Quaternary International 307 (2013) 96–104

Contents lists available at SciVerse ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

Mid-Holocene hunters and herders of southern cordillera, Northwestern Argentina

Silvina Castro*, Alejandra Gasco, Gustavo Lucero, Valeria Cortegoso, Víctor Durán

CONICET-UNCuyo, 5507 Mendoza, Argentina

ARTICLE INFO

Article history:
Available online 29 March 2013

ABSTRACT

This paper explores the characteristics of human occupation in the area near the Argentine-Chilean international boundary, in the Andes cordillera (northwest of San Juan province). Characteristics of human occupation of these high altitude environments and changes in subsistence strategies that occurred during the Middle Holocene are evaluated. The study is based on the analysis of the materials at the site located in a seasonally environment rich in resources. The paper contributes to knowledge of the function and the variability of socio-cultural systems of the past in Andean environments in the southern part of the Northwest Argentina region (NOA). The problem is approached from studies of the organization of lithic technology, and osteometric analysis recovered at the ARQ-18 site. These studies indicate changes in subsistence and technological strategies of human groups that occupied ARQ-18, incorporating herding activities in a chronological range between 5100 and 4300 BP.

1. Introduction

This research is based on the analysis of the material record of a mountain range site with a sequence of human occupation spanning almost the entire Holocene. As in other sites in similar environments, a hiatus of occupation during the middle Holocene was recorded, before and after which a change in subsistence strategies occurred. From the organizational study of the lithic record and osteometric analysis of camelid specimens, changes between strategies of hunter–gatherers and llama herders who seasonally occupied the ARQ-18 site are evaluated.

The study area includes the upper basin of the Las Taguas River and its valley between 29° 10′ and 29° 30′ S (Fig. 1), sector which includes an altitudinal gradient from the cordillera limit (4500–4000 masl) to the nearby eastern valleys (3700 masl). During summer months, this environment provides permanent water, ensuring the maintenance of large meadows and diverse fauna (Teillier, 2005). It also has available lithic raw material of good quality for shaping, and the existence of rock shelters (Cortegoso et al., 2012). This is an environment that occupies a strategic location, located in at the mid-point between the mountain range slopes. This latitude on the western slope is marked by the border between the northern regions of Chile (the semiarid and arid north). On the eastern slope, this portion of San Juan province corresponds to the southern end of the Argentine northwest (NOA), and borders central west Argentina. Therefore, the study of human use of this mountain range sector can be relevant to all these regions.

The ARQ-18 site is located at an altitude of 3761 masl in a small glacial valley which drains into the Las Taguas River. It consists of a group of stone structures and a cave and an eave, and stone walls at the access point. The archaeological work included exploratory pits inside and outside the cave and a systematic excavation of two grids of 1 × 1 m, and 2.50 m deep on the outside of the cave (Cortegoso et al., 2012, in press; Cortegoso, in press). The chronological sequence obtained for the site includes the earliest human occupation of the province of San Juan, and human use that covers practically the entire Holocene (8900–1500 BP). According to the deposit's stratigraphic composition and 18 radiocarbon dates on charcoal and bone samples (conventional and AMS), a chronostratigraphic sequence was developed consisting of five occupational components (Table 1) (Cortegoso et al., 2012, in press; Cortegoso, in press).

Research at this site has allowed for the development of preliminary proposals on the temporal patterns of occupation of the study area. Taking into account the paleoenvironmental data, the chronological sequence, and the archaeological record, it has been proposed that the area could have been explored during the early Holocene (component V: 8900–8000 BP) by hunter-gatherer groups, probably from the western slopes of the Andes

* Corresponding author.
E-mail address: silcastro24@hotmail.com (S. Castro).

1040-6182/$ – see front matter © 2013 Elsevier Ltd and INQUA. All rights reserved.
http://dx.doi.org/10.1016/j.quaint.2013.03.035

Table 1
Chronological delimitation of the components of ARQ-18 (data from Cortegoso et al., 2012).

ARQ-18 components	Radiocarbon dates (BP)
Component I	1540 ± 60
	2, 980 ± 70
Component II	3720 ± 60
Component III	4310 ± 90
	5120 ± 60
Component IV	6690 ± 90
	7300 ± 90
Component V	8070 ± 140
	8, 950 ± 100

(Cortegoso et al., 2012). Corresponding to the Mid-Holocene (component IV: 7300–6700 and III: 5100–4300 BP) and Late Holocene material records (component II: 3700 and I: 2900–1500 BP) to later stages of colonization (Cortegoso et al., 2012).

This paper presents the preliminary results of the lithic analysis and osteometric analysis of camelids bones for the Mid-Holocene: component IV (7300–6700 BP) and component III (5100–4300 BP), defined by the chronostratigraphic analysis (Cortegoso, in press). This temporal division is synthesized in Table 2. There is a chronological range without evidence of human occupation of about 1600 years, between 6700 and 5100 BP (Fig. 2), and in the stratigraphy this includes the bottom of layer V (levels 25 and 26) with a strong decrease in the archaeological material. Similar situations, linked to a period of aridity, have been recorded along the Andes (Zárate et al., 2005). Together with environmental change, there have been significant changes in subsistence strategies, such as the first appearance of camelid husbandry practices.

2. Paleoenvironment and human occupation of the Las Taguas valley

Paleoenvironmental studies conducted in nearby areas (directly dated moraines in the El Encierro valley) indicate that the ice retreat could have occurred between 10,400 and 9300 BP (Zech et al., 2006). Taking into account these data and the dating of the ARQ-18 site, it has been proposed that the Las Taguas valley could have begun to be explored around 9000 BP (Cortegoso et al., 2012). Other paleoenvironmental data available on the Chilean side in areas near the Las Taguas valley indicate that between 7300 and 5000 BP, there could have been a decrease in rainfall in the Andes of Chilean semiarid north (Veit, 1996), the driest period occurring between 7500 and 6000 BP, during which temperature increases have been estimated on the order of 3 C° (Maldonado and Rozas, 2008). Studies in the Negro Francisco Lake suggest arid conditions from 6000 to 3800 BP (Grosjean et al., 1997). Veit (1996) has established three periods with more water availability in the mountains and extreme aridity in the lower areas for the Chilean semiarid north: the first is up to 7300 BP, the second from 5000 to 3700 BP, and the third from 3000 to 1800 BP. Taking into account the correlation between periods of increased aridity on the Chilean side and the occupational components of the ARQ-18 site in mountain range (Table 3), it has been proposed that the summer occupation of the Las Taguas valley could have avoided the risks of the dry season of the western slope.

Table 3
Correlation between occupational components of the archaeological site ARQ-18 and periods of increased aridity in northern lowlands of Chilean semiarid north, and humidity in mountain range.

ARQ-18/Temporal components	Humid periods in mountain range
V: 8900–8000 BP	
IV: 7300–6700 BP	7300: increased humidity in mountain range
III: 5100–4300 BP	5000–3700: increased humidity in mountain range
II: 3700 BP	
I: 2900–1500 BP	3000–1800: increased humidity in mountain range

3. Materials and methods

Study of the process of occupation of the Las Taguas valley and its incorporation into settlement systems which involve larger areas, as well as the subsistence strategies developed by human societies which used this environment, used the biogeographic model of space usage proposed by Borrero (1994–1995). According to this, the occupation of the environment by human groups occurs in three stages: “Exploration”, “Colonization” and “Effective occupation of space” (Borrero, 1994–1995).

