, including individuals for which age could not be determined, while the right chart only presents individuals for which age was successfully estimated.





**Figure 6.** Slaughter rate (number of individuals per month) of sacrificed camelids at Huanchaquito Las-Llamas.

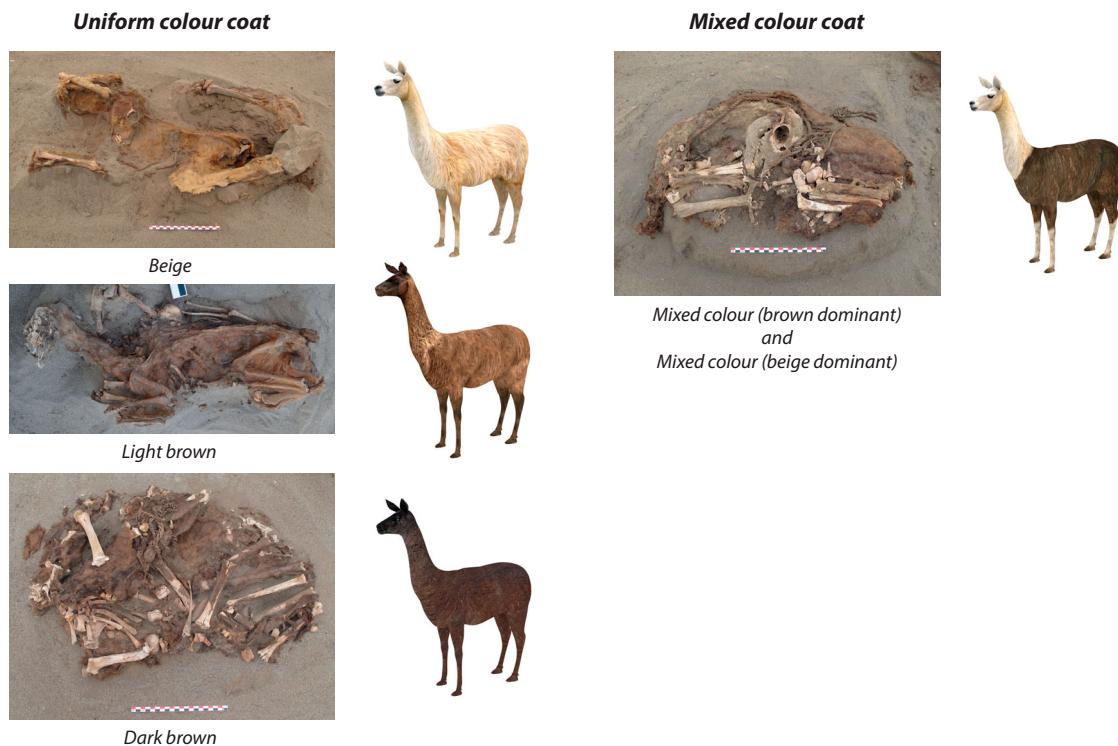
tooth abrasion is undoubtedly faster on the coast than in the highlands, we can infer that these individuals were even younger than the estimated age.

The rate of slaughter varies within the overall age range (Figure 6; Table 2 Supplementary data). The slaughter rate per month increases from 5.3 for the 0–3 month age class to 16.7 for the 3–9 month age class, then decreases to 6 for the age class covering 9 months to 1 year, and then decreases further, to 2.3, for the age class older than 1 year (Figure 6), showing a preference on the part of the officiants for certain age classes.

### Coat Colour Classification

The coat was preserved in 197 of the 206 animals (95.6%), and we could thus study its colour (Table 1

Supplementary data). Because camelid bodies were exposed to the open air which could have led to taphonomic modifications affecting the coat colour, we cannot be totally sure that the colour observed today is exactly the same as it was during the life of the animal. Although there may have been slight chromatic variations, some clear patterning can be observed. Flores Ochoa (1978) reported that the coat colour of domestic camelids ranges from white to black. At Huanchaquito, there is lack of white, grey and black animals. This could reflect the colours occurring in nature or it could result from human choice around which animals to use for the sacrifice. We identified three uniformly coloured coats: beige (11.2%), light brown (21.8%) and dark brown (22.3%) (Figures 7 and 8). Coats with both brown and beige, referred to as ‘mixed’, were divided into two groups, one in which brown is dominant, representing 38.1% of the corpus, and one in which beige is dominant, which is much rarer, representing 6.6% of the corpus (Figure 8). The five resulting coat colour categories are beige, mixed with dominant beige, light brown, dark brown, and mixed with dominant brown. When we incorporated the camelids with even and mixed colouring into the two main colour groups, brown largely predominated (82.2%) the corpus. This very strong dominance marks a clear preference for this colour and its nuances (light brown, dark brown and mixed with dominant brown). According to Flores Ochoa (1978, 1009), uniformly coloured animals are rare today, except for white animals, as their fleece is in demand on the international market. We cannot



**Figure 7.** Archaeological camelid deposits and 3D reconstruction of the animals at Huanchaquito-Las Llamas. The coat colour patterns are separated into two main groups, uniform and mixed. Three uniform coats (beige, light brown, dark brown) and two mixed coats (brown dominant, beige dominant) are present, for a total of five coat colour pattern groups.



