



Miscanti-1: Human occupation during the arid Mid-Holocene event in the high-altitude lakes of the Atacama Desert, South America

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ABSTRACT

This paper presents an interdisciplinary study of the Miscanti-1 archaeological site, located in the Holocene terrace deposits accumulated on the eastern margin of Miscanti Lake (4120 m.a.s.l.), northern Chile (23.7° S, 67.7° W). The human response to environmental and climatic variability in the Mid-Holocene (9500–4500 cal yr BP) is discussed through the zooarchaeological, lithic and paleoenvironmental records. We propose that, due to the increased aridity of the period, Miscanti Lake became a brackish paleowetland that attracted discrete groups of hunter-gatherers from lower elevation Andean areas. In contrast with the high frequency of human occupations known for the humid Late Pleistocene and Early Holocene (12600–9500 yr cal BP), the Miscanti-1 site is one of the few occupations recorded in the Atacama Highlands during the Mid-Holocene period. Data analysis suggests logistic and short-term campsite use for hunting the wild camelids that were attracted by the wetlands and fresh water (8100–8300 yr cal BP). In contrast to previous proposals for this period, we propose that access to high altitude environments did not cease, but was made possible by a shift to highly scheduled mobility and a specialized bifacial technology. Finally, the temporal and spatial links of Miscanti-1 are discussed in a regional context.

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1. Introduction

Consensus currently exists that during the Late Pleistocene and Early Holocene (16000–9700 yr cal BP), climatic conditions in the Atacama Desert (18–25°S) on the western slope of the Andes (>2000 m.a.s.l.) were more humid than today (Betancourt et al., 2000; Grosjean et al., 1997; Latorre et al., 2006, 2002; Moreno et al., 2007; Nester et al., 2007; Núñez et al., 2005; Placzek et al.,

2009; Quade et al., 2008; Rech et al., 2002; Sáez et al., 2016). The last glacial wet event corresponds to the widespread pluvial stages resulting from the expansion of the tropical circulation belt to 24–25°S (Kessler, 1991; Markgraf, 1989). Also called the “Central Atacama Pluvial Event” (CAPE), this regional wet event has been split into two phases: CAPE I (17500–14200 yr cal BP) and CAPE II (13800–9700 yr cal BP) (Gayó et al., 2012; Latorre et al., 2006; Placzek et al., 2009; Quade et al., 2008). In the Central Andes, two major lake expansion pulses have been registered, linked to the regional CAPE event: the Tauca phase (20000–15000 yr cal BP) and the Coipasa phase (13000–11000 yr cal BP) (Placzek et al., 2006; Sylvestre et al., 1999). However, the timing of the Tauca wet phase proposed for the large Central Andean lakes is different from that for lakes in the southern Atacama (25°S), particularly CAPE I dated around 14,500 yr cal BP (Sáez et al., 2016).

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The Mean Annual Precipitation (MAP) in the southern Atacama Desert exceeded 400–500 mm on the western slope of the Andes, compared to 200 mm currently (Grosjean, 1994; Kull and Grosjean, 1998). As result, large paleolakes formed in the basins located in the “high puna” (above 3800 m.a.s.l.), covering areas six times larger than today (Grosjean et al., 2001, 1997). Two peaks are recorded for elevated lacustrine levels of high altitude lakes in the *altiplano*: one around 12800 yr cal BP and another before 10200 yr cal BP (Geyh et al., 1999; Grosjean et al., 2001; Valero-Garcés et al., 1999, 1996).

The greater infiltration of groundwater increased phreatic levels in the pre-Andean floor (3000–3800 m.a.s.l.) and the foothills (2000 m.a.s.l.) (Betancourt et al., 2000; Grosjean et al., 1997; Latorre et al., 2002; Quade et al., 2008; Sáez et al., 2016). Wetter conditions even reached the intermediate depression or *pampa* (1000 m.a.s.l.) where extremely arid conditions prevail, as has been observed in the central Atacama (Gayó et al., 2012, 2010; Latorre et al., 2013; Nester et al., 2007).

Under these more favourable conditions, groups of hunter-gatherers that populated the highlands of the Atacama Desert (Fig. 1A) during the Late Pleistocene-Early Holocene transition had access to most of the environmental scenarios available. An important set of settlements distributed on the western slope of the Andes shows circuits of seasonal mobility between the high puna (>3800 m.a.s.l.), the basins and ravines of the pre-Andean floor (3000–3800 m.a.s.l.) and the oases of the foothills (2000 m.a.s.l.)

(Fig. 1B) (Bao et al., 2015; Cartajena et al., 2014; De Souza, 2004; Grosjean and Núñez, 1994; Loyola et al., 2017a,b; Núñez et al., 2002).