Table 2
Stratigraphic description: Middle Holocene at ARQ-18. For a complete description of the stratigraphy, see Cortegoso (in press); for the contexts and laboratory data of the radiocarbon dates, see Cortegoso et al. (2012: Table 2).

Layer (depth)	Level	Description	Component	Radiocarbon years (BP)
IV (45 cm)	16–21	Semicompact, homogenous, reddish loam. Some sectors have carbon spots. 3rd reconditioning feature. Pit with a hearth and an ashy sector, delimited by medium stones with blackened bases.	3rd	4310 ± 90 (Level 24) 5120 ± 60 (Level 18)
V (20 cm)	22–25	Thin layer, dark reddish brown loam with brown, compact lenses.		
VI (40 cm)	26–32	Thick, heterogeneous, reddish layer with carbon concentrations separated by lenses of fine, reddish loam	4th	6690 ± 90 (Level 29) 7300 ± 90 (Level 27)

For the application of the ecological model to the study case, specific archaeological expectations were taken for lithic record proposed by Franco (2004), referring to estimates of resource use and technological characteristics of the lithic sets for each of the stages of occupation of space. According to this proposal, as the colonization of a region moves on and knowledge of the area increases, more efficient exploitation of lithic resources is expected. Among the material expectations, for example, a higher representation of raw materials from more distant sources, and the more formal instruments of resources which have the best quality for shaping, and the development of artifacts related to tasks that involve longer stays and presence of site equipment are expected (Franco, 2004).

Changes present in the lithic assemblages and variation in exploitation systems are related to different types of risk involved in the subsistence systems. Thus, groups depending on the distribution of resources given by nature face a greater subsistence risk than those faced by societies with economic strategies that exercise some control over resources (Torrence, 1989). The technology is used to solve problems in different ways, concerning the

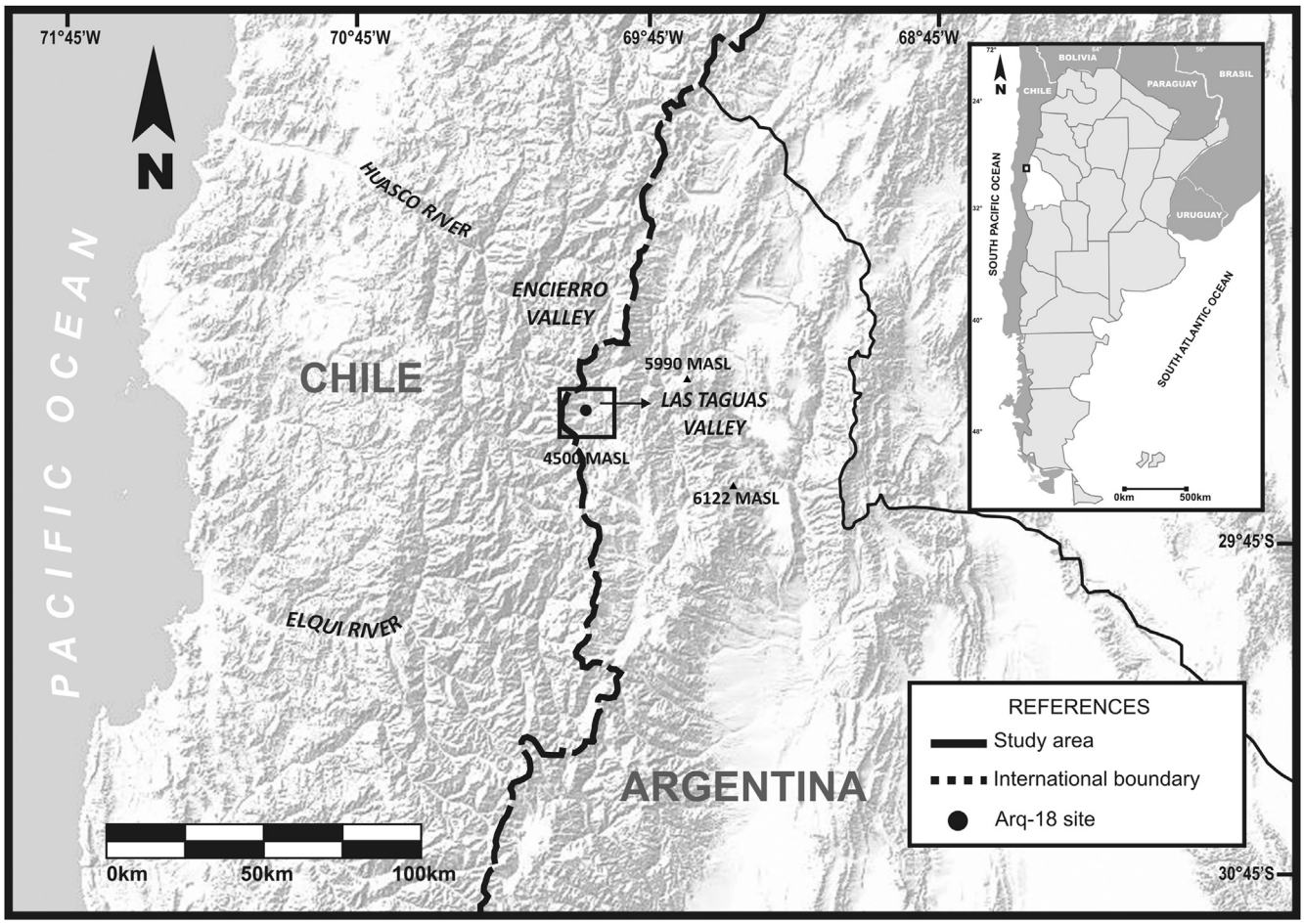

Fig. 1. Study area: Las Taguas valley.

mismatch between resources and their acquisition (Kelly, 1995; Torrence, 1995). Thus, hunter–gathering strategies require reliable technologies with a high labor investment, while producing economies allow less sophisticated artifacts and greater variability (Torrence, 1995).

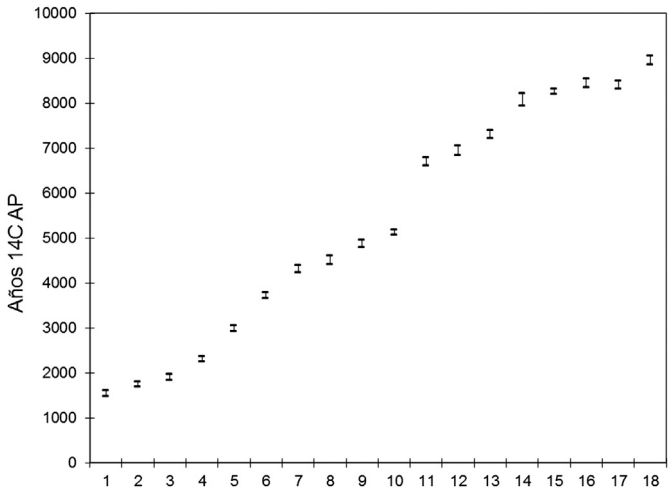

Fig. 2. Numerical dating of archaeological site ARQ-18. A chronological hiatus exists between 5120 ± 60 and 7300 ± 90 BP (data from Cortegoso, in press).