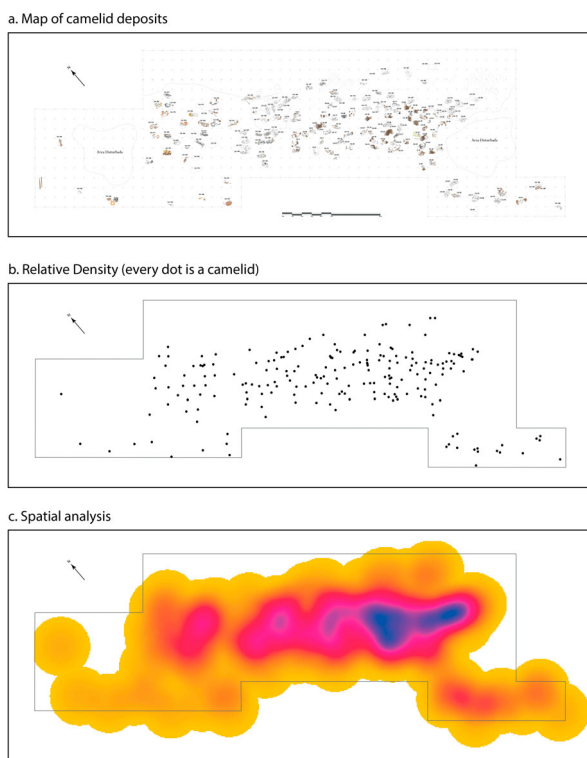
**Figure 8.** Pie charts showing the proportion of camelids by coat colour pattern at Huanchaquito-Las Llamas. The left pie chart comprises all individuals, including individuals for which coat colour pattern could not be determined, while the right chart only presents individuals for which coat colour pattern was successfully determined.

know if this was the case in the past, but if the camelids of mixed colour coat tended to be naturally dominant, then perhaps we should reconsider our colour classification and divide them into solid coloured and mixed-coloured coats. If we divide them this way, 55.3% of the specimens from Huanchaquito present a uniform beige, light brown or dark brown colour.

### Spatial Distribution of the Sacrificed Camelids

The bodies were deposited along the sand dune following a northwest-southeast axis (Figures 9(a,b)). Despite the disturbance due to looting and modern construction observed in the excavated area, intact

deposits remained. Density calculations confirm that most of the deposits that remained were concentrated in the northeastern part of the site (Figure 9(c)). The deposits at some distance from this zone are more dispersed, although there are no clearly defined groups of camelids. Multiple Kernel density analyses were performed to establish whether the camelids were distributed spatially by age and/or coat colour. For the defined age classes (i.e. 0–3 months, 3–9 months, 9 months–1 year, 1 year–2 years and adult), no preferential distribution related to the age of the animals was observed except for the 0–3 months group, which, unlike the camelids belonging to the age classes above 3 months, was found in the northeastern and western parts of the excavation (Figure 10). The lack of preferential distribution also applies to the five colour categories/groups defined previously with the exception of mixed colour animals with beige dominance, which are also observed in the southeastern part of the site, and the light brown and mixed colour groups with brown dominance, which are observed in the western part. Overall, there are no colour specific clusters apart from a higher concentration in the northeastern part (Figure 10).



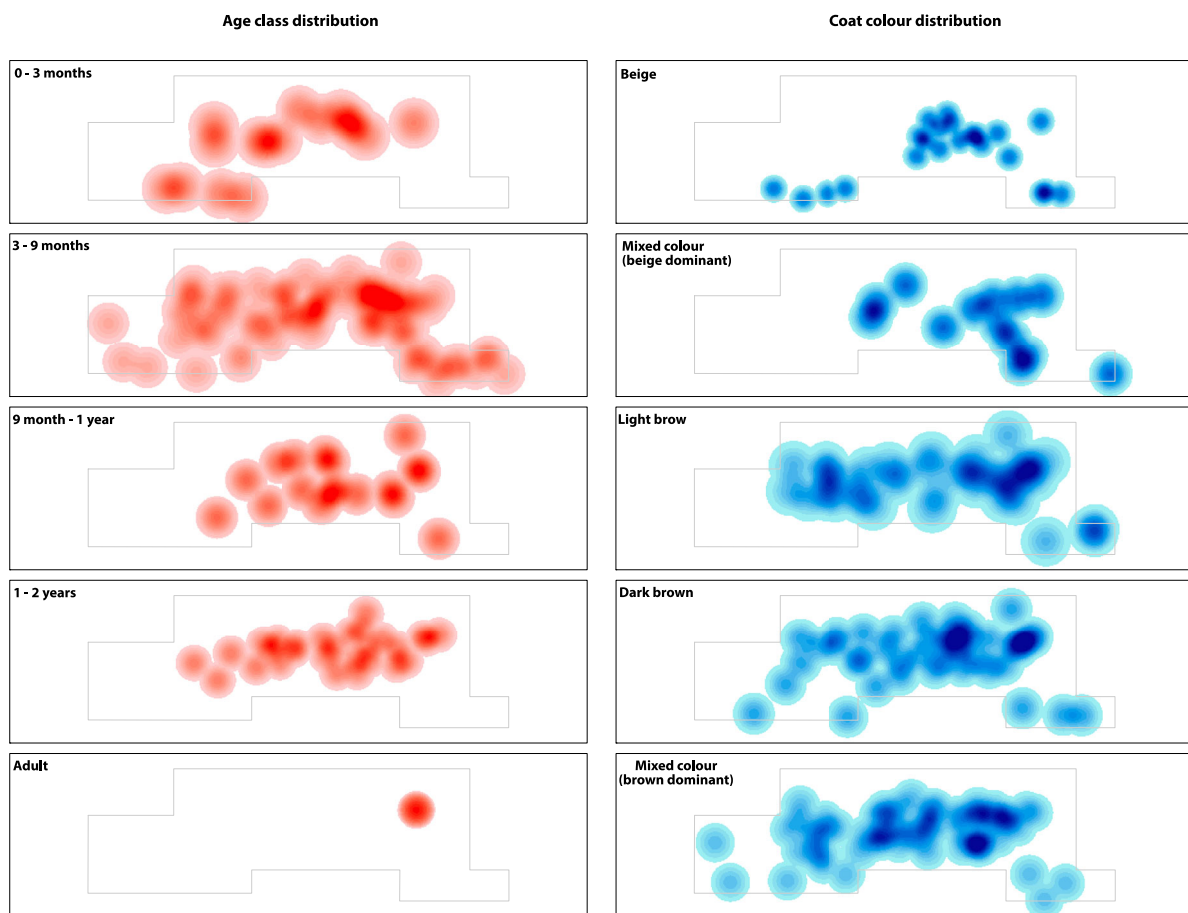
**Figure 9.** Spatial distribution of the sacrificed camelids of Huanchaquito-Las Llamas. (a) map of the camelids deposited; (b) relative density of camelids; (c) spatial distribution described by a density per core analysis.

