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Alero 4 rock shelter, north coast of Deseado estuary (Patagonia, Argentina): Hunter–gatherer mobility strategies during the Late Holocene

Pablo Ambrústolo*, María Laura Ciampagna

CONICET, División Arqueología, Museo de Ciencias Naturales, Universidad Nacional de La Plata, 1900, Argentina

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ABSTRACT

The Alero 4 site is a rock shelter located in the vicinity of the northern edge of the Deseado River in the Santa Cruz province of Patagonia, Argentina. The stratigraphic studies recorded evidence of human occupation assignable to late Holocene. Stone artifacts, bones, malacological and anthracological remains were identified. Based on the study of these items, the features and functionality of this type of site in the context of coastal occupations so far recorded in the lower basin of the Deseado River are discussed, mostly shell middens on coastal dunes. The study of the archaeological record of the Alero 4 site suggests that human hunter–gatherer groups who occupied the lower basin of the Deseado estuary and its vicinity during the late Holocene used rock shelters in a complementary and synchronously manner with the occupations with shell middens on dunes.

1. Introduction

The North Coast of Santa Cruz (NCSC) comprises the territory adjacent to the Atlantic coast of Argentinean Patagonia, located between the border of the provinces of Chubut and Santa Cruz to Laura Bay, to the west encompasses the intermediate zone between the coastline and the central Deseado Massif (Fig. 1b). The archaeological record is mostly on the surface, as isolated finds or as large concentrations of lithic scatters. In the coast, the most common type of sites are shell middens, which are located on coastal dunes. These sites have stratigraphic materials, as bones and malacological remains, and also lithic artifacts of local raw material as red siliceous rock and non-local black obsidian (Ambrústolo, 2011; Ambrústolo et al., 2012a). Studies of the distribution of these sites suggest a use of space associated with the high availability of shellfish beds in certain sectors (Castro et al., 2003; Zubimendi, 2010). The shell middens reflect an intensive use of marine resources on coastal sites, reporting high rates of re-occupation from the mid-Holocene and mainly during the late Holocene (Zubimendi et al., 2005; Ambrústolo, 2011; Castro et al., 2011; Zubimendi, 2012). The latter period records evidence for practice of specialized technologies for hunting of pinnipeds, including stone maces and bone harpoon points (Moreno et al., 2000; Beretta et al., 2013). Different types of human burials are recorded with radiocarbon dates between ca. 3000 and ca. 300 BP (Zilio et al., 2013).

The territory characterized as intermediate (Fig. 1b) shows a low archaeological density. These are mostly lithic surface concentrations of varying extent, recorded mainly in canyons and lagoons, which are interpreted as the product of short occupations (Castro et al., 2003; Zubimendi, 2010).

In recent years, we decided to deepen the studies in this intermediate zone with the aim of evaluating if the rocky outcrops have been used as shelters and/or habitation sites in the past. We have explored if they were part of the home ranges of the coastal hunter–gatherers populations of NCSC, and how they were used.

The study of this particular case of the use of the coast and the intermediate zone could advance knowledge of how hunter–gatherer populations exploited resources heterogeneously distributed in space. At this point in our research we begin with a simple model, but it is analytically useful for other regions in the world, where we can see a clear difference in the distribution of resources. Shellfish and pinnipeds are only found on the coast, while in the intermediate zone it is possible to find raw materials of very good quality for knapping and higher densities of guanaco (*Lama guanicoe*). Undoubtedly, the hunter–gatherer populations employed strategies that implied different home ranges, either to procure the resources of interest through direct procurement and/or exchange networks. In this way, the study of the archaeological

* Corresponding author.
E-mail addresses: pambrustolo@hotmail.com (P. Ambrústolo), mlciampagna@gmail.com (M.L. Ciampagna).