The methodological approach involves technology organization, understood as "the study of selection and integration of strategies for making, using, transporting and discarding the tools and materials needed for their manufacturing and maintenance" (Nelson, 1991; pp. 57). The process of lithic production is understood as part of a system, i.e. as the totality of synchronous activities and sites involved in the use and modification of a specific source of lithic material for the manufacture and use of stone tools in a wider social system (Ericson, 1984). The lithic record was analyzed for morphological and techno-typological attributes (Aschero, 1976–1983; Tixier et al., 1980; Mansur-Franchomme, 1982; Aschero and Hocsman, 2004).

In archaeozoological studies, it is crucial to make taxonomic identifications of bone specimens. This becomes difficult in the case of animal species with similar bone morphology, such as South American camelids. To this end, morphometric differences were studied, especially useful in order to differentiate domestic animals from their wild predecessors (Izeta, 2009, 2010; citations therein; Izeta et al., 2009). A quantitative approach is used, osteometry, which relies on bi-and multivariate analyses. This technique makes possible the discrimination of Camelidae species, based on morphological comparisons to post-cranial elements of modern camelids (Izeta, 2007).

The osteometric analysis uses modern comparative material from the four camelid species. The material used here comes from the continually growing reference collection of the Laboratory of Geoarchaeology, UNCuyo. Currently, the species *Lama guanicoe* is

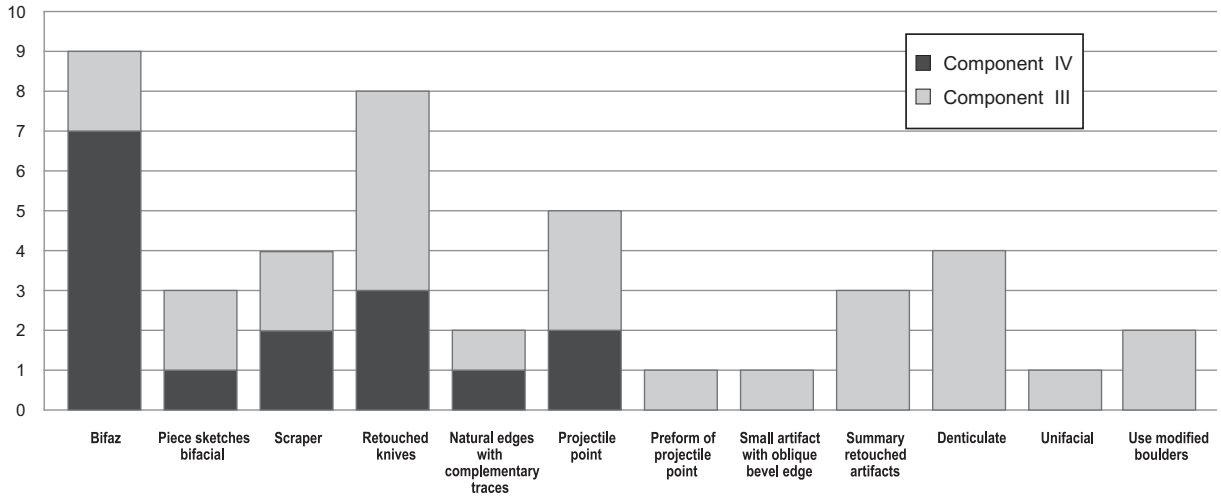

Fig. 3. Variability of artifacts in components IV and III of ARQ-18 site.

represented by elements from more than 50 Andean guanacos from the Argentine provinces of Mendoza, San Juan, and La Rioja; *Lama glama* is represented by elements from three llamas from Bolivia; *Vicugna vicugna* and *Vicugna pacos* are represented by elements from three and two vicuñas and alpacas, respectively, from Bolivia and the Mendoza Zoo (Gasco and Marsh, 2013; Gasco, 2013). The composition and characteristics of this reference material suggest a gradient of camelid size that is more complex than the one currently in use (Mengoni and Yacobaccio, 2006; pp. 232). Considering the metric and geographic variability within each camelid species (González et al., 2006), as well as effects of techniques used in herd management, the gradient is the following, from largest to smallest: castrated or cargo llama, Andean guanaco, llama, alpaca, and vicuña. This gradient is based on the metric evaluation of a reference collection with more than 6000 metric data for guanacos and llamas, created exclusively for use with archaeological specimens in Central Western Argentina (see Gasco, 2013: Chapter 7 for an in-depth discussion). As the study area is distant from Patagonia, the very large Patagonian guanaco is not considered, following Mengoni and Yacobaccio (2006).

The protocols and measurements proposed by Kent (1982) were followed for long bones and Izeta (2001) for short bones. For both the reference and archaeological specimens, all measured bone elements were fused, and had no evidence of being affected by heat, pathology, or weathering ($\leq$4 *sensu* Behrensmeyer, 1978). Continuous variables were measured with a digital caliper to the nearest 0.01 mm. Similarity matrices using Euclidean distance were analyzed with the cluster analysis UPGMA (Unweighted Pair Group Using Arithmetical Averages), resulting in a phenogram for each element or group of elements (Menegaz et al., 1989; Izeta, 2007). Principal Components Analyses (PCA) were also carried out on the same sets of data, based on symmetric matrices of variance and covariance, with the goal of highlighting the greatest differences among the data, and to identify the components that best explain the variance.

The first phalanges were classified as fore or hind, based on morphological features (Kent, 1982; Cartajena, 2009). This step is necessary given the overlap in the measurements of fore and hind first phalanges of different camelid species, and reduces the possibility of incorrect identifications. The faunal specimens in component IV (7300–6700 BP) do not meet the minimum requirements necessary for osteometry, so the only elements addressed here are those identified as Camelidae from component III (5100–4300 BP). Given the small sample size ($N = 27$), the results should be interpreted as tendencies in terms of the representation of different camelid species.

4. Results and discussion

4.1. Lithic and technological records

The lithic record of ARQ-18 site consists of a total of 16,221 pieces. The Early Holocene occupation represents a very low and discontinuous volume in the discarding of lithic items ($N = 2078$) (see Cortegoso et al., 2012, in press). Although the components for the Middle Holocene have the highest density of material ($N = 12{,}110$), which decrease again during the late Holocene ($N = 2033$). The focus is on the lithic record of components IV and III that correspond to the Mid-Holocene.

Component IV (7300–6700 BP), though it is the most limited in terms of time, has the most abundant lithic assemblage of the site ($N = 7075$, 44%). The presence of debitage ($N = 7059$) and tools ($N = 16$) could indicate the making of lithic tools in situ, which appear to have been aimed at the search for blanks to make and shape instruments. Among the debitage, the microdebris and flakes from bifacial thinning are mainly highlighted. The most abundant raw materials are cream color silica of excellent quality for lithic shaping, from secondary sources located in the valley of Las Taguas (Cortegoso et al., 2012).

As for the variability of tools, six general types were recorded (Fig. 3), predominantly bifaces ($N = 7$) (Fig. 4). Bifacial thinning characteristic of these artifacts requires extra investment in their manufacture, which can be correlated with the severity of the risk faced by groups (Torrence, 1989). This type of artifact is characterized as a versatile and portable design, which could be linked to high mobility systems, short stays in one place, and not very diversified subsistence strategies (Binford, 1979; Nelson, 1991; Kuhn, 1992).