## Discussion

### Criteria for the Selection of Camelids for Sacrifice During Chimú Times

The selection of victims for sacrifice is a difficult theme to assess through archaeology. In the case of Huanchaquito, we are faced with two imposing assemblages: 140 young humans and 206 camelids. The children and adolescents are aged between 5 and 15 years. DNA analysis on 11 individuals showed no preference for young males or females. The observed cranial deformations, along with the stable isotopic analyses, show that these individuals came from both the coast and the highlands (Prieto et al., *forthcoming*). Therefore, the officiants do not seem to have had multiple selection criteria: the boys and girls selected came from





**Figure 10.** Spatial distribution of the sacrificed camelids of Huanchaquito-Las Llamas by age and coat colour pattern. On the left, spatial distribution of the different age classes described by a density per core analysis. On the right, spatial distribution of the different coat colour pattern groups described by a density per core analysis.

different environments, and the only thing they had in common is that they were all immature.

Young was clearly a major selection criterion for the camelids. The selection of young specimens is in keeping with funerary practices from earlier periods, such as the Mochica culture, where juveniles (that is, individuals under two years old) predominate (Goepfert 2011, 2012). However, at Huanchaquito, the proportion of juveniles is much higher. The selection of very young individuals that belong to the age classes 0–3 months and 3–9 months, confirmed by slaughtering profiles, points to a very strict selection of sacrificial victims. Unlike the Mochica, who also mainly sacrificed young camelids, but who deposited only the head and the limb extremities and ate the rest of the animal (Goepfert 2012), the Chimú deposited only whole specimens at Huanchaquito. As the animals were not consumed, tenderness of their meat is not a variable to take into consideration. One hypothesis is that officiants targeted undesirable and infertile young males as suggested by Wheeler (2005) at El Yaral. The criteria used by Kaufmann et al. (2013) to determine the sex of camelids were not suited to our assemblage because they only concerned guanaco and adult specimens. We have not yet tried using the sexing

criteria proposed by Cartajena (2007). In the future, we plan to verify our hypothesis using the Cartajena (2007) method as well as ancient DNA analysis. Previous work (Goepfert and Prieto 2016) has argued that there is a link between the young age of the sacrificed children (between 5 and 15 years old) and the young age of the sacrificed camelids (mostly juvenile).

In contrast with the human sacrificial victims, the biological age of the camelids was not the only criterion taken into account; they were also probably selected for their coat colour. At Huanchaquito, not all colours are present, and the colours that are present are unequally represented. Light and dark brown dominate, also in animals with mixed coats, where brown predominates and beige remains marginal. The absence of three colours, white, grey and black, which are found in modern-day herds and, we presume, also in ancient herds (although perhaps in different proportions), suggests that animals with coats containing these colours were excluded from the sacrifice. This raises the following question: Is the predominance of brown within the sacrifice a reflection of natural coat colour distribution in domestic camelid herds during the Chimú period or of a choice made by the officiants? Unfortunately, in his

work on colour classification of modern herds, Flores Ochoa (1978) does not provide colour repartition for a typical Andean herd, nor do any other written sources. But even if a modern reference were to be established, it would not necessarily be relevant for comparison with archaeological material. Today, the majority of herds, particularly alpacas, are bred for the production of wool for the international market, which has a preference for uniform white coats. One suggestion for future research would be to compile a coat colour dataset from pre-Hispanic camelids found in archaeological contexts, particularly on the Pacific coast. The dataset should be composed of non-sacrifice animals so that it is more likely to reflect the natural coat colour distribution. However, obtaining such a representative dataset would likely be difficult because the presence/absence of coat depends exclusively on the preservation condition of each site and region. Huanchaquito is an unprecedented example because of the quality of coat preservation and the large number of animals recovered.

Without comparative data, it is difficult to be conclusive about the significance of the predominance of the colour brown. If we can assume that camelids with the colours white, grey or black in their coats also existed in the past, the existence of colour selection is not in doubt. These camelids were probably used for other purposes. Moreover, the ethnographic data and our personal observations of camelid herds have led us to think that the strong dominance of brown animals may be suggestive of a specific significance that may be related to a particular event. It is possible that a colour may have been associated with a divinity (Goepfert and Prieto 2016), as was the case for the Inca (Cobo 1990 [1653]; de Molina, Urbano, and Duviols 1988 [1573]), among whom white llamas were dedicated to Inti (the sun); brown llamas were dedicated to Viracocha (the creator); and mottled llamas were dedicated to Illapa (the lightning). Could brown be linked to the climatic event during which this sacrifice took place or to a specific period on a ritual calendar? It is not possible to estimate the seasonality of the Huanchaquito animals' deaths and, based on the lack on birth timing on the Pacific coast, to speculate on the existence of a ritual calendar in this region. For the moment, these questions around the timing of the sacrifice are still unresolved, even though we know that the integration of the Chimú in the Inca empire had repercussions in many domains, such as metallurgy (Guerra and Nuñez-Regueiro 2017) and ritual practices (Uceda 1997). Indeed, the Huanchaquito evidence shows that the use of a specific colour precedes the Inca Empire. We are not assuming that the Chimú used the same religious system as the Inca, but we can nonetheless hypothesise that a system of classification for the sacrificial victims based on their colour predates the Inca. Maybe it inspired their colour classification system as described by the Spanish chroniclers.

The selection of the camelids could have been carried out either long- or shortly before the ritual was to take place. In both scenarios, the selection could have had an impact on the progress of the sacrifice. We can imagine the officiants choosing to sacrifice a particular age class or colour at a particular moment and maybe grouping them in a specific area of the sacrificial space. The camelids had been grouped together in the surroundings of Chan Chan. They were later brought to Huanchaquito in different groups, as attested by the orientations of footprints recorded (Prieto, Verano, and Goepfert 2017). The analysis of the density of the deposits shows a greater concentration of camelids in the northeastern part of the excavated area, but it shows no preferential distribution of camelids by age or colour. We do not see a special spatial organisation of the camelids despite the identification of selection criteria.