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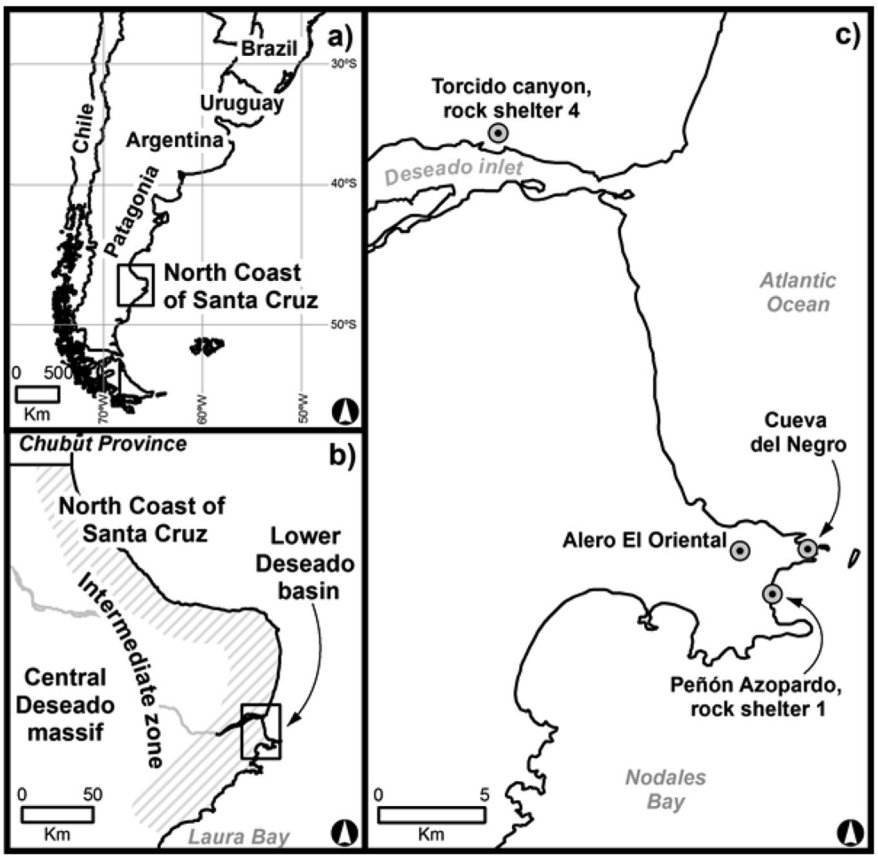

Fig. 1. a) Location of the North Coast of Santa Cruz archaeological area; b) Different zones mentioned in the text; c) Locations of archaeological sites mentioned in the text.

record of the rock shelters located in the intermediate zone (where the existence of other stratigraphic archaeological sites is virtually null, see Zubimendi, 2010) is a valid pathway of analysis to assess the extent of the home ranges of these and other coastal groups.

In the lower Deseado basin and its surroundings (Fig. 1c) we have identified several rock shelters that have provided evidence of human settlements in the past (Ambrústolo, 2011; Ambrústolo et al., 2012b). We began systematic studies to evaluate this possibility and analyse which role they might have had within the settlement and subsistence system of the human groups that occupied the NCSC during the Holocene. We believe these studies will complement the information gathered from the excavation of stratified shell middens on the coast and distributions of lithic artefacts in the intermediate zone. Also, this information will allow us to deepen discussion concerning the mobility ranges of these hunter–gatherer populations in contexts of effective use of space, considering the coastal and the intermediate zone. In both zones, we found rock shelters with evidence of human occupation with radiocarbon dates from Middle and Late Holocene.

The archaeological record in rock shelters of NCSC can be characterized by a succession of several small and discrete hearths with low frequencies of bone and malacological remains and relatively high frequencies of lithic artifacts. These characteristics suggest that the occupational events might have been of relative low intensity. Evidence suggests that the rock shelters have been used as refuges of medium or short duration, and were part of the home ranges of hunter–gatherer populations who occupied the coast for longer periods of time (Ambrústolo et al., 2012b). In this context, the studies in the Alero 4 site will continue to deepen the discussions on the existence of variations in the contexts of occupation and strategies of mobility of the groups that occupied the northern coast of the province of Santa Cruz during the late Holocene.

