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Editorial

Human populations and environments during the Middle Holocene in the South-Central Andes

The South-Central Andes include some of the highest and some of the widest sections of this major orographic chain, and includes several volcanoes, as well as intermediate depressions and the Altiplano plateau, which is the second-highest plateau in the world (Allmendinger et al., 1997; Kennan, 2000; Coutand et al., 2001; among others). The influence of the Andes in climate and biotic communities is so profound that it is considered to be the most important morphological element in the globe (Morello, 1984; Baker et al., 2001; Garreaud et al., 2003; Strecker et al., 2007). The region is encompassed within the Andean-Patagonia subregion of the Neotropical biogeographic region, and comprises the Dry Puna and the even drier Salt Puna (Sclater, 1858; Wallace, 1876; in Cox, 2001; Troll, 1958; Cabrera and Willink, 1980; Baied and Wheeler, 1993). It currently includes some of the driest areas on Earth. However, this has not always been the case, as there were wetter periods during the Pleistocene and Early Holocene (see Tchilinguirian and Morales, 2013, and bibliography therein). At the onset of the Middle Holocene, a process of aridization took place, variedly affecting different areas across the region, as is shown throughout this special volume. This challenged biotic communities, including humans, who were in the process of effectively occupying the region after initial colonization during the final Pleistocene (see Núñez et al., 2002, 2005; Santoro et al., 2011; Yacobaccio and Morales, 2011; among others) and possibly shifting from conditions where *r* selective pressures prevailed to others where *K* selective pressures did (Muñoz and Mondini, 2007, 2008). Thus, human populations in the region have had to cope not only with high altitudes but also with deserts, among other environmental factors.

The Mid-Holocene environments, the aridization process and its impact on environments and human populations have been thoroughly studied to the north and south of the South-Central Andes (Zárate et al., 2005; Garvey et al., 2008; Craig, 2011; Hoguin and Restifo, 2012; among others), and interest has kept growing in the region in the last decades (e.g., Núñez and Santoro, 1988; Grosjean et al., 2005; Yacobaccio and Morales, 2005; Aschero and Hocsman, 2011; Muscio, 2012). This volume aims at bringing together some of the latest research.

The volume has its origin in a workshop carried out in Córdoba, Argentina, in 2011. It was the *Taller de Arqueología del NOA: Poblaciones humanas y ambientes durante el Holoceno medio* (https://sites.google.com/site/tallerarqnoa/), co-organized together with Jorge Martínez, Hernán Muscio and M. Bernarda Marconetto. It was focused mainly in NW Argentina (*NOA* in Spanish), and also included surrounding areas such as northern Chile to the west. The abstracts of the conferences and contributions at the workshop were published in Spanish (Mondini et al., 2011), and can be accessed at: https://sites.google.com/site/tallerarqnoa/publicacion-del-taller.

This volume introduces the full version of most of these presentations, comprising twelve contributions. It includes some general works dealing with models on the human occupation and environmental changes occurred in the South-Central Andes during the Middle Holocene, as well as papers focused in more specific subjects and some case studies that help understand these unique processes. Here, an outline of each paper is provided, followed by some general comments on their contribution to our current knowledge of human populations and environments during the Middle Holocene in the South-Central Andes.

The contribution by Lautaro Núñez, Isabel Cartajena and Martin Grosjean deals with a deeply rooted concept in the archaeology of Mid-Holocene South-Central Andes: that of "*silencio arqueológico*" ("archaeological silence"). It refers to the decrease and even lack of archaeological signals in the western slope of the Andes during the Hypsithermal. The authors also consider the concept of ecorefuges, by analyzing different paleoenvironmental proxy data as well as archaeological data in varying settings through time. By linking both concepts, Núñez and collaborators provide a more thorough picture of the varied impact of dry conditions on human populations in these hyper-arid lands.

A similarly complex picture is prompted by Pablo Tchilinguirian and Marcelo R. Morales, who provide a thorough paleoenvironmental picture of NW Argentina during the Middle Holocene. They compile proxy data from multiple archives of different temporal and spatial resolution, and consider both recurrent patterns and discrepancies and their implications for human settlement and adaptation. Further, they compare this picture to that prior to the onset of the Mid-Holocene conditions, as well as to that emerging in the Tropical Andean region. Even though a general trend towards aridization is inferred in Mid-Holocene NW Argentina, identification of some wetter, more productive localities suggest a complex resource structure available to human populations.