### *Herd Management in the Chimú Period*

This study shows that Chimú officiants employed criteria when selecting sacrificial animals. These are age, as the vast majority of camelids are less than one year old (82.2% of the corpus), and, for most of them (82.2%), coat colour, as in most cases brown was the unique or dominant colour. The age and coat colour investigations indicate a strong specialisation in the choice of sacrificial victims. Sex may also have been a criterion, but we have not been able to investigate it.

As the sacrificed human and camelid individuals were found together in the same stratigraphical context within the sand dune and without any overlap, strongly suggests that the sacrifice was a single, mass event which probably took place over a short period of time (several days or weeks). The preferential slaughtering of a large quantity of camelids over a very short duration would have negatively impacted the herds that provisioned the sacrifice. In fact, it is not so much the quantity of sacrificed camelids as the almost exclusive selection of three age classes of very young individuals that is important to underline. The killing of juvenile specimens, which either are not yet of reproductive age or have not yet reproduced, could, in theory, endanger livestock sustainability. The Chimú must have practiced rather strict herd management and had huge herds to be able to afford to forego these young age classes. One herd management strategy that would lessen the impact of such a sacrifice is the preferential elimination of young males (Wheeler 2005). The impact would also have been reduced if the deposit was the result of several sacrificial events repeated over one or several years. Even though our observations do not point to this hypothesis, in the absence of data that would facilitate a reconstruction of the seasonality of death, it cannot be completely discarded. In this scenario, the yearly

births of camelids would have somehow balanced the impact of the loss. Even if we were able to show that all of the sacrificed camelids were males or that the site resulted from a series of sacrifices, the mass killing of very young camelids at Huanchaquito strongly suggests that the Chimú availed themselves of important resources and that their large herds were capable of absorbing the loss.

The geographic origin of the camelids selected for the sacrifice remains to be determined. For biological and anthropological reasons, they do not appear to come from the highlands. According to ethnographic sources (e.g. Lecoq 1987; Nielsen 2001), the integration of young llamas into caravans for a first reconnaissance journey occurs between the ages of one-and-a-half and two years. Moreover, the presence of very young animals is considered indirect evidence for their ‘local’ origin and the ‘local’ origin of their parents. During gestation (345–355 days; Wheeler 1991), females are gregarious and are not able to move very far. Thus females did not travel from the highlands during their gestation period or shortly after. So the very young individuals present at the site could not have been born in the highlands and exchanged. Stable isotopic analysis of several dozen specimens confirms that these animals originated from the lowlands and did not come from the highlands (Dufour et al. 2018), as for some domestic camelids during the Mochica period (Dufour et al. 2014) and the Virú-Gallinazo period (Szpak et al. 2014).

The selection of animals on the basis of coat colour will have had implications for herd organisation and specialisation during the pre-Hispanic period. The implications are still difficult – if not impossible – to assess based solely on archaeological evidence. Today, camelid livestock farmers from the highlands of

southern Peru divide their herds according to five main criteria: (1) their domestication status (wild or domestic), (2) the quality of their fibre, (3) their sex, (4) their age and (5) the colour of their fibre (Flores Ochoa 1978). For the fourth criterion, the number of years that the animal has been alive does not matter as much as the number of times the animal has given birth, whether the animal has any illnesses, the state of its teeth, the quantity and quality of its fibre, its capacity as a pack animal, etc. The modern-day classification for the colour of the fibre (the fifth criterion) is very complex and is based on three ranges of colour: white and black at the two extremes, and one in between, called *kulur*. There are seven variations of the latter, called basic colours. Each basic colour is then divided into two or more tones, 2 each for white and black and 15 altogether for *kulur*. In order to compare the resulting 19 tones, we have to take account of their relative darkness. However, some tones, derived from local regional variations, cannot be accurately classified (Flores Ochoa 1978, 1009), thereby introducing a bias to compare modern and archaeological coat colours that we cannot assess. Then come the different combinations, that is, how the colours are combined and how the patches of colour are distributed on the animal’s body. This classification system comprises multiple combinations, whereby the aim is to provide livestock farmers with a nomenclature for enhanced herd organisation and thus improved pastoral activity (Flores Ochoa 1978, 1015). Our perception or approach is different from that of modern herders and even more different from that of pre-Hispanic societies.

Given the large number of sacrificed animals, we conclude that the Chimú probably drew their stock

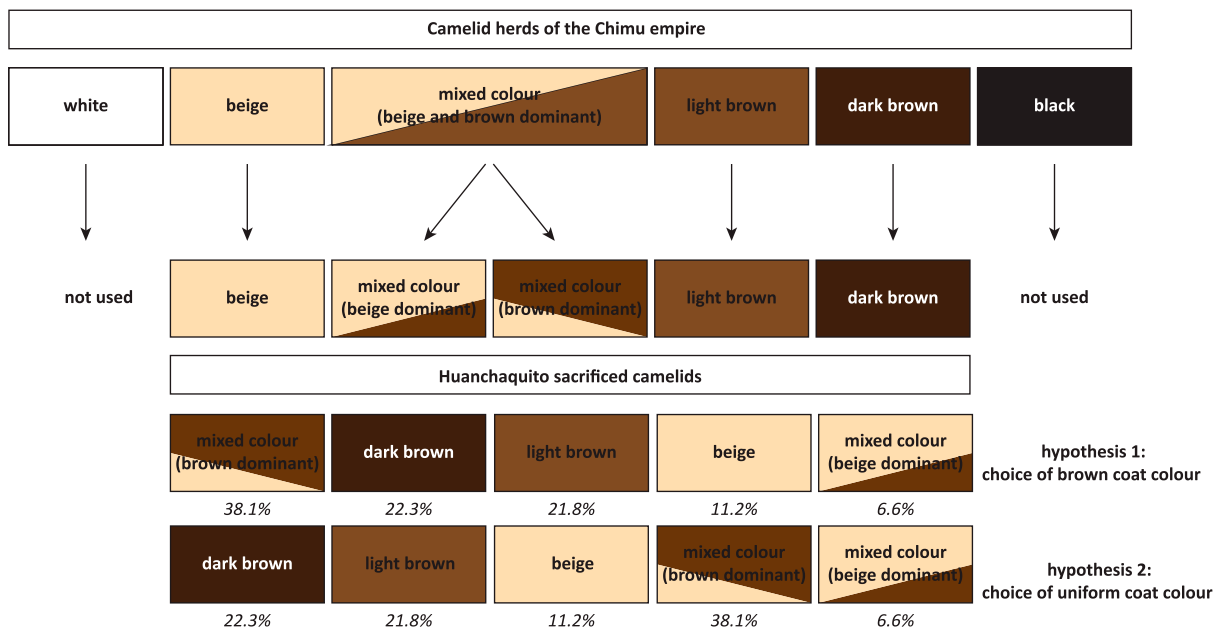


Figure 11. Schema of herd organisation by the Chimú empire and the hypothesis of coat colour pattern selection.



