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Understanding foraging radius and mobility in a high desert

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ABSTRACT

We examine botanical and lithic assemblages from two rock-shelters in a high elevation desert in NW Argentina in order to understand the relationship between the size of foraging radii, territorial ranges and habitat quality during the Early and Middle Holocene (ca. 8300–6200 BP). We find an increase in foraging radii associated with declining habitat quality and propose a shift from complete radius leapfrog to a point-to-point mobility pattern. The use of nonlocal plants and obsidian suggest large territorial ranges, as well as wide interaction networks between the Puna and neighboring lowlands to the east.

1. Introduction

The aim of this paper is to examine the material traces of mobility in a high-elevation desert by considering static resources —plant macroremains and toolstone— as indicators of foraging radii, foraging ranges and interactions at a regional and macro-regional scale among prehistoric hunting societies in the Salt Puna (Fig. 1). Although archaeobotanical and lithic research often operate as independent research avenues, in this paper we integrate both in order to examine the effect that increased aridity had on the distribution of plant communities, and hence on firewood, plant gathering and toolstone procurement, as well as on the thresholds of human occupation in a high-elevation desert. First, we address land-use strategies at a local scale, within the Laguna de Antofagasta drainage basin, by focusing on the assemblages from Cueva Salamanca 1 site, a residential camp that contains evidence of human activity during the Middle Holocene (7600–6200 BP). Next we compare these finds to those from Quebrada Seca 3, which bears evidence of human occupation for the Early and Middle Holocene (Fig. 2). We propose an increase in the size of foraging radii around residential sites as the result of a decline in habitat quality during the Middle Holocene. Finally, the use of different obsidian sources suggests variation in territorial range sizes, and the intensification in the use of allochthonous plants suggests inter-regional interaction during periods of decreased habitat quality in the Puna.

1.1. Environment in the South Puna

Our research focuses in the Argentine Salt Puna —also known as the South Puna— where climate is cold, temperature averages less than 10° C annually, and vegetation is sparse. Solar radiation is high. Rainfall is estival (November to March) and averages less than 100 mm annually and potential evapotranspiration is 570 mm, resulting in a pronounced hydric deficit year round and arid environment (Morlans, 1995). Precipitation decreases in an east-west gradient, and a complete lack of rainfall over several consecutive years is common (Cabrera, 1976). Soils are immature, sandy and gravelly. The topography in the basin of Laguna de Antofagasta, where this study is centered, combines plateaus, or *pampas*, that rise rapidly from a base level of about 3400 masl. Mountain ranges and volcanoes to the east top 5500 masl. Wetlands (*vegas*), characterized by a dense plant cover of Poaceae and Juncaceae species, border rivers, streams, lakes and *salares* (saltpans).

Relief and altitude gradient have a pronounced effect on plant and animal communities, as well as on transportation and mobility costs to hunter-gatherers. From a phytogeographical standpoint, the vegetation of the Puna belongs to the Andean Dominion, which includes the Altoandean and Puneño provinces (Cabrera, 1957),

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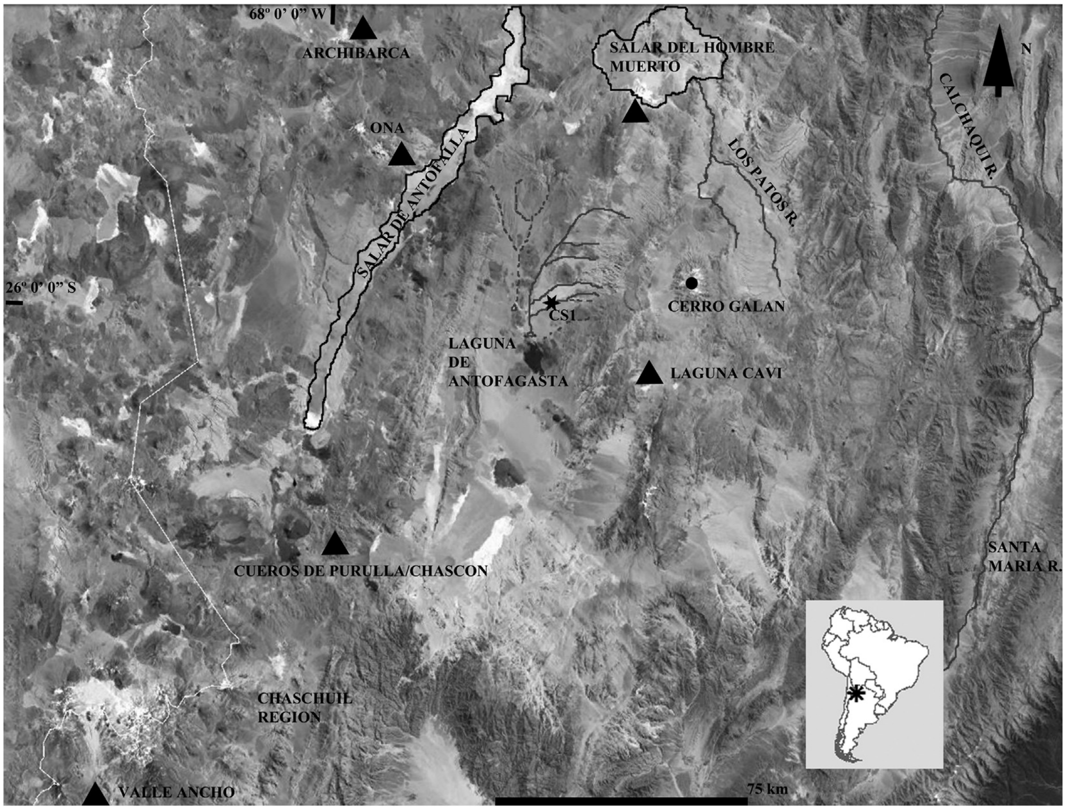