2. Alero 4 site

The Alero 4 site is near the northern end of the Ría Deseado, 8 km from the Atlantic coast in the northern province of Santa Cruz (Fig. 1). It is a rock shelter formed by porphyritic rocks belonging to

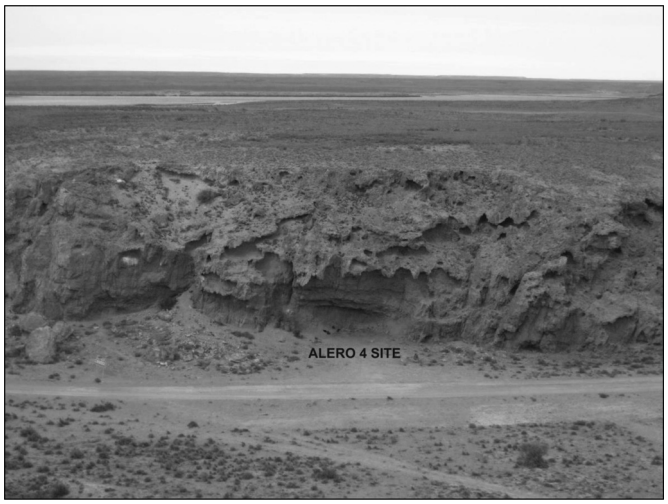

Fig. 2. The Alero 4 site.

Grupo Bahia Laura (Fig. 2) (Giacosa et al., 1998) and is located in one of the banks of Torcido Canyon, which flows into the Deseado estuary.

As the Alero 4 site is located 4 km to the Puerto Deseado city, in some sectors of the site modern anthropogenic disturbances were registered on the surface. The stratigraphic excavation was conducted in an undisturbed area, with one test pit and seven excavation grids. The excavated area was ~2 m^2 (Fig. 3) with a stratigraphic potential of 40 cm. The excavation was carried following artificial levels of 5 cm thick. The site has one cultural component. Lithic artifacts, bone and malacological remains were identified in a matrix ~25 cm thick. In some cases, combustion areas were registered (Fig. 4). Two radiocarbon dates were performed, one on a bone of guanaco with cut marks resulting in a date of 2760 ± 70 BP (LP-2762) and another, in a charcoal combustion area, with a date of 1690 ± 90 BP (LP-2908). The context of occupation is assignable to the late Holocene.

3. Results

3.1. Archaeofaunal remains

Among the archaeofaunal evidence were recovered 230 skeletal remains, 159 (69%) of pinnipeds (*Otaria flavescens*), 48 (21%) of guanacos (*L. guanicoe*), and 23 (10%) of sea birds (Table 1). The pinnipeds sample included 112 determinable specimens (Table 2) and 46 small indeterminable fragments corresponding to diaphysis of long bones and vertebrae. All anatomical parts were represented. The ribs, vertebrae, scapulae, and skull have high frequencies of NISP (Table 2). The MNI is three individuals, two youths, and one adult. Most of the specimens correspond to young individuals (98.2%), whereas only 1.8% represents adult individuals (Table 2). The pieces have a good state of preservation with a low degree of weathering (Mengoni Goñalons, 1999; Borella, 2004). Evidence of anthropogenic consumption include crop marks in V on scapulas and pelvis, as well as flakes on a tibia distal fragment.

Table 1
Faunal remains recorded in the Alero 4 site.

Faunal remains								
Bone elements				N				%
Pinnipeds (*Otaria flavescens*)				159				69
Guanaco (*Lama guanicoe*)				48				21
Sea birds				23				10
Total				**230**				**100**
Pinnipeds (*Otaria flavescens*)								
Anatomical part	NISP	Symmetry			Age range			MNI
		R	L	Undet.	Y	A	Undet.	
Ribs	33	5	7	21	11		22	1
Atlas	1				1			1
Cervical vertebrae	3				3			1
Dorsal vertebrae	3				3			1
Lumbar vertebrae	3				3			1
Sacrum	1				1			1
Coccygeal vertebra	3				3			1
Skull	12				1			1
Incisor teeth	3	2	1		3			1
Canine teeth	10	4	6		10			3
Premolar teeth	8	4	4		8			1
Molar teeth	5	2	3		5			1
Scapula	11	3	2	6	2		9	3