from different sets of animals of uniform colour: several herds with light brown animals, others with dark brown animals or beige animals. We can suggest that the animals with a uniform coat colour came from specialised herds (Figure 11), maybe in order to avoid jeopardising the uniformity of the herd colour. The animals with mixed colour, predominantly beige or brown, also could have come from the same herd. Herds producing only animals of white or black did not provision the sacrifice. The Huanchaquito evidence suggests that the Chimú state had large herds located in different localities and maybe organized by the colour of the coats.

Contrasting the archaeological data from Huanchaquito with ethnographic information highlights that herd management prior to the Inca period was more complicated than was previously thought. The Chimú officiants probably used a classification system based on coat colour, with a clear preference for animals with brown (uniform and mixed) coats (Figure 11-hypothesis 1) or for animals from several herds grouped together on the basis of their coat characteristics, uniform on the one hand and mixed on the other (Figure 11-hypothesis 2). The youngest camelids were taken from these multiple herds composed by beige and brown animals. Thus, age appears to have been the primary selection criterion for the officiants, as they took only a fraction (the young specimens) of the animals that would have been available in the different herds, whether they were beige, brown or mixed. A parallel can therefore be established between camelids and humans, because for the latter, neither the sex nor the geographic origin were determinant, but, rather, the young age of the individuals. It is problematic to base our current reflections on a biological age determined by the time spent after birth, because that was not as relevant as a social age – or social utility – to herders to define the quality and value of an animal.

## Conclusions

The mass sacrifice discovered at Huanchaquito is undoubtedly the largest described so far, but other sites of the same period also present similar characteristics. For the Moche Valley alone, smaller deposits were found at Huanchaco (Donnan and Foote 1978), Pampa la Cruz (Prieto unpublished data), Chan Chan (Gonzales Mendes 2009) and Huaca de la Luna (Tufinio 2006, 2008). The Huanchaco coastline seems to have been a privileged place for the deposition of sacrificed children and camelids during the Chimú period. These sacrificial events took place during a period of political stability corresponding to the apogee of the Chimú society. It is therefore difficult to invoke a period of political crisis to explain the Huanchaquito sacrifice. Huanchaquito would thus be part of a

broader sacrificial and ritual programme, encompassing the sacrifice of several hundred human children, adolescents and animals. The recurrence of these deposits for this period has yet to be explored, but it seems to have been in response to a climatic event which induced a social crisis. Despite the presence of shared similarities, the assemblage at Huanchaquito is exceptional from a methodological perspective. The configuration of the individuals (both humans and camelids) deposited in an open space, a large sand dune, in the same layer, without different levels, and during a short period of time, allows us to study the spatial distribution at an unprecedented detail and test whether there was a specific organisation of the sacrificial victims. We demonstrate that no spatial organisation by age or coat colour exists and that the camelids were deposited randomly upon their arrival. Unfortunately, the same analysis cannot be performed for the moment for the other sites of Huanchaco because of the heterogeneity of the deposits or the lack of data. In addition to sacrificial deposits, camelids were present in Chimú graves, where they held a key role in funerary offerings (Donnan and Mackey 1978; Millaire and Surette 2011; Ravines 1980). The use of camelids in rituals was inherited from the Mochica and became more intense over time, probably reaching its peak with the Chimú. In addition, camelids played an increasingly important role in the daily diet. According to Pozorski (1976), they represented up to 95% of the protein intake during the Chimú period, which was much higher than in earlier societies. The intensification of these domestic and ritual uses, as well as the economic aspect, including long-distance exchange (Topic 1980, 1982), point to the extensive role played by camelids in the Chimú society (Goepfert and Prieto 2016).

The choices made by officiants at Huanchaquito show that the Chimú state had huge herds of animals capable of absorbing the ‘losses’ represented by the sacrifice of hundreds of camelids meeting specific criteria, without endangering the economy of production. In addition, the choices applied to camelid selection suggest that herd management was very controlled. These elements are strongly suggestive of a change of scale in production occurring through time. During the Virú-Gallinazo period (400–AD 200 BC), animal husbandry may have operated at a family level, as suggested by Szpak et al. (2014). Tighter control was applied to animal diet and thus to livestock management by the Mochica (100/200–800 AD), (Dufour et al. 2014). Finally, management was organised at the state level by the Chimú. On account of its diversity, the corpus from Huanchaquito provides exceptional evidence of the complexity of camelid management at the end of the pre-Hispanic period and opens up new perspectives regarding the history of ritual practices.

## Acknowledgements

We thank Jean-François Cuénot (UMR 8096, Cnrs, France) for processing the spatial analysis on ArcGIS, Sébastien Lepetz for his advice on slaughtering profiles and graphical representation, Belkys Gutiérrez León (BGL Arqueologia, Peru) for her administrative help, and all the students and colleagues who helped us during the zooarchaeological study. We also thank Louise Byrne for the translation and Suzanne Needs-Howarth who greatly improved the quality of the English writing. Lastly, we thank the reviewers for their comments, which improved our thought on this exceptional mass sacrifice.

## Disclosure Statement

No potential conflict of interest was reported by the authors.

## Funding

This work was supported by the ANR CAMELANDES [grant number ANR-15-CE27-002], the PEPs ECOCAM (CNRS), and the French institute of Andean studies in Lima (Institut Français d'Études Andines). The excavations at Huanchaquito–Las Llamas were supported by the Municipalidad Distrital de Huanchaco, Yale University, Tulane University, National Geographic Society and Beca de Repatriación de Investigadores Peruanos (Contrato Nro. 354-15) by INNOVATE PERU and Universidad Nacional de Trujillo.