Yacobaccio's paper on the Southern Andean Puna from the perspective of human ecology represents an instance of the integration of cultural and environmental factors in the understanding of human and natural history in the region. It deals with the innovative social and cultural strategies introduced by hunter-gatherers to cope with environmental fragmentation, a key challenge posed by Mid-Holocene environmental changes to human populations, and provides examples of these in relation to the changing use of faunal resources throughout the whole region, including the Dry and Salt Punas and both Andean slopes.

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Also dealing with the incidence of different kinds of factors in human–animal interactions, Isabel Cartajena's contribution provides a thorough account of these in the western slope of the Puna de Atacama during the Middle Holocene. She assesses the differential influence of environmental and cultural agents upon the variability of archaeofaunal assemblages, particularly in osteometric terms, from different areas of the Chilean Puna through time. The author concludes that the ongoing process of domestication had an impact stronger than environmental factors on the variation observed in large camelids.

Hugo D. Yacobaccio, Marcelo R. Morales, Patricia Solá, Celeste T. Samec, Rodolphe Hoguin, and Brenda I. Oxman discuss the human occupation of the Dry Puna in NW Argentina based on evidence from archaeological site Hornillos 2, in Jujuy Province. The archaeological record in this rockshelter ranges the terminal Pleistocene through the Middle Holocene, providing an instance of continuous occupation even during the Hypsithermal, unlike the areas affected by the "archaeological silence". Drawing from multiple lines of evidence, the authors infer reduced residential mobility and increased occupation intensity, as well as a higher rate of technological innovations for the period.

The contribution by Gabriel E. J. López, Federico Coloca and Juan Pablo Orsi deals with an intermediate area between the Dry Puna and the Salt Puna in Argentina: the Pocitos basin, in Salta Province. Based on the surface and stratified archaeological record, they analyze the human occupations of the Middle Holocene and beginnings of the Late Holocene in the area in the context of the South-Central Andes. The authors suggest that given its location in the transition from the Dry to the Salt Punas, this area would have been suitable for social interaction and cultural communication.

The paper by Norma Ratto, Carolina Montero and Fernando Hongn discusses the relationship of environmental instability during the Mid-Holocene and the regional cultural development in western Tinogasta, Province of Catamarca, in the Salt Puna. After analyzing natural profiles comprising volcanic and peat deposits throughout the area, the authors suggest that the environmental instability generated by inferred climatic fluctuations, explosive volcanism and seismic activity would have impinged upon the low to null human occupation intensity in it.

The paper by Mariana Mondini, Jorge G. Martínez, Elizabeth Pintar, and M. Carmen Reigadas focuses on hunter-gatherer foraging, mobility and landscape use in Antofagasta de la Sierra, Province of Catamarca, also in the Salt Puna. Through the analysis of multiple lines of evidence, particularly those referring to inferred human–animal interactions and the presence of non-local resources, the paper deals with the influence of environmental changes on organizational aspects such as mobility and exchange at the onset of the Middle Holocene.

Two other papers account for more specific issues in the same Antofagasta de la Sierra area. The one by Jorge A. Funes Coronel and Jorge G. Martínez is on lithic production sequences at an early Mid-Holocene quarry-workshop by the Ilanco river. It informs of a large volcanic rock source there, which according to the products and sub-products of flintknapping episodes on surface and to the stratified archaeological record in the area would have been used since the Early Holocene, especially for the manufacturing of bifaces and lanceolate projectile points.

The contribution by Guillermo A. Arreguez, Jorge G. Martínez and Graciela Ponessa introduces the presence of a wild species of *Amaranthus* within a hunter-gatherer occupation of the initial Mid-Holocene in the area, at Peñas de la Cruz 1.1 site. The presence of these seeds are interpreted, in the context of the South-Central Andes, as suggesting an early handling of wild plant species by these hunter-gatherers, possibly intended for human consumption.

Two other contributions deal with case studies located at the eastern and southern margins of the Puna plateau, respectively. The one by Jorge G. Martínez, Eduardo P. Mauri, Cecilia Mercuri, Mario A. Caria, and Nurit Oliszewski focuses on a Middle Holocene human occupation at site Taller Puesto Viejo 1 in Quebrada de Los Corrales, a high altitude ravine in Tucumán Province. This occupation is interpreted as corresponding to a residential base. Its significance relates to the scarce human occupations of this age identified so far in the lower NW Argentina areas, and potential connections with highland Puna inhabitants are discussed.