Among these tools, two projectile points were registered; one of lanceolate morphology and the other one being triangular (Fig. 4). Both cases have designs similar to those recorded in the micro-region of Antofagasta de la Sierra (Hocsman, 2007; Martínez, 2007) and the province of San Juan (Gambier, 1974) on the Argentine slope and Combarbalá region of Coquimbo, on the Chilean side (Méndez and Jackson, 2008). These pieces are made of translucent yellowish white cryptocrystalline silica. This is a

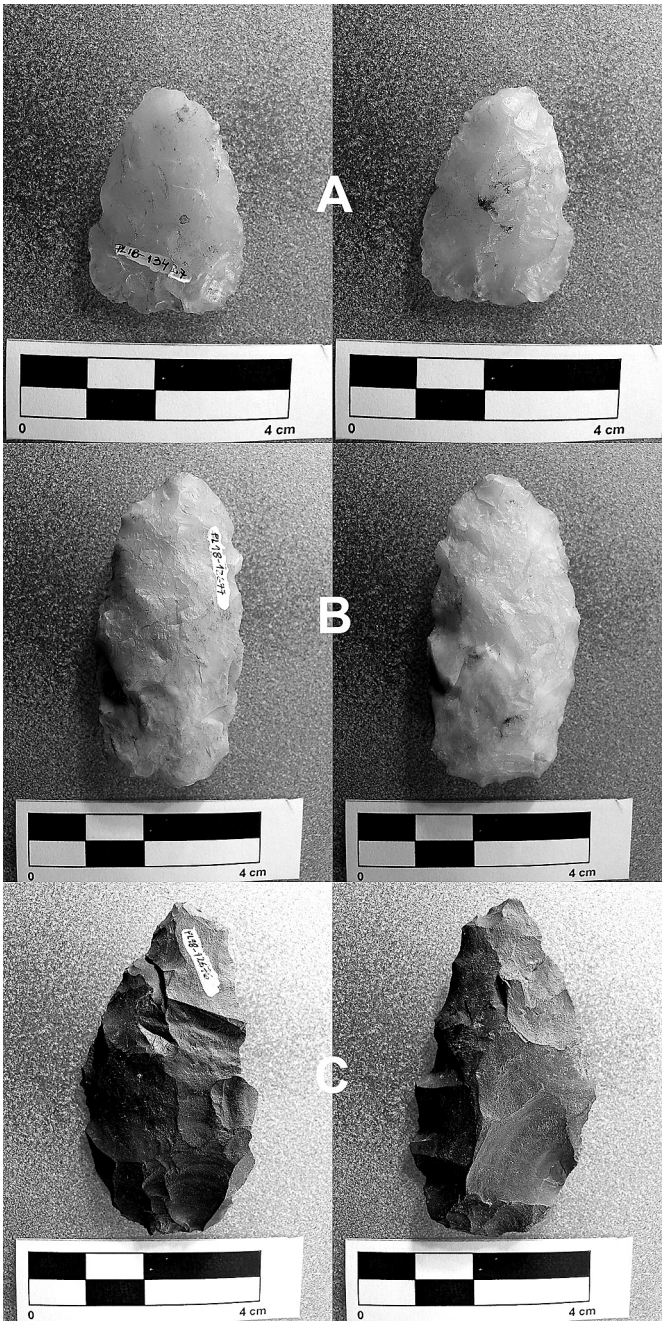

Fig. 4. Lithic tools of component IV: A, B – projectile point, and C – biface.

raw material of exceptional quality for lithic shaping whose origin are uncertain, although this type of resource has been registered in the village of Combarbalá on the Chilean slope (Solar et al., 2010). The rest of the instruments are incomplete pieces bifacial ($N = 1$), scrapers ($N = 2$), retouched knives ($N = 3$) and natural edges with complementary traces ($N = 1$). Such artifacts' purpose may be for activities related to hunting camelids and related practices, such as the butchering of prey and the processing of hides and skins.

The high density of material as well as the efficient exploitation of local resources and the association of likely foreign resources to the manufacture of hunting weapons, suggests an advanced knowledge of the region and a redundancy in the occupation of space. Both features are related to a strengthening of the process of colonization of the area (Franco, 2004).

After an occupational hiatus of 1600 years, similar to the one registered in a large part of the Andean area, linked to the process of aridness (Zárate et al., 2005), at the end of Mid-Holocene archaeological evidence reappears at the site. In Component III (5100–4300 BP) the site shows the beginning of a pattern of conditioning the space, which will continue during the Late Holocene occupations (Cortegoso, in press). This is a large pit surrounded by several rocks that defines an internal space like a pit house. The domestic space contains a wealth of carbon, a product of fires, feces, and a high density of material.

This occupation has a temporal extent similar to the previous component, although it has a less dense lithic record ($N = 5035$, 33%). The sample is composed of debitage ($N = 5009$) and tools ($N = 26$), in both cases local and non-local raw materials were used (Cortegoso et al., 2012).

While shaping activities at the site appear to have decreased, the representation and variability of instruments increased significantly (Fig. 3). There were 11 types of tools, predominating retouched knives ($N = 5$) (Fig. 5) and denticulates ($N = 4$). Regarding projectile points ($N = 3$) (Fig. 5), the presence of small and big triangular pieces is highlighted, also registered for this period at sites in San Juan (Gambier, 1985) and Chile (Méndez et al., 2009). Also represented are bifaces ($N = 2$), bifacial sketch pieces ($N = 2$), scrapers ($N = 2$), natural edge with traces ($N = 1$), preform of projectile point ($N = 1$), small artifact with oblique bevel edge ($N = 1$), unifacial ($N = 1$) and summary retouched artifacts ($N = 3$). Inside the house, there are also two large use-modified boulders with picketing and soot that could be considered site equipment (*sensu* Binford, 1979). Such morphological variability, which indicates a diversification of activities on the site, could be related to the change in mobility patterns of the groups and/or longer stay on the site. In general, a reduction of artifacts bifacial thinning and reduction can be observed. A total of 80% was achieved through non-invasive work, mostly unifacial (*sensu* Aschero and Hocsman, 2004) which implies a tendency to diminish the investment of labor in manufacturing.

There was a large amount of material registered in this pit house, which is associated with combustion features: bone remains, flakes, cores and tools, especially knives and flakes with complementary traces. This, accompanied with the increase in volume and variability of instruments, and the wide range of raw materials represented, could signal a recurrent use strategy and anticipation of the requirements to be met during the stay at the site. Besides these instruments, a bone tool was recovered from this component, similar to those used in textile production (Durán and Cortegoso, 2008).

4.2. Osteometric analysis

Measurements were obtained for 27 archaeological specimens from 11 different elements. Comparisons to modern reference elements resulted in the identification of the species represented by each specimen (Table 4). The phenogram and PCA scatterplot are examples of the analyses carried out for all elements (Figs. 6 and 7). In Fig. 3, two large clusters are apparent, separated by a large similarity distance; one comprises modern *Lama guanicoe* elements, and the other reveals three smaller clusters. One of these includes modern *Lama glama* elements, associated with archaeological specimen ARQ18-B.11832; another of "small camelids" (alpacas and vicuñas) is associated with archaeological specimen ARQ18-B.11610. The PCA scatterplot suggests the same taxonomic associations, in which component 1 explains 91% of the variance. A large scatter of guanaco specimens can be clearly

seen to the right of the vertical axis that represents component 2, whereas vicuña specimens are located on the extreme left, alpaca specimens in the lower left quadrant, and llamas in the upper left quadrant (Fig. 6).