## Notes on contributors

**Nicolas Goepfert** is an investigator at the CNRS (the French National Centre for Scientific Research). He is an archaeologist and zooarchaeologist specialising in the northern coast of Peru. His research deals with funerary and sacrificial practices linked to animals, especially South American camelids, and the adaptation of human and animals to the desert Pacific coast of Peru. He has published several articles on the topic, and he is co-editor, with S. Vásquez, C. Clément and A. Christol, of *Las sociedades andinas frente a los cambios pasados y actuales: dinámicas territoriales, crisis, fronteras y movi­lidades* (IFEA-LabEx DynamiTe-UNT, 2016).

**Elise Dufour** is an associate professor at the Muséum national d'Histoire naturelle in Paris. Her research deals with the relationship between humans and animals during the Holocene. She uses stable isotopes measured on different archaeological archives, such as bones, teeth and otoliths. In collaboration with Nicolas Goepfert (investigator at the CNRS) is currently involved in a programme entitled Pre-Hispanic societies facing their environment: spatial and diachronic change in Andean pastoralism (100–1470 AD) 'CAMELANDES' that studies pastoralism on the northern coast of Peru. The CAMELANDES project aims to bring new data on the adaptation to the coast of the complex pre-Hispanic human societies of Northern Peru. Stable isotope analysis (carbon, nitrogen, oxygen and strontium) performed by Elise Dufour highlights the complexity of and diversity in pastoral practices in the Mochica, Lambayeque and Chimú cultures ('Life History and Origin of the Camelids Provisioning a Mass Killing Sacrifice During the Chimú Period: Insight from Stable Isotopes', *Environmental Archaeology*, 2018).

**Gabriel Prieto** is a professor in archaeology at the National University of Trujillo. Since 2010 he has been working on the northern coast of Peru, specifically at Huanchaco, excavating fishing settlements from different periods. His projects focus on understanding the social dynamics and social interactions of ancient maritime communities. Prieto has published articles and book chapters in different peer-reviewed journals and books. Currently, he is co-editing, with Daniel Sandweiss, a book on ancient maritime adaptations on the South American Pacific coast.

**John Verano** is a biological anthropologist who specialises in human osteology, palaeopathology, bioarchaeology and forensic anthropology. Professor Verano's primary research area over the past 30 years has been Andean South America, with a focus on prehistoric populations of coastal and highland Peru. His research interests include the study of disease in skeletal and mummified remains, trepanation and other ancient surgery, warfare, human sacrifice, and mortuary practices. He is co-editor, with Douglas Ubelaker, of *Disease and Demography in the Americas* (Smithsonian Press, 1992) and, with Andrew Scherer, of *Embattled Bodies, Embattled Places: War in Pre-Columbian Mesoamerica and the Andes* (Dumbarton Oaks, 2014). His most recent book is *Holes in the Head: The Art and Archaeology of Trepanation in Ancient Peru* (Dumbarton Oaks, 2016).

## ORCID

Nicolas Goepfert  <http://orcid.org/0000-0002-6155-1856>

Elise Dufour  <http://orcid.org/0000-0001-8865-7055>

Gabriel Prieto  <http://orcid.org/0000-0001-6229-986X>

## References

- Benavente, Antonia M., Luis Adaro, Plinio Gecele, and Claudio Cunazza. 1993. *Contribución a la determinación de especies animales en arqueología: Familia Camelidae y Taruca del Norte*. Santiago de Chile: Universidad de Chile, Vicerrectoría Academia y Estudiantil, Departamento Técnico de Investigación.
- Cartajena, I. 2007. "Una propuesta metodológica para la estandarización De medidas en huesos cortos de camélidos y para la determinación de sexo." *Revista Werken* 10: 49–62.
- Cobo, Bernabé. 1990 [1653]. *Inca Religion and Customs*. Austin: University of Texas Press.
- Conrad, Geoffrey W. 1982. "The Burial Platforms of Chan Chan: Some Social and Political Implications." In *Chan Chan: Andean Desert City*, edited by Michael E. Moseley and Kent C. Day, 87–117. Albuquerque: University of New Mexico Press.
- Day, Kent C. 1982. "Ciudadelas: Their Form and Function." In *Chan Chan: Andean Desert City*, edited by Michael E. Moseley and Kent C. Day, 55–66. Albuquerque: University of New Mexico Press.
- de Molina, Cristóbal, Enrique Urbano, and Pierre Duviols. 1988 [1573]. *Relación de las fábulas y ritos de los Incas*. Historia 16. Madrid.
- Donnan, Christopher C., and Leonard J. Foote. 1978. "Child and Llama Burials from Huanchaco." In *Ancient Burial Patterns of the Moche Valley*, edited by Christopher C. Donnan and Carol Mackey, 399–408. Austin: University of Texas Press.