Table 1 (*continued*)

Pinnipeds (*Otaria flavescens*)								
Anatomical part	NISP	Symmetry			Age range			MNI
		R	L	Undet.	Y	A	Undet.	
Pelvis	2	1	1		2			1
Humerus	1	1			1			1
Radio	1	1			1			1
Patella	1		1		1			1
Tibia	1		1		1			1
Calcaneus	2	1	1		1	1		2
Metatarsus 2	1		1		1			1
Metatarsus 5	1		1		1			1
Phalanx 1	1		1		1			1
Sternebrae	1				1			1
Thyrohyoid	3	2	1		2	1		3
Basihioides	1				1			1
Guanaco (*Lama guanicoe*)								
Anatomical part	NISP	Symmetry			Age range			MNI
		R	L	Undet.	Y	A	Undet.	
Ribs	2	1	1		1	1		1
Cervical vertebrae	2						2	1
Skull	1						1	1
Femur	1	1					1	1
Cuboid	1		1			1		1
Navicular	1		1		1			1
Metatarsus	3	2	1		1	1	1	2
Metacarpus	1	1				1		1

Table 2
Pinnipeds (*Otaria flavescens*) remains recorded in the Alero 4 site. References: NISP (Number of Identified Specimens), MNI (Minimum Number of Individuals), Symmetry (R: Right, L: Left, Undet: Undeterminable), Age range (Y: Young, A: Adult, Undet: Undeterminable).

Pinnipeds (*Otaria flavescens*)								
Anatomical part	NISP	Symmetry			Age range			MNI
		R	L	Undet.	Y	A	Undet.	
Ribs	33	5	7	21	11		22	1
Atlas	1				1			1
Cervical vertebrae	3				3			1
Dorsal vertebrae	3				3			1
Lumbar vertebrae	3				3			1
Sacrum	1				1			1
Coccygeal vertebra	3				3			1
Skull	12				1			1
Incisor teeth	3	2	1		3			1
Canine teeth	10	4	6		10			3
Premolar teeth	8	4	4		8			1
Molar teeth	5	2	3		5			1
Scapula	11	3	2	6	2		9	3
Pelvis	2	1	1		2			1
Humerus	1	1			1			1
Radio	1	1			1			1
Patella	1		1		1			1
Tibia	1		1		1			1
Calcaneus	2	1	1		1	1		2
Metatarsus 2	1		1		1			1
Metatarsus 5	1		1		1			1
Phalanx 1	1		1		1			1
Sternebrae	1				1			1
Thyrohyoid	3	2	1		2	1		3
Basihioides	1				1			1

With respect to the bone remains of guanaco (*Lama guanicoe*) ($n = 48$) (Table 3), only 24% of the sample is anatomically determinable. Indeterminate specimens correspond mostly to fragments of shafts of long bones of large individuals. Twenty bone flakes were recorded.

Table 3
Guanaco (*Lama guanicoe*) remains recorded in the Alero 4 site. References: NISP (Number of Identified Specimens), MNI (Minimum Number of Individuals), Symmetry (R: Right, L: Left, Undet: Undeterminable), Age range (Y: Young, A: Adult, Undet: Undeterminable).

Guanaco (*Lama guanicoe*)								
Anatomical part	NISP	Symmetry			Age range			MNI
		R	L	Undet.	Y	A	Undet.	
Ribs	2	1	1		1	1		1
Cervical vertebrae	2						2	1
Skull	1						1	1
Femur	1	1					1	1
Cuboid	1		1			1		1
Navicular	1		1		1			1
Metatarsus	3	2	1		1	1	1	2
Metacarpus	1	1				1		1

In Table 3, the anatomical bony parts of guanaco registered on the site are observed. Most bones correspond to the axial skeleton and the hindquarters. The bones of the autopodium suggest an MNI of two individuals in the sample, a young and an adult (Table 3).