52% are morphometrically linked to modern *Lama guanicoe* elements, 33% to *Lama glama* elements, and 15% to elements from the small camelids, specifically those of *Vicugna vicugna* (Table 4). The presence of *Lama guanicoe* in component III is most

Table 4
Summary of the results, showing the number of comparative specimens, coefficients of correlation for the cluster analyses, and taxonomic assignments of the archaeological specimens (Lg = *Lama guanicoe*; Lgl = *Lama glama*; Vv = *Vicugna vicugna*; Vp = *Vicugna pacos*).

Elements from component III	Archaeological specimens	Comparative specimens	Coefficient of correlation	Lg	Lgl	Vv
First fore phalange, complete	1	42	0.81			1
First fore phalange, proximal portion	1	42	0.82			1
First fore phalange, distal portion	1	42	0.75		1	
First hind phalange, distal portion	2	50	0.76	1	1	
Astragalus	5	16	0.84	4	1	
Carpal 2	1	10	0.83	1		
Accessory Carpal	1	7	0.79	1		
Malleolus	2	10	0.91	2		
Central Tarsal	4	12	0.79	3	1	
Tarsal 3	2	13	0.88		2	
Humerus	2	32	0.84		1	1
Tibia	1	11	0.76	1		
Metacarpal	3	17	0.95	1	1	1
Metatarsal	1	13	0.82	1		

The rest of the elements reveal groupings similar to those described for the humerus, that is, modern reference data clusters into three large groups, with which the archaeological specimens are associated. The coefficient of correlations for each element ranges from 0.75 to 0.95 (Table 4). Based on these analyses, the specimens from component III of ARQ-18 represent two wild and one domestic camelid species. Of the total sample, likely the result of pursuing hunting as a subsistence strategy. Other similar guanaco in components I and II support the continuity of this strategy throughout the occupation (Gasco, 2009, in press). The representation of *Lama glama* can be explained by the development of herd management practices, a transhumant strategy set within a larger system of mobility and use of space, as the site cannot be occupied year round. The use of both

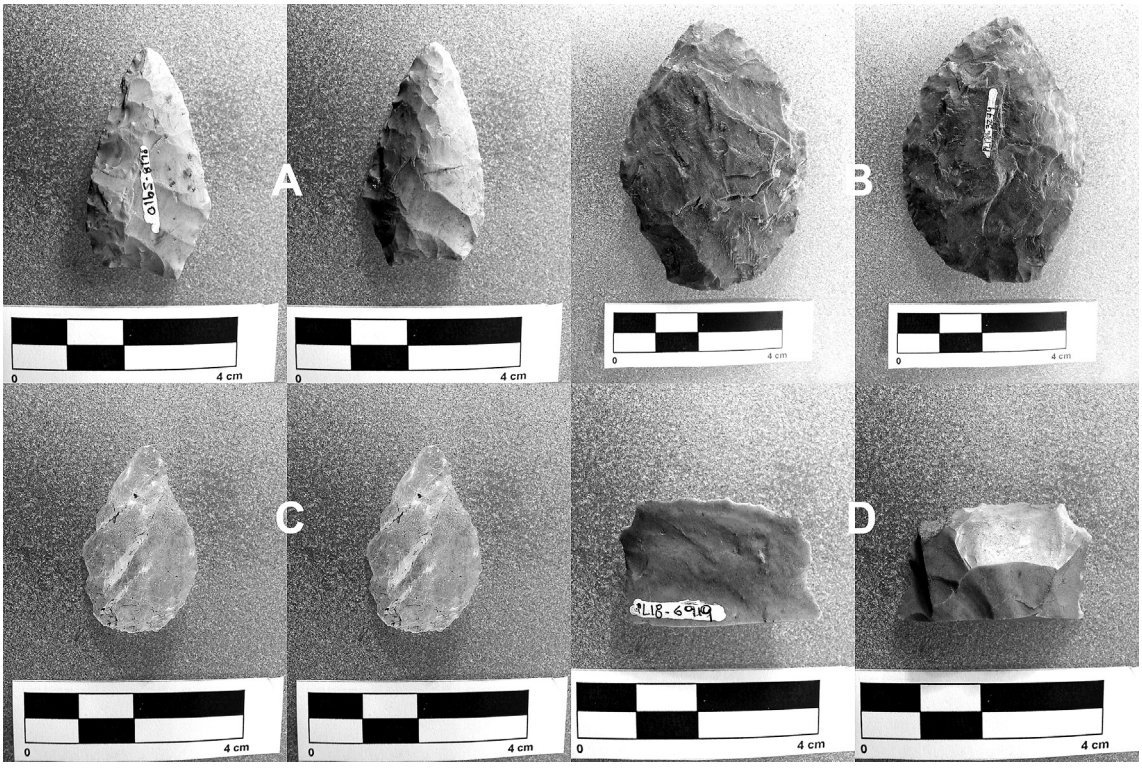

Fig. 5. Lithic tools of component III: A, B, C – projectile point, and D –retouched knives.

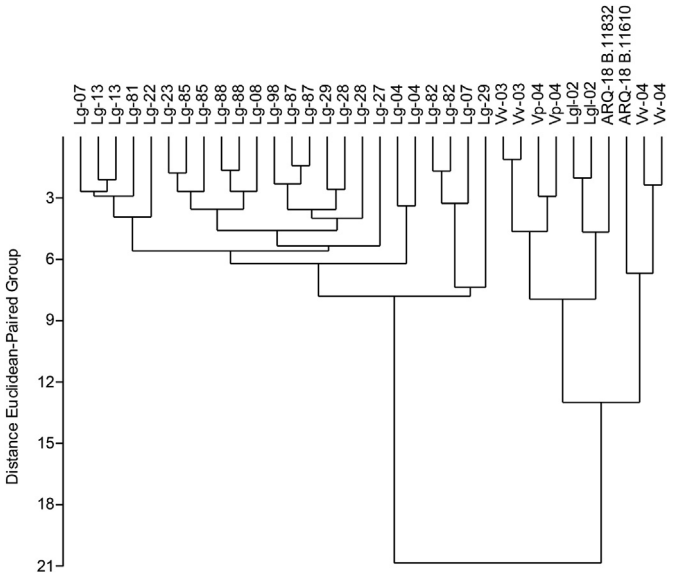

Fig. 6. Phenogram of similarity relationships for the humerus.

species at the site demonstrates the combination of economic strategies adapted by groups who occupied the rock shelter (Yacobaccio, 2001).