- Donnan, Christopher C., and Carol Mackey, eds. 1978. *Ancient Burial Patterns of the Moche Valley*. Austin: University of Texas Press.
- Dufour, Elise, Nicolas Goepfert, Belkys Gutiérrez, Claude Chauchat, Regulo Franco Jordan, and Segundo Vasquez Sanchez. 2014. "Pastoralism in Northern Peru During Pre-Hispanic Times: Insights from the Mochica Period (100–800 AD) Based on Stable Isotopic Analysis of Domestic Camelids." *PLoSone*, doi:10.1371/journal.pone.0087559.
- Dufour, Elise, Nicolas Goepfert, Manon Le Neün, Gabriel Prieto, and John W. Verano. 2018. "Life History and Origin of Camelids Provisioning a Mass Killing Sacrifice During the Chimú Period: Insight from Stable Isotopes." *Environmental Archaeology*, doi:10.1080/14614103.2018.1498165.
- Farrington, Ian S., and C. C. Park. 1978. "Hydraulic Engineering and Irrigation Agriculture in the Moche Valley, Peru: c. A.D. 1250–1532." *Journal of Archaeological Science* 5 (3): 255–268. doi:10.1016/0305-4403(78)90043-2.
- Flores Ochoa, Jorge. 1978. "Classification et dénomination des camélidés sud-américains." *Annales Économies, Sociétés, Civilisations* 5–6: 1006–1016.
- Flores Ochoa, J. A., K. MacQuarrie, and J. Portus. 1994. *Oro de los Andes: Las llamas, alpacas, vicuñas y guanacos de Sudamérica*. Vol. 2. Barcelona: Jordi Blassi.
- Goepfert, Nicolas. 2011. *Frayer la route d'un monde inversé: Sacrifice et offrandes animales dans la culture Mochica (100–800 Apr. J.-C.), côte nord du Pérou*. Paris: Monographs in American Archaeology 28/Oxford: British Archaeological Reports.
- Goepfert, Nicolas. 2012. "New Zooarchaeological and Funerary Perspectives on Mochica Culture (a.d. 100–800), Peru." *Journal of Field Archaeology* 37 (2): 104–120.
- Goepfert, Nicolas, and Gabriel Prieto. 2016. "Offering Llamas to the Sea: The Economic and Ideological Importance of Camelids in the Chimú Society, North Coast of Peru." In *The Archaeology of Andean Pastoralism*, edited by José M. Capriles and Nicolas Tripcevich, 197–210. Albuquerque: University of New Mexico Press.
- Gonzales Mendes, Guillermo. 2009. *Proyecto de Investigación Arqueológico "Restauración de Los Muros Perimetrales Norte, Este y Oeste Del Conjunto, y Muro Perimetral Del Recinto Funerario, Conjunto Amurallado Ñain-An (Ex Bandelier), Complejo Arqueológico Chan Chan"*. Lima: Ministerio de Cultura, Perú.
- Guerra, Maria Filomena, and Paz Nuñez-Regueiro, eds. 2017. *La orfebrería en los Andes en la época Inca (siglos XV–XVI)*. Bulletin de l'Institut Français d'Études Andines 46. Lima: Institut Français d'Études Andines.
- Gutiérrez, Belkys. 2008. "Plataforma uhle: Enterrando y desenterrando muertos." In *Arqueología Mochica: Nuevos enfoques: Actas del primer Congreso Internacional de Jóvenes Investigadores de la Cultura Mochica, Lima, 4–5 de Agosto de 2004*, edited by Luis J. Castillo Butters, Hélène Bernier, Grégory Lockard, and Julio Rucabado Young, 245–259. Lima: Institut Français d'Études Andines and Fondo Editorial de la Pontificia Universidad Católica del Perú.
- Huckleberry, Gary, Ari Caramanica, and Jeffrey Quilter. 2017. "Dating the Ascope Canal System: Competition for Water During the Late Intermediate Period in the Chicama Valley, North Coast of Peru." *Journal of Field Archaeology* 43 (1): 17–30. doi:10.1080/00934690.2017.1384662.
- Izeta, Andrés D., Clara Otaola, and Alejandra Gasco. 2009. "Estándares métricos y variabilidad en falanges proximales de camélidos sudamericanos: Su importancia como conjunto comparativo para interpretaciones en arqueología / Metric standards and variability in South American camelids proximal phalanges." *Revista del Museo de Antropología* 2 (1): 169–180.
- Kaufmann, Cristina A., María C. Álvarez, Lorena G. L'Heureux, and María A. Gutiérrez. 2013. "Dimorfismo Sexual en la Pelvis de *Lama guanicoe* (Artiodactyla, Camelidae): Un Caso de Aplicación en el Sitio Paso Otero 1, Buenos Aires, Argentina." *Mastozoología Neotropical* 20 (1): 47–59.
- Keatinge, Richard W. 1975. "Urban Settlement Systems and Rural Sustaining Communities: An Example from Chan Chan's Hinterland." *Journal of Field Archaeology* 2 (3): 215–227. doi:10.1179/009346975791491033.
- Kent, Jonathan D. 1982. "The Domestication and Exploitation of the South American Camelids: Methods of Analysis and Their Application to Circum-Lacustrine Archaeological Sites in Bolivia and Peru." *PhD diss.*, Washington University.
- Kolata, Alan. 1993. *The Tiwanaku: Portrait of an Andean Civilization*. Cambridge: Blackwell Publishers.
- Lecoq, Patrice. 1987. "Caravanes de llamas, sel et échanges dans une communauté de Potosí, en Bolivie." *Bulletin de l'Institut Français d'Études Andines* 16 (3–4): 1–38.
- Millaire, Jean-François. 2004. "The Manipulation of Human Remains in Moche Society: Delayed Burials, Grave Reopening, and Secondary Offerings of Human Bones on the Peruvian North Coast." *Latin American Antiquity* 15 (4): 371–388. doi:10.2307/4141584.
- Millaire, Jean-François, and Flannery Surette. 2011. "Un fardo funerario procedente de Huaca Santa Clara, valle de Virú (ca. 1150 a. D.)." *Bulletin de l'Institut français d'études andines* 40 (2): 289–305. doi:10.4000/bifea.1408.
- Miller, George R. 1977. "Sacrificio y beneficio de camélidos en el sur del Perú." In *Pastores de Puna. Uywamichiq Punarunakuna*, edited by Jorge Flores Ochoa, 193–210. Lima: Instituto de Estudios Peruanos.
- Moore, Jerry D., and Carol J. Mackey. 2008. "The Chimú Empire." In *The Handbook of South American Archaeology*, edited by Helaine Silvermann and William H. Isbell, 783–807. New York: Springer.
- Moseley, Michael E., and Kent C. Day, eds. 1982. *The Burial Implications of Chan Chan: Some Social and Political Implications*. Albuquerque: University of New Mexico Press.
- Nielsen, Axel M. 2001. "Ethnoarchaeological Perspectives on Caravan Trade in the South-Central Andes." In *Ethnoarchaeology of Andean South America: Contributions to Archaeological Method and Theory*, edited by Lawrence A. Kuznar, 163–201. Ethnoarchaeological Series 4. Ann Arbor: International Monographs in Prehistory.
- Orefici, Giuseppe. 1994. "El recinto de los camélidos." In *Documentos de trabajo. Memorias del VI Congreso de la FIEALL (Varsovia 23 Mai–2 Juin 1993)*, 49–53. Warsaw: Centrum Studiów Latinoamerykańskich, University of Warsaw.
- Ortloff, Charles R. 1981. "La ingeniería hidráulica Chimú (Parte I): El sistema de canales La Cumbre." In *La tecnología en el mundo Andino: Subsistencia y mensuración*, edited by Heather Lechtman and Ana Maria Soldi, 91–134. Mexico City: Universidad Nacional Autónoma de México.
- Pacheco Torres, Victor R., Alfredo J. Altamirano Enciso, and Emma S. Guerra Porras. 1979. *Guía osteológica de*