In general, guanaco bones are in good condition, with only one sample having weathering grade two (Mengoni Goñalons, 1999). Evidence of anthropogenic consumption of guanaco is represented by cut marks on V, burnt bones, and cool bone fractures. Other evidence indicating the consumption of these animals includes longitudinal fractures in four metapodiums and helical femur fractures associated with crop marks on V.

An awl made on a metapodium of guanaco (Fig. 5) displays short and deep cut marks on V. The piece was made by scraping and polishing. Evidence of these processes and their use can be observed on all surfaces, particularly at the tip of the part. The specimen is not weathered. This record would suggest that leather processing activities probably would have been carried out in the site.

Among the sea bird remains were skeletal parts of cormorant (*Phalacrocorax* sp.) ($n = 22$) and albatrosses (*Thalassarche melanophris*) ($n = 1$). The NMI of the first suggests the presence of an individual. The elements represented are anatomical parts of the lower limb and wings. The albatross is represented by a sternal rib. The cormorant remains include cut anthropogenic marks as a V on a tibia-tarsus and one femur. All specimens exhibit excellent condition with low degree of weathering.

The archaeofaunal bony record suggests the processing of pinnipeds (*Otaria flavescens*) mainly small juveniles, which would have facilitated transport. Probably, as seen in Table 2, the pinnipeds were transported complete to the site, and could have been processed, like birds, mainly as a food source. Moreover, the high concentration of guanaco (*Lama guanicoe*) (Table 3) compared to coastal shell midden sites (Zubimendi, 2012; Hammond and Zubimendi, 2013) suggests that the location of the site within a network of canyons would favored capturing them. The most productive anatomical parts of the animals entered the site (Table 3), which have been exploited for food and/or economic purposes, such as leather processing and bones for making implements.

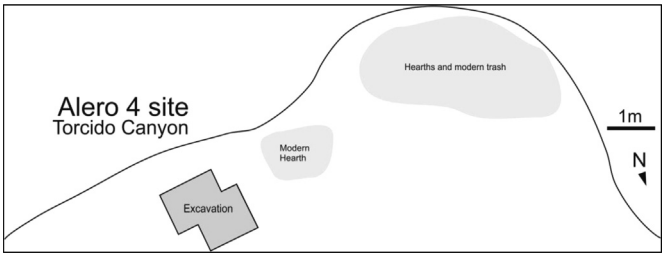

Fig. 3. Spatial characteristics and excavated area in the Alero 4 site.

Fig. 4. Lithic artifacts, bone and malacological remains were identified in a matrix having ca. 25 cm thick.

Mollusc species were identified following the methodology detailed in Hammond and Zubimendi (2013) and Hammond (2013). NISP and MNI values of total mollusc species recovered in the initial test pit of 50 by 50 cm are presented in Table 4. Seven species were recorded, slightly lower than the number recorded in other shell middens sites in NCSC (Zubimnedi and Hammond, 2009; Zubimendi, 2012; Hammond and Zubimendi, 2013; among others). This difference could be related to the proximity of the shell middens to spaces where shellfish are available, littoral sites near the coastline. This is similar to the assemblage identified in a similar context at Alero El Oriental site (Ambrústolo, 2011). Mussels predominate, primarily *Mytilus edulis* and *Aulacomya atra*, with *Perumytilus purpuratus* and the gastropod *Nacella magellanica* in smaller percentages (Table 4). These species are available on the coast of the Deseado estuary (Ringuelet et al., 1962; Otaegui and Zaixso, 1974), near the site (the minimum distance is 700 m). Other species of gastropods including *Crepipatella dilatata*, *Pareuthria plúmbea*, and *Siphonaria lessoni* occurred in low percentages (Table 4). These are generally regarded as bycatch (Orquera and Piana, 1999, 2000), and could have been transported to the site unintentionally during collection of food species of bivalves, such as mussels and clams.

Table 4
Shellfish record. Number of Remains (NR) and Minimum Number of Individuals (MNI).

