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Of Hunting and Herding: Isotopic evidence in wild and domesticated camelids from the Southern Argentine Puna (2120–420 years BP)

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ABSTRACT

Using stable isotope analysis, this paper studies the interaction between Prehispanic camelid herding and hunting practices in agropastoralist societies of the Antofagasta de la Sierra Basin (Southern Argentinean Puna) between 2120 and 420 years BP. Stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotope ratios were measured on 45 archaeological wild (*Vicugna vicugna*) and domesticated (*Lama glama*) camelid bone samples from the Early and Late Formative Period (3000–1000 years BP) site of Casa Chavez Montículos, and from the Regional Late Period (1000–420 years BP) sites of Corral Alto, Bajo del Coypar, Real Grande 1 and Real Grande 6.
The isotopic analysis showed that domestic camelids at the sites segregated into two groups according to $\delta^{13}C$, reflecting two distinct animal management strategies. This could have involved differences in foddering practices or altitudinal herding ranges. In the case of wild camelids, $\delta^{13}C$ and $\delta^{15}N$ values indicated that the distances travelled in their hunting varied depending on the site. The observed variability in the management strategies of herding resources, and in the mobility circuits linked to the exploitation of wild camelids, presents the case for puna groups relying on an ongoing re-organisation of longstanding local economic practices to mediate the socio-political and environmental factors that arose through time.

1. Introduction

South American camelids occupied a central role in the economic, social and ritual lifeways of past Andean hunter-gathers, herders and farmers. The llama and alpaca were the only medium to medium-large domesticated animal of the Americas. Their exploitation presaged the development of the only autochthonous herding strategy in the New World (Bonavia, 2008; Mengoni Goñalons, 2007; Wheeler, 1995; Yacobaccio, 2001). The domestication of camelids was especially important for the highland regions, such as the Southern Argentine Puna, where critical resources – water, forage, fertile soil, etc. – were limited for both humans and animals. Likewise, agriculture played an important role in the variety of economic systems adopted by the agro-pastoralist societies of the highlands (Erickson, 2006; López, 2003; Olivera, 1997; Stanish, 2006). Nevertheless, the means by which subsistence agriculture and camelid herding interacted at this ecological juncture is a long understudied theme.

Archaeological research shows that by 1000 years BP, the South-Central Andes saw an intensification in both agricultural and pastoralist production. This pastoralist intensification would have engendered a specialised use of domesticated camelids for diverse functions, such as meat, fibre and as load-bearing animals (Mengoni Goñalons, 2007; Nielsen, 2001; Olivera, 1997; Olivera and Grant, 2008; Reigadas, 2008; among others). In spite of these profound changes, to date, there have been no studies into the impact that this economic intensification had on the transhumant mobility practices of pastoral people, linked to livestock management and the productivity of a given study area (Olivera, 2006; Grant, 2014).

In addressing these lacunae, I study the trajectory of Andean Prehispanic pastoralism in a particular sector of the South-Central Andes – Antofagasta de la Sierra (Southern Argentine Puna) – where hunting, herding and agriculture occupied shifting social and economic roles across time. The archaeological and zooarchaeological data from Antofagasta de la Sierra (Southern Argentinean Puna) indicates that camelid pastoralism constituted, from around 3000 years BP, a fundamental element in the economy and lifestyle of these ancient Prehispanic communities. Even so, the adoption of pastoralist strategies, the final result of a process of domestication, did not mean the end of hunting; indeed, the evidence strongly suggests that hunting remained a much more important resource within the economies of these societies than previously acknowledged (Grant, 2010; Olivera and Grant, 2008; Ortiz and Urquiza, 2012; Urquiza and Aschero, 2006).

Concomitantly, agriculture from an initial small-scale endeavour at the commencement of the agropastoralist process grew in importance until it constituted a crucial link in the organisation of late societies (ca. 1000 years BP). In this article, I address the impact of this increase in scale and intensity of agricultural practices on the existing herding and hunting strategies, as well as the specific locations of their pasturelands.

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The aim of this paper then is to elucidate changes and continuities through time in animal management practices and the economic use of camelids, both domestic and wild, in the Antofagasta de la Sierra Basin of the Southern Argentine Puna. I do this through an analysis of carbon and nitrogen stable isotopes on bone collagen from archaeological camelid remains. The bones sampled are from five archaeological sites dating to between 2120 and 420 years BP, located at different altitudes within the Antofagasta de la Sierra Basin. Specifically, this study seeks to determine the characteristics of animal management practices, as well as the interplay between hunting, herding and agriculture in early and late agropastoralist societies of the study region.

This new data shows that the isotopic signature of bones can be used as a tool for identifying differences in the foddering practices and the elevational habitat in which camelid were pastured or hunted within short radial distances, such as those of the Antofagasta de la Sierra Basin. These results are discussed within a framework covering the political, social and economic changes that occurred in this sector of the Southern Argentine Puna across 1700 years Prehispanic history.

1.1. Environmental and archaeological setting

The Puna of Argentina is a highland desert located between 22° and 27°S and at 3000 to 5000 masl. This area is characterised by high solar radiation due to altitude, wide daily thermal variation, low atmospheric pressure and marked rainfall seasonality. Primary productivity is mainly concentrated on stable hydrological systems such as wetlands and primary basins. There are a few low-flow rate, permanent and semi-permanent watercourses that are distributed unevenly throughout the landscape. These are the only sources of fresh water (Olivera, 2006; Tchilinguirian, 2008). In terms of precipitation distribution, the Argentinean Puna exhibits a latitudinal gradient that determines two sub-regions: the Dry or Northern Puna and the Salt or Southern Puna. While both have similar vegetational compositions, the Salt Puna is dominated by salt-lakes and saline soils (Cabrera, 1976).