- camélidos sudamericanos*. Serie Investigaciones 4. Lima: Universidad Nacional Mayor de San Marcos.
- Pozorski, Shelia Griffis. 1976. "Prehistoric Subsistence Patterns and Site Economics in the Moche Valley, Peru." *PhD diss.*, University of Texas.
- Pozorski, Shelia Griffis. 1979. "Late Prehistoric Llama Remains from the Moche Valley, Peru." *Annals of the Carnegie Museum* 48 (9): 139–69.
- Prieto, Gabriel, Nicolas Goepfert, and Katia Vallares. 2015. "Sacrificios de niños, adolescentes y camélidos jóvenes durante el Intermedio Tardío en la periferia de Chan Chan, Valle de Moche, costa norte del Perú." *Arqueología y Sociedad* 27: 255–96.
- Prieto, Gabriel, John W. Verano, and Nicolas Goepfert. 2017. "Lluvias e inundaciones en el siglo XV de nuestra era: Sacrificios humanos y de camélidos Chimú en la periferia de Chan Chan." In *Actas del II Congreso Nacional de Arqueología*, 55–65. Lima: Ministerio de Cultura.
- Prieto, Gabriel, John W. Verano, Nicolas Goepfert, Jeffrey Quilter, Steven LeBlanc, Douglas Kennett, Lars Fehren-Schmitz, et al. *Forthcoming*. "A Mass Sacrifice of Children and Camelids at the Huanchaquito-Las Llamas Site, Moche Valley, Peru." *PlosOne*.
- Ravines, Rogger. 1980. *Chan Chan, Metropli Chimú*. Lima: Instituto de Estudios Peruanos (IEP).
- Shimada, Melody, and Izumi Shimada. 1985. "Prehistoric Llama Breeding and Herding on the North Coast of Peru." *American Antiquity* 50 (1): 3–26. doi:10.2307/280631.
- Szpak, Paul, Jean-François Millaire, Christine D. White, and Fred J. Longstaffe. 2014. "Small Scale Camelid Husbandry on the North Coast of Peru (Virú Valley): Insight from Stable Isotope Analysis." *Journal of Anthropological Archaeology* 36: 110–129. doi:10.1016/j.jaa.2014.08.005.
- Topic, John R. 1980. "Excavaciones en los barrios populares de Chan Chan." In *Chan Chan: Andean Desert City*, edited by Rogger Ravines, 267–282. Lima: Instituto de Estudios Peruanos.
- Topic, John R. 1982. "Lower-Class Social and Economic Organization at Chan Chan." In *Chan Chan: Andean Desert City*, edited by Michael E. Moseley and Kent C. Day, 145–176. Albuquerque: University of New Mexico Press.
- Tufinio, Moises. 2006. "Excavaciones en el Frontis Norte y Plaza 1 de Huaca de La Luna." In *Informe técnico 2005: Proyecto Arqueológico Huaca de La Luna*, edited by Santiago Uceda, Elias Mujica, and Ricardo Morales, 47–63. Trujillo: Facultad de Ciencias Sociales, Universidad Nacional de la Libertad.
- Tufinio, Moises. 2008. "Frontis Norte, Huaca de La Luna: Ofrenda Chimú." In *Informe técnico 2007: Proyecto Arqueológico Huaca de La Luna*, edited by Santiago Uceda, Elias Mujica, and Ricardo Morales, 13–19. Trujillo: Facultad de Ciencias Sociales, Universidad Nacional de la Libertad.
- Uceda, Santiago. 1997. "Esculturas en miniatura y una maqueta de madera." In *Investigaciones en la Huaca de La Luna 1995*, edited by Santiago Uceda, Elias Mujica, and Ricardo Morales, 151–176. Trujillo: Facultad de Ciencias Sociales, Universidad Nacional de la Libertad.
- Verano, John W., and Marla J. Toyne. 2011. "Estudio bioantropológico de los restos humanos del Sector II, Punta Lobos, Valle de Huarmey." In *Arqueología de la Costa de Ancash, vol 8*, edited by Milosz Giersz and Iván Ghezzi, 449–474. ANDES. Lima: Institut Français des Études Andines/Warsaw: Centrum Studiów Latynoamerykańskich, University of Warsaw.
- Wheeler, Jane C. 1982. "Aging Llamas and Alpacas by Their Teeth." *Llama World* 1 (2): 12–17.
- Wheeler, Jane C. 1991. "Origen, evolución y status social." In *Avances y perspectivas del conocimiento de los camélidos sudamericanos*, edited by S. Fernandez-Baca, 11–48. Santiago de Chile: Food and Agriculture Organization.
- Wheeler, Jane C. 1996. "El estudio de restos momificados de alpacas y llamas precolombinas." In *Zoarqueología de camélidos: Perspectivas teóricas y metodológicas, vol. 2*, edited by Dolores C. Elkin, Celina Madero, Guillermo L. Mengoni Goñalons, Daniel E. Olivera, Maria del Carmen Reigadas, and Hugo D. Yacobaccio, 91–101. Año 1. Buenos Aires: Grupo de Zoarqueología de camélidos.
- Wheeler, Jane C. 2005. "Pre-Conquest Alpaca and Llama Breeding." *Camelid Quarterly*, 1–5.
- Wheeler, Jane C., A. J. F. Russel, and Hilary Redden. 1995. "Llamas and Alpacas: Pre-Conquest Breeds and Post-Conquest Hybrids." *Journal of Archaeological Science* 22 (6): 833–840.