Fig. 1. The basin of Laguna de Antofagasta in the Salt Puna of NW Argentina. The following are shown: Cueva Salamanca 1 (CS1) and obsidian sources (▲).

better known as the *pajonal* and *tolar* respectively. The *tolar* plant community is characterized by shrub steppes dominated by *Fabiana densa*, *Acantholippia punensis*, *Adesmia horrida*, *Parastrephia* sp. and *Baccharis* sp. that occupy the lower elevations of the Puna in the basin floors between 3400 and 3900 masl. Ground cover is 20–30%. *Tolar* shrubs form heterogeneous associations dominated by one species. Shorter herbaceous plants grow in the shade of these shrubs. As elevation increases, shrubs become lower and are scattered.

The *pajonal* plant community, which covers mountain slopes at elevations between 3900 masl and 5600 masl, consists of grasslands where species of Poaceae (*Stipa* and *Festuca* genera) are predominant, although sub-shrub species of *A. horrida*, *Sysimbrium philippianum*, *Baccharis* and *Fabiana bryoides* are also present. *Pajonal* grasses grow in sandy soils, lack continuity given the topography, and form small islands. Ground cover ranges between 5 and 10%. Overall, primary productivity in the Puna is low, albeit with some variation (Morales, 2011), and pockets of resources result in a mosaic or patchy and heterogeneous environment (Yacobaccio, 1994). The local fauna includes vicuñas (*Vicugna vicugna)*, which mainly graze in the *pajonal* grasslands, and llamas (*Lama glama*), which mostly feed off wetland grasses. Large rodents (Chinchillidae family) are found in *quebrada* rockeries, whereas birds (*Rhea pennata*, Phoenicopteridae family) are common around water sources. Foxes (*Pseudalopex culpaeus* and *Pseudalopex griseus*) and pumas (*Puma concolor*) are the main predators (Olivera and Elkin, 1994).

1.2. Paleoenvironment of Antofagasta de la Sierra (10,000–4500 BP)

Although today the climate is arid, paleoenvironmental studies show that it fluctuated during the Holocene. In the Puna region of northwest Argentina the Early Holocene had moist conditions (Alcalde and Kulemeyer, 1999; Fernandez et al., 1991; Kulemeyer et al., 1999; Markgraf, 1985; Morales, 2011; Olivera et al., 2004; Tchilinguirian et al., 2012; Yacobaccio and Morales, 2005). In the study region, sediment analyses in Laguna Colorada (Fig. 2) reveal a cold and wet climate that resulted in lake transgression, ca. 10,000–8700 BP, when the first human settlements in the study area occurred at Peñas de las Trampas 1.1 site ca. 10,200 BP, Quebrada Seca 3 site ca. 9400 BP and Punta de la Peña 4 ca. 8900 BP (Martínez, 2012; Urquiza, 2009) (Fig. 2). In general, an arid trend is observed in the Middle Holocene, ca. 8700–4500 BP. In our study region, this period coincided with the occupation of several rock shelters —Cueva Salamanca 1, Quebrada Seca 3 and Peñas de la Cruz 1— with brief humid events in the late Middle Holocene, ca. 6300–5800 BP, as shown by diatoms, organic materials and paleosoils in Laguna Colorada, Mirihuaca River and Las Pitas River (Fig. 2) (Tchilinguirian and Morales, 2013; Tchilinguirian and Olivera, 2014). This trend toward arid conditions is also observed in other regions of the South-Central Andes. Many Altiplano lakes, such as Lake Titicaca (Bolivia), Laguna Miscanti, Laguna del Negro Francisco (Chile), and Laguna El Peinado (Argentina) show low lake levels between 8500 and 4000 BP. An increase in grass pollen in Laguna Seca (Chile) and El Aguilar (northern Argentina) not only shows an increase in aridity, but also in temperature after 8000 BP (Baied and Wheeler, 1993; Grosjean et al., 2001, 2007; Markgraf, 1985; Valero Garcés et al., 1996, 2000). However, there is some disagreement regarding the extent of this aridity, given the presence of moist phases lasting several hundred years (Grosjean, 2001; Betancourt et al., 2000; Latorre et al., 2003, 2006, among others). It appears, therefore, that this climatic change did not have the same severity throughout the Puna, and that some locations retained moisture, such as rivers and lakes with large catchments as well as rivers that descend from the Puna into the Mesothermal