For the moment, all the archaeological specimens separated from the "large group" of camelids (*sensu* Wing, 1972) are interpreted as vicuñas. There are several other specimens osteometrically linked to modern vicuñas (Gasco, 2009, in press), and elsewhere in the study area, there is evidence of vicuñas in later periods (Michieli, 1986, 1994) and earlier periods (Nuñez et al., 2006; Cartajena, 2009). In addition, there are currently large populations vicuñas near the site, in the San Guillermo National Reserve. In terms of alpacas, it is necessary to clarify that there are few reference elements from *Vicugna pacos*, but there are no biological studies that suggest the presence of alpacas in the region. However, incisors and fiber, probably from alpacas, have been reported on the western slope of the Andes at Tulan-54 on contexts dated to 3200–2300 AP (Nuñez et al., 2006; Cartajena, 2009), a thousand years after component III. Therefore, in the later components of ARQ-18, specimens assigned to the small group of camelids should be interpreted with caution.

5. Conclusions

The ARQ-18 site is a cave with an eave, located in the Las Taguas River Valley on the Argentine-Chilean border (NW of San Juan Province). The site represents a human occupation spanning almost the entire Holocene (8900–1500 BP). Two of its occupational components are attributable to the Mid-Holocene: components IV (7300–6700 BP) and III (5100–4300 BP). The relevance of this site in the regional context is given by the changes in subsistence strategies observed between both components. The application of osteometric analysis, innovative for the study area, established the exploitation of wild and domestic camelids by groups that inhabited ARQ-18 since component III.

In a high altitude environment, occupation and exploitation are necessarily seasonal. The valley has an interesting variety of biotic and abiotic resources, the large *bofedales* that during the summer months provide a great availability of pasture being highlighted. It is likely that such features have made it attractive for groups from both Andean slopes with different subsistence systems.

The occupation of this environment in the early Mid-Holocene was made by hunter–gatherers with extensive mobility circuits who had already colonized the area, probably from the Chilean side (Cortegoso et al., 2012, in press). The large volume of debitage that makes up this record indicates that the site could have been also used for the knapping of blanks and final shaping of stone tools. The site could have functioned as a seasonally occupied logistical camp for the acquisition of faunal resources (wild camelids).

After this occupation, a 1600 years hiatus is apparent, comparable with situations over the length of the Andes, linked to a period of aridity (Zárate et al., 2005). Under such environmental

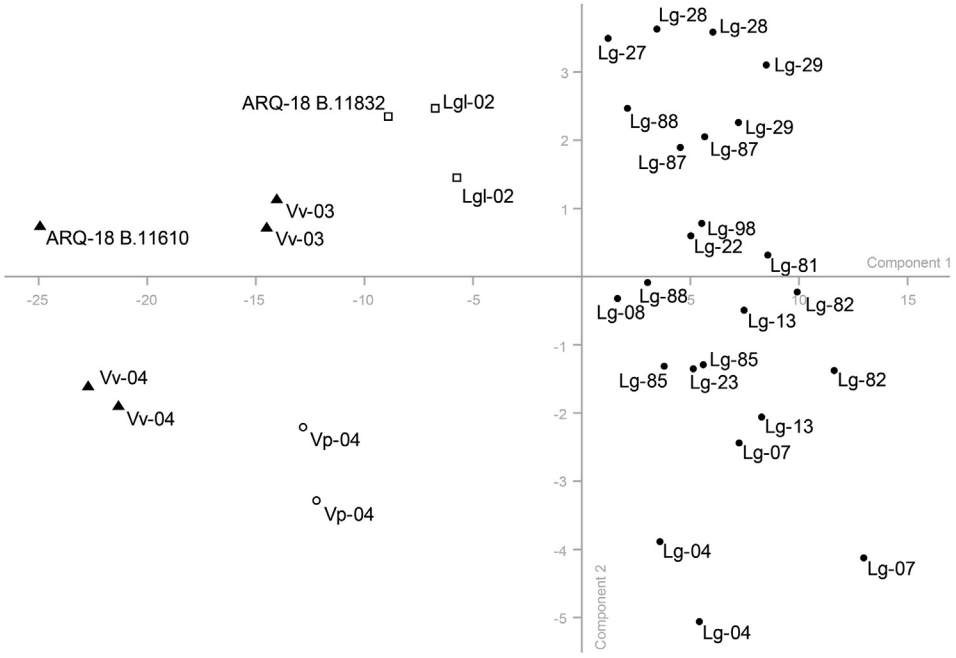

Fig. 7. PCA scatter plot for the humerus.

conditions, access to water resources could have been a priority. The strategies adopted by human groups for the acquisition of such resources are under consideration. Some authors posit the expansion of mobility circuits in relation to the greater distances between water availability environments (Yacobaccio, 2003), while others argue that human occupations tended to be located in ecological refuges or areas of exceptional productivity resulting in reducing the mobility (Núñez et al., 1999). Changes in mobility associated with these phenomena, in Northern Argentina and Chile could be related to the intensification in the use of camelids (Yacobaccio, 2003) and/or the incorporation of pastoral practices (Núñez et al., 1999). It is expected that these changes in subsistence strategies and annual mobility circuits involved groups that exploited the Las Taguas valley. Whichever the answer, these societies dealt with new environmental conditions, and exploitation of the study area after this hiatus was made by groups with different subsistence systems than in previous periods.

After this hiatus, the occupation of ARQ-18 (component III) could be part of a process of recolonization of the area. Osteometric analysis performed on 27 specimens yielded archaeological evidence for two species of wild camelids (guanacos and vicuñas) and demonstrated the presence of a domesticated species (llama). The presence of llamas implies the development of herding at some point between 5100 and 4300 BP. The temporal span of component III is long, and may be improved with additional radiocarbon dates in the future. This chronology is comparable to contemporary data from the NOA region, which includes bones of similar size to modern llamas (Yacobaccio, 2003: Table 1). Transhumance, as a herd management strategy, could characterize the pattern of mobility and use of space by human groups during the summer. The remains of wild camelids, accompanied by lithic weapons, suggests hunting of camelids and other related activities with the subsistence strategies. The exploitation of vicuña may also be linked to the use of its high quality fiber. By adopting herding practices, the subsistence economy could have been diversified (the exploitation of three camelid species), reducing the risk in adverse environmental situations. The adoption of pastoralism as a new economic strategy and as a complement to hunting resulted in control over resources contributed to the reduction of the risk involved in subsistence. This may have acted as a factor in the change toward stone tools with lower production costs, but functionally apt for required activities (Hocsman, 2006). Such technological changes in the micro-region Antofagasta de la Sierra have been recorded between 5500 and 1500 BP (Hocsman, 2006). The decline in bifacial thinning, and reduction in density of lithic material during the end of the mid-Holocene, could be an indicator of this trend in the Las Taguas valley.

This component shows a conditioning pit house type with the presence of site equipment (bonfires and rocks modified by use). This could be linked to a recurrence in the use of the site and an effective occupation of territory, understood as a stabilization phase in which all desirable space is used (Franco, 2004).

The changes evident in subsistence in the end of the Mid-Holocene resulted in observable changes in technology, use of space, and organization of mobility. Housing structures and their maintenance over time, the variability of lithic artifacts and their reduced complexity, are expected in a nomadic mobility pattern. The pastures available during the summer season could be exploited by transhumant herds to maintain the herd. This pattern of mobility is observed even today in the southern valleys where goat herders from the western slope of the ridge, make use of the high pastures during the warm season (Gambier, 1986; Escolar, 2005; Gasco and Giardina, 2008).