Molluscs	Alero 4 Site			
Gastropoda	**NR**	**% NR**	**MNI**	**%MNI**
Nacella magellanica	26	5.94%	26	10.03%
Crepipatella dilatata	13	2.97%	13	5%
Pareuthria plumbea	7	1.60%	7	2.70%
Siphonaria lessoni	2	0.45%	2	0.77%
Bivalvia	**NR**	**%NR**	**NMI**	**%NMI**
Mytilus edulis	277	63.38%	150	57.91%
Aulacomya atra	58	13.27%	32	12.35%
Perumytilus purpuratus	54	12.35%	19	7.33%
Richness	7	–	7	–
Total	437	100%	259	100%

3.2. Combustion areas

Combustion areas are considered here in terms of Marconetto (2002, 2005) as "the concentration of remains at a limited area which were produced in a combustion event (ash, charcoal)". Three flat combustion areas (Pérez de Micou, 1991; Ancibor and Pérez de Micou, 2002) were identified in this site (A, B and C), with thickness of ~2 to 1.5 cm. Dimensions of hearth A were 15 by 7 cm. It is associated with lithic artifacts, bones and malacological material. Hearth B consists of a lens of charcoal 14 by 13 cm, associated with a guanaco bone and a lithic scraper. Hearth C, the closest to the mouth of the rock shelter, is the largest one (42 by 23 cm), and has malacological remains. The entire sediment of each of the hearths was recovered together as a unique sample, except for hearth C which extended along grids 6 and 7. One subsample was selected from each charcoal sample by the implementation of richness species curve, although the analysis includes always at least 10% of the total number of charcoals of each sample (Andreoni, 2014). Relative frequency in density values was calculated.

Regarding the spatial distribution of the hearths in Alero 4 site, different authors suggest that the hearths in the rock shelters are usually recorded near the walls, far from the entrance (Frank, 2011; Henry, 2012). From the hearths registered in this site, C is the closest to the drip line and therefore might have received a greater impact of wind, which could have reduced the original size. A high frequency of scattered charcoals was recorded.

The total number of wood charcoal recovered in the hearth A was 257, and the density calculated in terms of number of individuals per liter of sediment was 60.47. The number of wood charcoal pieces analyzed in each hearth as well as the relative density percentage is shown in Table 5. The following genera were identified: *Atriplex*, *Senecio/Baccharis*, *Lycium*, *Berberis* and *Schinus*. The diameter classes registered have a range of 10–14.9 mm to 2–4.9 mm but most of the charcoals are in the classes 2–4.9 and 5–9.9 mm. The subsample analyzed was 27 charcoals. The charcoal relative density is similar for all genera (Table 5). In the analyzed subsample three charcoals (11.11%) with hyphae were identified, *Baccharis/Senecio* ($n = 2$) and *Lycium* ($n = 1$). Six charcoals (22.22%) have cracks, and openings in the radius: *Berberis* ($n = 2$), *Schinus* ($n = 3$) and non-determinable. Only two charcoals (7.40%) showed evidence of vitrification, one identified as *Berberis* and the other undeterminable. The wood used in this hearth can be classified as medium hard and medium heavy (i.e. *Berberis*, *Schinus*, *Atriplex*), soft and light to medium hard (i.e. *Lycium*) and very soft and light (*Senecio/Baccharis*). These taxa, according to informants, produce heat and embers and are durable when combined with wood not producing charcoal. Three samples (37.5%) of *Schinus* have openings in the form of radial cracks. According to experimental work carried out by one of the authors of this paper, these traits suggest that fire would reach a temperature of at least 700 °C (Ciampagna, 2014). If we assume that each hearth is product of one or a few combustion events after cleaning activities, this hearth would be a domestic hearth. The association of the hearth with lithic material with thermal alteration and malacological and bone remains suggest that its functionality would be related

Fig. 5. Awl made on a metapodium of guanaco recovered in the Alero 4 site.

Table 5
Anthracological study. References: *n* (Subsample analyzed).

Taxa	Charcoal relative density (%) in hearths		
	A ($n = 27$)	B ($n = 10$)	C ($n = 120$)
Schinus	29.64	–	46.67
cf.*Schinus*	–	–	9.17
Atriplex	7.41	–	0.83
Baccharis/Senecio	18.9	40	0.33
Berberis	14.82	–	10.83
Discaria	–	–	1.67
Lycium	3.71	–	1.67
Prosopis denudans	–	–	0.83
Nardophyllum/Chuquiraga	–	20	–
Undetermined	25.94	40	25
Total	**100**	**100**	**100**

Fig. 6. Scrapers recovered in the Alero 4 site.

to activities linked to the consumption of marine and terrestrial resources and processing activities.