At the southern end of NW Argentina, in the Andes of San Juan Province, a high-altitude Early and Middle Holocene occupation is reported at ARQ-18 site by Silvina Castro, Alejandra Gasco, Gustavo Lucero, Valeria Cortegoso, and Víctor Durán. Lithic and faunal analyses were made in the two Mid-Holocene components that suggest changes in subsistence and technological strategies at this seasonally available site. Based on some large camelid bones, the development of transhumant herding is inferred as early as 5100 to 4300 BP.

Generally, these contributions allow framing a general picture of the environments in this important section of the Andean landscape during the arid Middle Holocene, and especially of the human populations in them and their strategies to cope with these settings. As seen above, some contributions have focused on the changes occurring right after the Early Holocene, while others consider those occurring in the transition to the Late Holocene. Relevant problems concerning these issues are addressed across the papers, such as how environmental instability and fragmentation impacted on human demography and social organization, and the intensification of human–camelid interactions that eventually led to domestication.

Among the most general contributions, it is worth noting that the periods proposed in Yacobaccio's paper – which consider the main cultural characteristics of hunter-gatherer populations in the Puna along with the changing environmental settings throughout the Early and Middle Holocene – roughly coincide with the traditional cultural divisions of the so-called Archaic period, i.e., the Early, Middle and Late Archaic (Núñez, 1983; Núñez and Santoro, 1988; Santoro, 1989; Aschero, 1994; Aldenderfer, 1998; among others). The main value of Yacobaccio's contribution is that he adds an explicit explanatory framework to this organization of empirical evidence and the inferred processes accounting for them, as did some of these other authors (also see Nielsen, 1995; Muscio, 1999; Muscio and López, 2011), in this case from the theoretical viewpoint of human ecology. Other papers in the volume also explicitly address models from a specific theoretical framework, as is the case in the paper by López and co-authors, who draw from evolutionary ecology. Generally, most papers here frame their research within the family of ecology models. However, natural/environmental/extrinsic and cultural/social/intrinsic factors are proposed in different contributions to have acted variedly in the process, although they are often hard to tell apart, and complex factors involving both strictly anthropic and non-anthropic elements are to be considered.

The environmental settings described by Núñez and collaborators, Tchilinguirian and Morales, and Ratto and co-authors, among other contributors, suggest growingly patchy, less productive, and unstable conditions in both slopes of the Andes during the Middle Holocene. This has undoubtedly produced a profound impact in human demography, mobility, social networks, and other aspects, the consequences of which remain today. In the light of research in the last couple of decades, the concept of "archaeological silence" has been refined to account for the most severe instances of this impact on the western slope of the Andes (Grosjean et al., 2005; Núñez et al., 2013). However, both slopes of the Andes have structurally different properties, largely due to the presence of the extensive Altiplano plateau to the east, which bears the effects of altitude

without such a high habitat fragmentation as on the steeper Pacific slope (Muñoz and Mondini, 2008; Yacobaccio, 2013, and bibliography therein). Also, the Dry Puna to the north-west and the drier Salt Puna to the south-east bear different properties, which has prompted Yacobaccio in his single and co-authored contributions, as well as Ratto and collaborators and others, to suggest different trajectories in human populations in both areas, and interestingly, according to López and co-authors, to consider intermediate interaction areas in-between. Even within these different large areas, as Tchilinguirian and Morales emphasize, complex variations in the Mid-Holocene conditions are beginning to be unraveled with recent research. Generally, as shown throughout this volume, these varying conditions in the South-Central Andes have impinged differentially in Mid-Holocene hunter-gatherers. Another relevant, healthy outcome of all of this research is that interdisciplinary and multi-scale studies are becoming more common, which allow understanding these complexities.

The interactions of humans and animals, especially camelids, which were their staple prey in the region, has been dealt with in detail in both Yacobaccio's and Cartajena's contributions, as well as others throughout the volume. The increasing emphasis in camelids, especially large individuals, is related by both authors to increasing habitat aridization, along with changes in technology and mobility. This can in turn be related to the fact that given that altitude has effects similar to latitude on human populations, and that habitats went drier during the Mid-Holocene, relatively more collector strategies (*sensu* Binford, 1980) would have been favored in the Andean plateau – unlike surrounding areas – (see discussion in Muñoz and Mondini, 2008). In the long term, camelid intensification can be understood within a broader shift from conditions prompting *r*-selection to others where *K*-strategies would have been favored (Muñoz and Mondini, 2008; Mondini et al., 2013).