These studies involve issues corresponding to the Andean region that are being discussed and addressed in different countries. This is the case of the aridity phenomenon of the Andes during the Mid-Holocene and the way in which it affected human populations during this period. The understanding of human adaptations to high altitude environments is a dynamically developing field in science. The study of the archaeological record of ARQ-18 site, located almost 4000 masl, provides valuable information to this field of general knowledge. Archeozoological and lithic technologies studies make it possible to characterize the strategies implemented by human groups that occupied Las Taguas valley and how they varied over time. The continuation of this research will not only provide important archaeological information for the specific area of Las Taguas valley, which has no previous archaeological background, but will also provide interesting insights for the near areas (such as Central West and Northwest Argentina, and the northern regions of Chile).

Acknowledgements

We acknowledge the Research and Development Program of the Universidad Nacional de Cuyo: Paleoecological perspectives for the study of human–environment relations in the central western Argentina. National Agency for Scientific and Technological Promotion PICT-2006-N° 421, Ministry of Science and Technology, Universidad Nacional de Cuyo 06/G502: Mid and Late Holocene in the Central West Argentina-Analysis of sites Andean archaeological record: changes in subsistence and the technology. CONICET PIP 114-200801-00177: Exploiting Midwestern Andean environments during the Holocene: spatial and temporal variability in the organization of lithic technology. To this special issue's editors, for the invitation to be a part of it.

References

Aschero, C., 1983–1976. Ensayo para una clasificación morfológica de artefactos líticos. Informe a CONICET, Mendoza, Argentina. (MS).
Aschero, C., Hocsman, S., 2004. Revisando cuestiones tipológicas en torno a la clasificación de artefactos bifaciales. In: Acosta, A., Loponte, D., Ramos, M. (Eds.), Temas de Arqueología, Análisis lítico. Sociedad Argentina de Antropología, Buenos Aires, pp. 7–25.
Behrensmeyer, A., 1978. Taphonomic and Ecologic information from bone weathering. Paleobiology 4, 150–162.
Binford, L.R., 1979. Organization and formation processes: looking at curated technologies. Journal of Anthropological Research 35, 255–273.
Borrero, L., 1994-1995. Arqueología de la Patagonia. Palimpsesto 4, 9–69.
Cartajena, I., 2009. Explorando la variabilidad morfométrica del conjunto de camélidos pequeños durante el Arcaico Tardío y el Formativo Temprano en Quebrada Tulán, Norte de Chile. Revista del Museo de Antropología 2, 199–212.
Cortegoso, V. Las Taguas. ARQ-18. estratigrafía, secuencias temporales y ocupaciones humanas. In: Cortegoso, V., Durán, V. (Eds.), Arqueología de ambientes de altura de Mendoza y San Juan (Argentina), in press.
Cortegoso, V., Durán, V., Castro, S., Winocur, D., 2012. Disponibilidad de recursos líticos y explotación humana en la divisoria andina. Valle del río de las Taguas, San Juan, Argentina. Chungara. Revista de Antropología Chilena 44, 59–72.
Cortegoso, V., Durán, V., Castro, S., Gasco, A., Lucero, G., Winocur, D. Human occupation in the north of Argentine-Chilean central Andes during the Early Holocene (San Juan, Argentina). Current Research in the Pleistocene, in press.
Durán, V., Cortegoso, V., 2008. Ocupaciones humanas en la cordillera del norte de San Juan durante el Holoceno: cambios en la subsistencia y la tecnología ósea. In: Resúmenes del I Congreso Nacional de Zooarqueología Argentina, Malargüe, pp. 12.
Escolar, D., 2005. La soberanía en el campo. Poder, etnografía y secreto en los Andes sanjuaninos. In: Wilde, Schamber (Ed.), Historia, poder y discursos. Paradigma indicial, Antropología Socio-cultural, Buenos Aires, pp. 49–76.
Ericson, J.E., 1984. Toward the analysis of lithic production systems. In: Ericson, J.E., Purdy, B. (Eds.), Prehistoric Quarries and Lithic Production. Cambridge University Press, pp. 1–19.
Franco, N.V., 2004. La organización tecnológica y el uso de escalas espaciales amplias. El caso del sur y oeste del Lago Argentino. In: Acosta, A., Loponte, D., Ramos, M. (Eds.), Temas de Arqueología, Análisis lítico. Universidad Nacional de Luján, pp. 101–144.
Gambier, M., 1974. Primitivo poblamiento agrícola prehispánico del valle de Iglesia. Revista Hunuc Huar. Universidad Nacional de San Juan. Instituto de Investigaciones Arqueológicas y Museo, San Juan.
Gambier, M., 1985. La Cultura de Los Morrillos. Instituto de Investigaciones Arqueológicas y Museo. Universidad Nacional de San Juan, San Juan.