During the Mid-Holocene (9500–4500 yr cal BP), the water levels of high puna lakes dropped dramatically as a result of lower rainfall and a sustained increase in temperatures (Bao et al., 2015; Geyh et al., 1999; Grosjean and Núñez, 1994; Grosjean et al., 2003, 2001, 1997, 1995; Valero-Garcés et al., 1996; Wirrmann and Oliveira Almeida, 1987). Several studies agree that these arid conditions were a widespread event in the central and south-central Andes (Placzek et al., 2009; Sifeddine et al., 1998; Sylvestre et al., 1999; Wirrmann and Mourguiart, 1995). In the southern Atacama, this dry period has been identified between 9500 and 4000 yr cal BP through the study of lacustrine sediments in the Miscanti Lake (4200 m.a.s.l.) and groundwater discharge deposits in Sierra Varas (3446 m.a.s.l.) (Grosjean et al., 2003, 2001; Sáez et al., 2016).

After the decrease in lacustrine levels and the contraction of Miscanti Lake (Fig. 1), hypersaline conditions prevailed and in some sectors the previously deposited sediments were exposed to the atmosphere (Valero-Garcés et al., 1996). However, around 6000 to 5500 yr cal BP, several humid events occurred (Grosjean et al., 2003). Similar phenomena have been found in the short humid pulses recorded near the Salar de Atacama, Salar de Uyuni and Potosi (Abbott et al., 2003; Baker et al., 2001; Bobst et al., 2001). Moreover, the same pattern of events has been registered in distant

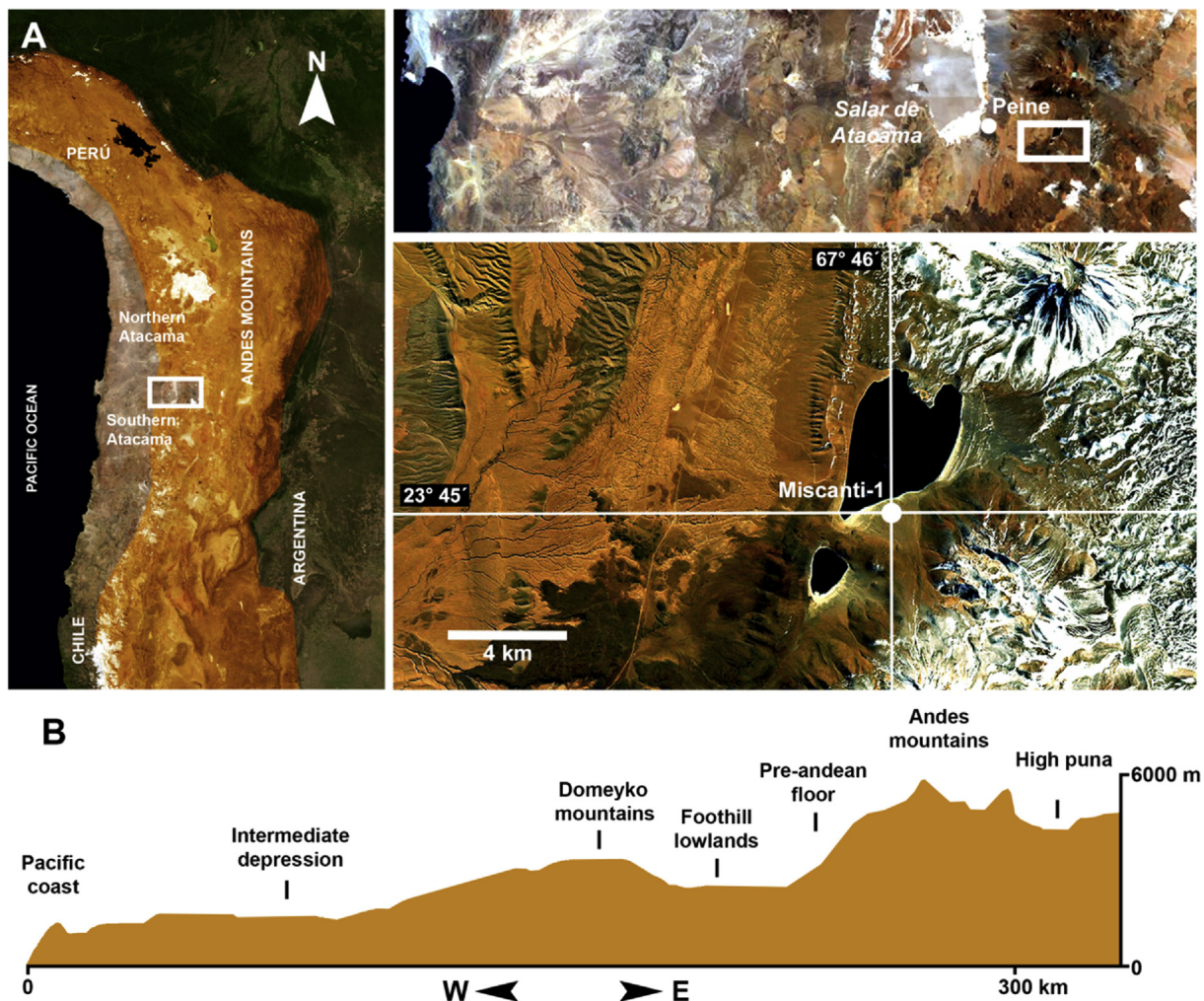


Fig. 1. Study Area: (A) Location of Miscanti-1 site, (B) Geomorphologic profile of Central Atacama Desert.

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