The Antofagasta de la Sierra Micro-region is located between 25° 50′ and 26° 10′S, and 67° 30′ and 67° 10′W and falls within the Salt Puna (see Fig. 1). It is characterised by extreme aridity (arid Andean Puna climate) with average summer rainfalls below 100–150 mm annually, sometimes failing altogether in given seasons. The hydrological network is endorheic, fed by scarce precipitation, ice-melt (November–March) and subterranean water sources. In keeping with the rest of the puna, the wide altitudinal range results in moisture variations that underpin the development of distinct plant communities.

Below 3800 masl there is the *Tolar* (shrub steppe) community, dominated by shrubs of the Asteraceae family and with a low proportion of herbs. The *Tolar* includes mainly C_3 (shrubs and grasses) and C_4 (mostly grasses) plant species. Between 3900 and 5000 masl extends the *Pajonal* ecozone (herbaceous grasslands), dominated by Festuca and other grasses, containing mostly C_3 plant species. At the interface between the two zones – 3800/3900 masl - there is an ecotone characterised by a mixed shrub and steppe community ecotone. These plant communities constitute 99% of the desert matrix. The remaining 1% is composed of poorly drained moorland known as *vegas* (wetlands). *Vegas* are found at different altitudes and represent densely vegetated areas containing several grass species (Haber, 1991; Tchilinguirian and Olivera, 2009).

Various archaeological studies undertaken in Antofagasta de la Sierra show that the Early Formative Period (3000–1800 years BP) was categorised by the presence of groups practicing agro-pastoralism. The life-cycle of these human groups was organised primarily around llama herding, with agriculture playing a minor role (Olivera, 1997, 2006). Nevertheless, vicuña hunting still played an important part in the economic strategies of these societies (Escola, 1996; Grant, 2010; Olivera and Grant, 2008). During the Late Formative period (1800–1000 years BP) there was a slow, human demographic increase among these agropastoral societies, and a concomitant rise in agricultural production. This agricultural production was focussed around the improved use of those sectors best suited to agriculture (Olivera, 1997). At this stage, camelid hunting seems to have diminished in intensity, perhaps as a consequence of greater economic reliance on farming among these groups (Olivera and Grant, 2008).

Finally, during the Late Period (1000–420 years BP), there is another population increase, and the appearance of semi-urban habitational centres associated to increased social complexity. At this time, there seems to have been a marked tendency towards greater agricultural production, whereby the best lands are actively, extensively, and intensively cultivated (Tchilinguirian and Olivera, 2009). This increase in agricultural production is mirrored by an equal intensification in pastoralist production, reflected in the increasingly evidence for a more complex management of camelids, such as the rearing of specialised fibre and load-carrying llama types (Olivera, 1997; Olivera and Vigliani, 2000/2002; Olivera and Grant, 2008; Reigadas, 2008). Likewise, by this stage, hunting has again regained its importance within the existing economic set-up (Grant, 2010; Olivera and Grant, 2008; Ortiz and Urquiza, 2012; Urquiza and Aschero, 2006).

1.2. Camelids and Andean pastoralism

At present there are four camelid species in South America: guanaco (*Lama guanicoe*) and vicuña (*Vicugna vicugna*) both wild, and llama (*Lama glama*) and alpaca (*Vicugna pacos*) both domesticated. Here, I concentrate on the characteristics of llamas and vicuñas given that these two species dominate the analysed archaeological record of Antofagasta de la Sierra. The alpaca is a rare presence in the Argentinean Puna, given that this dry region is environmentally unsuited to this animal. Likewise, there is no strong evidence to suggest its presence in the study area in the Prehispanic period (Grant, 2014; Olivera and Grant, 2008). In the case of the guanaco, although currently not present in the study area (Olivera, 2006), osteometric and contextual evidence suggests their presence in different archaeological sites of Antofagasta de la Sierra until the end of the Formative Period, although in ever decreasing frequency through time (see Section 2 below).

The vicuña is the smallest camelid. In the Argentine Puna, vicuñas have been classified as variable graziers, implying that they feed preferably on herbs and grasses, but sometimes vary their diet by feeding on steppe shrubs (Benítez et al., 2006). Despite this dietary flexibility, they register higher consumption of C_4 plants relative to most ungulates (Borgnia et al., 2008, 2010). In spatial terms, individual vicuñas organise themselves into stable family groups that dominate a given territory (Franklin, 1982; Vilá, 2000). The llama is the largest domesticated camelid and it is adapted to a great variety of environments. It has the capacity to eat a wide range of different plants and is thus known as a generalist species (Gundermann, 1984; Yacobaccio, 2001). Insofar as its spatial range is concerned, its social behaviour in these circumstances, as in others, is circumscribed by human intervention.

In this sense, there are a number of studies on contemporary Andean pastoralism noting that the spatial separation and temporal availability of pasturelands is managed by the mobilisation of herds and people (e.g. Göbel, 1994; Gundermann, 1984; Yacobaccio et al., 1998). These migrations usually follow a seasonal vertical movement – transhumance – that results in a dispersed human settlement pattern across the landscape (Yacobaccio et al., 1998).

In modern-day Antofagasta de la Sierra, because of a range of different factors, including work migration to cities, and the introduction of exotic animals into the herds (e.g. *Ovis aries*), these transhumant mobility patterns have been further modified, such that herders show a preference for maintaining llamas at the valley basin for the whole of the year, as opposed to yearly migrations. Here, close to the modern village, the llamas pasture freely in the *vegas* and fields, complementing their diet with fodder, mainly alfalfa (*Medicago sativa*), an Old World C_3 plant (Grant, 2016).