Gambier, M., 1986. In: Los valles interandinos o veranadas de la alta cordillera de San Juan y sus ocupantes: los pastores chilenos. Instituto de Investigaciones Arqueológicas de San Juan, Universidad Nacional de San Juan, pp. 1–19.
Gasco, A., 2009. Variabilidad osteométrica de camélidos a lo largo del Holoceno en Las Taguas-ARQ18 (San Juan-Argentina). Poster presented at the 13th Congreso de Antropología Colombia and 1st Encuentro Latinoamericano de Zooarqueología.
Gasco, A. Las Arqueofaunas del Alero ARQ-18 (San Juan, Argentina): Aprovechamiento de Camélidos Silvestres y Domésticos durante el Holoceno medio y tardío. In: Cortegoso, V., Durán, V., (Eds.), Arqueología de ambientes de altura de Mendoza y San Juan (Argentina), in press.
Gasco, A., 2013. Caza y pastoreo de camélidos en la frontera meridional del "mundo" andino. Una aproximación osteométrica. Unpublished PhD disserataion, Universidad Nacional de Córdoba.
Gasco, A., Giardina, M., 2008. Relevamiento de Crianceros. Línea de Base Ambiental y Social. (Informe Antropológico. Proyecto el Pachón, Xstrata Copper. Ms).
Gasco, A., Marsh, E., 2013. Hunting, herding, and caravanning: osteometric identifications of camelid Morphotypes at Khonkho Wankane, Bolivia. International Journal Osteoarchaeological.
González, B.A., Palma, R.E., Zapata, B., Marín, J.C., 2006. Taxonomic and biogeographical status of guanaco Lama guanicoe (Artiodactyla, Camelidae). Mammal Review 36, 157–178.
Grosjean, M., Valero Garcés, B., Geyh, M., Messerli, B., Schotterer, U., Schreier, H., Kelts, K., 1997. Mid-and late-Holocene limnogeology of Laguna del Negro Francisco, Northern Chile, and its palaeoclimatic implications. The Holocene 7, 151–159.
Hocsman, S., 2006. Tecnología lítica en la transición de cazadores recolectores a sociedades agropastoriles en la porción meridional de los Andes Centro Sur. Estudios Atacameños 32, 59–73.
Hocsman, S., 2007. Aportes del sitio Peñas Chicas 1.3 a la arqueología de fines del Holoceno medio de Antofagasta de la Sierra (Catamarca, Argentina). Cazadores-recolectores del cono sur. Revista de Arqueología 2, 167–189.
Izeta, A., 2001. Medidas en carpales y tarsales de Camelidae. Documento interno del Laboratorio. Museo de Antropología, Córdoba. Argentina, p. 2. (MS).
Izeta, A., 2007. Zooarqueología del Sur de los Valles Calchaquíes (Provincia de Tucumán y Catamarca, República Argentina). In: Estudio de Conjuntos Faunísticos del Primer Milenio A.D.. British Archaeological Reports, International Series 1612. Oxford.
Izeta, A., 2009. Dossier: Osteometría de Camélidos Sudamericanos. Revista del Museo de Antropología 2, 125–126.
Izeta, A., 2010. Variabilidad Osteométrica de Camélidos de Sitios Arqueológicos del NOA. In: Gutiérrez, M., De Nigris, M., Fernández, P., Giardina, M., Gil, A., Izeta, A., Neme, G., Yacobaccio, H. (Eds.), Zooarqueología a Principios del Siglo XXI: Aportes Teóricos, Metodológicos y Casos de Estudio. Ediciones del Espinillo, Buenos Aire, pp. 29–38.
Izeta, A., Otaola, C., Gasco, A., 2009. Estándares métricos y variabilidad en falanges proximales de camélidos sudamericanos. Su importancia como conjunto comparativo para interpretaciones en arqueología. Revista del Museo de Antropología 2, 169–180.
Kelly, R.L., 1995. The Foraging Spectrum. Diversity in Hunter–gatherer Lifeways. Smithsonian Institution Press.
Kent, J. 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. Unpublished Ph. D. Dissertation. Washington University. St. Louis, Missouri, USA.
Kuhn, S.L., 1992. On planning and curated technologies in the Middle Paleolithic. Journal of Anthropological Research 48 (3), 185–214.
Maldonado, A., Rozas, E., 2008. Clima y Paleoambiente durante el Cuaternario Tardío en la Región de Atacama. In: Squeo, F.A., Arancio, G., Gutiérrez, J.R. (Eds.), 2008. Libro Rojo de la Flora Nativa y de los Sitios Prioritarios para su Conservación: Región de Atacama, 16. Ediciones Universidad de La Serena, La Serena, Chile, pp. 293–304.
Mansur-Franchomme, M.E., 1982. Huellas de utilización y tecnología lítica: hacia una nueva definición de los criterios de análisis tipológico. (MS).
Martínez, J.G., 2007. Ocupaciones humanas tempranas y tecnología de caza en Antofgasta de la Sierra, Puna Meridional Argentina (10.000–7.000 AP). Cazadores-recolectores del cono sur. Revista de Arqueología 2, 129–150.
Méndez, C., Jackson, D., 2008. La ocupación prehispánica de Combarbalá (Norte Semiárido, Chile): una propuesta sintética. Chungara 40, 107–119.
Méndez, C., Troncoso, A., Jackson, D., Pavlovic, D., 2009. Movilidad y uso del espacio entre cazadores recolectores tardíos en espacios cordilleranos del Norte Semiárido de Chile. Intersecciones en Antropología 10, 311–326.
Menegaz, A., Goin, F.J., Ortiz Jaureguizar, E., 1989. Análisis Morfológico y Morfométrico Multivariado de los Representantes Fósiles y Vivientes del Género Lama (Artiodactyla, Camelidae). Sus Implicancias Sistemáticas, Biogeográficas, Ecológicas y Biocronológicas. Ameghiniana 26, 153–172.
Mengoni, G., Yacobaccio, H., 2006. The domestication of South American camelids: a view from the South-central Andes. In: Zeder, M.A., Bradley, D., Emshwiller, E., Smith, B.D. (Eds.), Documenting Domestication: New Genetic and Archaeological Paradigms. University of California Press, Berkeley, pp. 228–244.
Michieli, C.T., 1986. Textilería de la Cultura Calingasta (San Juan, Argentina). Comunicación preliminar. Chungará 16-17, 377–380.
Michieli, C.T., 1994. Textilería de la Cultura Calingasta. Publicaciones 22, 9–35.
Nelson, M.C., 1991. The study of technological organization. In: Schiffer, M. (Ed.). Archaeological Method and Theory, vol 3. The University of Arizona Press, Tucson, pp. 57–100.
Nuñez, L., Grosjean, M., Cartagena, I., 1999. Un ecorefugio oportunístico en la Puna de Atacama durante eventos áridos del Holoceno Medio. Estudios Atacameños 17, 125–177.
Núñez, L., Cartajena, I., Carrasco, C., de Souza, P., Grosjean, M., 2006. Emergencia de comunidades pastoralistas formativas en el sureste de la Puna de Atacama. Estudios Atacameños 32, 93–117.
Solar, C., Méndez, C., Jackson, D., López, P., 2010. Tecnología Lítica y Áreas de Actividad en un Contexto de Cazadores-Recolectores en el Norte Semiárido de Chile. Revista Chilena de Antropología 22, 57–76.
Teillier, S., 2005. Contribución al conocimiento de la flora y la vegetación de las vegas de la cuenca del río de las Taguas, departamento de Iglesias, San Juan, Argentina. Chloris chilensis, Revista Chilena de Flora y Vegetación Año 8 (2). URL: http://www.chlorischile.cl.
Tixier, J., Inizan, M., Roche, H., 1980. Prehistoire de la Pierre Taillée. I Terminologie et Technologie, Cercle de Echerches et d'Etudes Préhistoriques, Valbonne, France.
Torrence, R., 1989. Tools as optimal solutions. In: Torrence, R. (Ed.), Times, Energy and Stone Tools. Cambridge University Press, Cambridge, pp. 1–6.
Torrence, R., 1995. Strategies for moving on lithic studies. In: Carr, P. (Ed.), The Organization of North American Prehistoric Chipped Stone Tool Technologies. International Monographs in Prehistory. Archaeological Series 7, pp. 123–136.
Veit, H., 1996. Southern Westerlies during the Holocene deduced from geomorphological and pedological studies in the Norte Chico, Northern Chile (27°-33°S). Palaeogeography, Palaeoclimatology, Palaeoecology 123, 107–119.
Wing, E., 1972. Utilization of animal resources in the Peruvian Andes. In: Seiichi, I., Terada, K. (Eds.), Andes 4: Excavations at Kotosh, Peru 1963 and 1964. Tokyo University, Tokyo, pp. 327–351.
Yacobaccio, H.D., 2001. Cazadores Complejos y Domesticación de Camélidos. In: Mengoni, G., Olivera, D., Yacobaccio, H. (Eds.), El uso de los Camélidos a través del Tiempo. Grupo de Zooarqueología de Camélidos. International Council for Archaeozoology y Ediciones del Tridente, Buenos Aires, pp. 261–282.
Yacobaccio, H.D., 2003. Procesos de intensificación y de domesticación de camélidos en los Andes Centro-Sur. In: Memorias del tercer Congreso Mundial sobre Camélidos, Tomo I, pp. 211–216. (Potosí, Bolivia).
Zárate, M., Neme, G., Gil, A., 2005. Mid-holocene paleoenvironments and human occupation in southern South America. Quaternary International 132, 1–5.
Zech, R., Kull, C., Veit, H., 2006. Late Quaternary glacial history in the Encierro valley, northern Chile (29°S), deduced from ^{10}Be surface exposure dating. Palaeogeography, Palaeoclimatology, Palaeoecology 234, 277–286.