Hearth B has 61 charcoals and the density is 305 individuals per liter of sediment. Two diameter classes, 5–9.9 and 2–4.9 mm, were observed. A subsample of ten charcoals was taken and the genera *Senecio/Baccharis* and *Nardophyllum/Chuquiraga* were identified. The percentage density indicates that *Senecio/Baccharis* are the taxa with more specimens, together with undeterminable charcoals (Table 5). The latter are small, making taxonomic determination difficult. Vitrification or aperture features were not observed. *Senecio/Baccharis* are soft and light woods, while *Chuquiraga* is a soft to medium hard wood. This latter has been described by informants as a wood that produces abundant smoke (Ciampagna, 2014). The hearth contained a bone of guanaco and one lithic scraper.

Based on the characteristics of hearth B, it would have had a different role than hearth A. Considering the calculated density of charcoal per liter of sediment, hearth B would have constituted an intense combustion event of short duration. The samples recorded in the latter produced a significant fire, so the fire could have been used for lighting and/or the use of smoke in some activity.

Hearth C contained 1194 charcoals, and the density is 478 pieces per liter of sediment. The diameter classes recorded are 20–24.9 and 2–4.9 mm. The latter range is the most represented in the sample. The analyzed subsample is 120 charcoals. This hearth shows the greatest taxonomic diversity. *Schinus*, *Berberis*, *Discaria*, *Atriplex*, *Lycium*, *Senecio/Baccharis* and *Prosopis denudans* were identified. *Schinus* has a higher relative density (Table 5). Five charcoals were recorded with traces of vitrification (4.16%), two identified as *Schinus* and three undeterminable specimens. Concerning the recording of openings, 37 charcoals (30.83%) show evidence in the form of cracks and eyes. Semi-heavy and semi-hard woods are combined (i.e. *P. denudans*, *Schinus*, *Berberis* and *Atriplex*) with other soft/very soft and lightweight woods that have been used start the fire (*Discaria*, *Lycium* and *Senecio/Baccharis*). High density woods predominate, with a high frequency of samples of *Schinus* with openings (37.5%), a feature that is associated with high temperature combustion. The fire would have reached at least 700 °C. This hearth is the largest and consists of woods with high calorific value and durability. The structure could represent a combustion event more intense than in the other cases. The high frequency of scrapers and recorded a bone awl might suggest that one of the functions of the hearth C, plus related food consumption, could be associated with the production of heat for technological activities, such as leather processing (Marchione and Bellelli, 2013).

The anthracological study suggests the selection of different local taxa by hunter gatherers who occupied the site. These taxa have different heating values, and functionalities. The proportions and combinations of woods vary in the hearths. These differences indicate a variation in the activities associated to each hearth, although, based on the archaeological record, those related with consumption and processing of animal resources appear to be most important.

3.3. Lithic artifacts

Following Aschero (1983), a techno-typological study of lithic artifacts recovered was performed. A total of 1946 artifacts were registered, including knapping products (flakes and chunks), tools and cores (Table 6). The siliceous rocks (54.96%) and translucent chalcedony (26.84%) are the most represented raw materials in all typological classes (Table 7).

Table 6
Lithic artifacts recovered in the Alero 4 site.

Typological class	N (%)
Knapping products (flakes and chunks)	1856 (95.42)
Tools	78 (4.01)
Cores	11 (0.57)
Total	**1945**

Table 7
Percentages of raw materials of lithic artifacts recovered in the Alero 4 site.