Cartajena further discusses the role of natural versus anthropic factors upon camelid size changes, and the fact that decreasing size and increasing variability during the Middle Holocene could be related to the domestication process (also see Mengoni and Yacobaccio, 2006; Cartajena et al., 2007; Yacobaccio et al., 2013). Rather than conceiving camelid domestication as a risk-reduction technology under unstable environmental conditions, she tends to favor the idea that socio-cultural factors were of greater relevance in triggering this process, which was part of a more general one of increasing complexity. Such complexity has its roots in the Early Holocene and intensely developed under the Mid-Holocene setting, giving rise to the conditions leading to the fully Formative societies (see Yacobaccio, 2007; Núñez and Santoro, 2011; among others). The interplay between anthropic and environmental factors is key to understanding these processes.

Regarding camelid domestication, it is worth pointing out that should the interpretation put forward by Castro and collaborators regarding the development of a transhumant herding management strategy in the high Andes of San Juan at 5100–4300 BP be further supported, this would be one of the earliest and southernmost instances of such an economy in the South-Central Andes. Elsewhere in the region it has been suggested to be preceded by initial llama (*Lama glama*) domestication within a system of protective herding only sometime between 4400 and 3000 BP and presumably not earlier than 5000 BP (Mengoni and Yacobaccio, 2006; Wheeler, 2012; also see Cartajena, 2013). Establishing a stronger database of faunal remains unambiguously attributed to early domestic llama and of all the other archaeological elements supporting such a transhumant herding economy would help further support this idea in the San Juan area, on which the authors are currently working.

Some other papers in the volume are on the Antofagasta de la Sierra area, in the arid Salt Puna of Catamarca Province in Argentina. Mondini and collaborators deal with a general picture emphasizing occupation intensity, interactions within the biotic community and other human groups as well as organizational aspects of these foraging groups, while Funes Coronel and Martínez and Martínez and co-authors introduce more specific case studies on these issues. This set of papers also helps understanding how deep the social complexity signatures are rooted, including the intensive use of animal and plant resources, and the organizational dimensions allowing the amplification of the home range to include an amazingly large provenience area of resources. This was vital to these foraging societies, considering that Puna environments would not have included all critical resources, such as the canes and woods used in hunting weaponry. These patterns emerged early on, and continued in later times in the region (Aschero and Hocsman, 2011; Olivera, 2012). Aschero (2011) emphasized social mechanisms as fission and fusion of groups with distant social units to understanding the flux of material culture in the region. As discussed in Mondini et al., it is feasible that the former occurred more frequently under less stable local conditions, while the latter become more common during more favorable local conditions, along with decreased mobility.

Regarding the interactions of Puna inhabitants with surrounding populations, the new evidence of hunter-gatherer occupations at least since the Middle Holocene in the NW Argentina valleys out of the Puna introduced by Martínez and collaborators in this volume is compelling, and adds to the few known foraging occupations in these areas, as is the case of Puente del Diablo site in the Calchaquí valleys in Salta Province, dated as far back as the Early Holocene (Lema, 2011).

These are but some instances of the new findings and ideas that have been put forward in this volume concerning the interactions between humans and environments in the Middle Holocene throughout the South-Central Andes, and it is expected that the wide audience of *Quaternary International* readers will enjoy going through them as much as the attendants to the 2011 Córdoba workshop did.

For the future agenda, it would be very productive to continue with the implementation of interdisciplinary and multi-proxy studies at varying spatial and temporal scales to better understand Mid-Holocene environments and human populations in the South-Central Andes. While NW Argentina and N Chile have long been regarded as an integrated region in these studies, further integration of studies and models with the flourishing paleoenvironmental and archaeological studies in areas to the north (e.g., Aldenderfer and Flores Blanco, 2011) would be very healthy.

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Mariana Mondini*
LaZTA, IDACOR CONICET/Museo de Antropología UNC, Av. H. Yrigoyen 174, 5000 Córdoba, Argentina

Universidad de Buenos Aires (FFyL), Puan 480, 1406 Buenos Aires, Argentina

* LaZTA, IDACOR CONICET/Museo de Antropología UNC, Av. H. Yrigoyen 174, 5000 Córdoba, Argentina.
E-mail addresses: mariana.mondini@gmail.com, mmondini@filo.uba.ar

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