Raw material (%)	Tools	Cores	Knapping products	Total
Basalt	1.28	–	3.77	3.65
Translucent chalcedony	21.79	18.18	27.10	26.84
Quartzite	–	–	1.62	1.54
Obsidian	3.85	9.09	4.69	4.68
Opal	–	–	0.05	0.05
Porphyry	–	18.18	5.12	4.99
Rhyolite	–	9.09	0.16	0.21
Tuff	–	–	0.65	0.62
Síliceous rocks	70.51	27.27	54.47	54.96
Silicified tuff	1.28	–	2.26	2.21
Silicified wood	1.28	18.18	0.11	0.26
Total	**100**	**100**	**100**	**100**

A total of 4.68% of the lithic pieces are black obsidian (Table 7), a high value compared to the coastal shell midden sites. Cores (9.09%), knapping products (4.69%), and tools (3.85%) were recorded (Table 6). Geochemical studies on samples of obsidian artifacts from the area suggest that the source of origin of the raw material was the Pampa del Asador, ~400 km northwest of the site (Ambrústolo et al., 2012a,b). The record of evidence of initial and intermediate stages of knapping of nonlocal obsidian artifacts, added to the record of artifacts with cortex, indicates that these raw materials were obtained from gravels or cores. This lithology was probably acquired through exchange with inland populations (Ambrústolo et al., 2012a,b). The transport and exchange of nodules in southern Patagonia was suggested by Civalero and Franco (2003)

on the basis of evidence obtained up to 270 km from the source area.

Among the tools, scrapers (Fig. 6) are most frequent ($n = 46$; 59%) (Table 8). This is a tool kit in which the artifacts made for performing processing activities predominate. The artifacts used for extractive activities (cores) are scarce or, in some cases such as projectile points, are not recorded.

Table 8
Lithic tools identified in the Alero 4 site.

Lithic tools	Total
Biface	5
Knife	4
Spokeshave	5
Flake with retouching	18
Scraper	46
Total	**78**

The siliceous rocks (78.26%) were the most selected for making scrapers; followed by translucent chalcedony (19.56%) and only one tool of silicified wood (2.27%). In all cases, rocks are of good and very good quality (Aragón and Franco, 1997). Choosing almost exclusively siliceous rocks and chalcedony to manufacture scrapers is related to the characteristics for knapping of these raw materials. Their resistance to premature dulling of the edges is usually higher than other rocks and constitutes an important variable in the selection (Beck and Jones, 1990). The rocks called "siliceous rocks" include some lithological varieties, primarily related to the color and texture. Most are not local, or at least are not directly available. Some varieties were identified in primary sources located south of Deseado estuary, to ~25 km from the site. This is the case for red siliceous rocks of very good quality for knapping (Ambrústolo, 2011).

4. Discussion

A dynamic view of the landscape is important for the discussion of mobility models of hunter–gatherers where space boundaries fluctuate over time (Kelly, 2003). Borrero (1989–1990, 1994–1995) raised a biogeographical model to explain the human peopling of Patagonia using the concepts of exploration, colonization, and effective occupation. A basic assumption in this model is that sites are optimally occupied by the hierarchy of spaces available in each expansion, which is related to productivity of environments (Borrero, 1989–1990).

Following Borrero (1994–1995), we believe that occupations in coastal shell middens and rock shelters corresponding to late Holocene, such as Alero 4, located near the Deseado estuary would have been structured under effective occupation of space, archaeologically defined when all the desirable land is in use (Borrero, 1989–1990). Borrero (1994–1995) postulated that the human groups would develop mechanisms dependent on population density, including population settings, cultural drift, or competition for highly productive territories. He also postulated that archaeologically this stage has a high visibility but low resolution, produced by the overlap of occupations and home ranges (Borrero, 1989–1990). In this context, the Alero 4 site would have worked as a strategic space in the context of expanding the home range of the hunter–gatherers who occupied the coast.

The evidence registered in the site suggests that its functionality was organized around the implementation of activities of consumption and processing of marine and terrestrial resources. These tasks are indicated by the relatively high frequency of remains of molluscs and the bones with anthropic marks. The variability in the proportion and combining of taxa of wood in the hearths with different caloric density suggests some variability in the functionality of each combustion structure. Hearth C would represent an event of longer duration where hardwoods predominate, and it could be related to the manufacture of tools and other technological activities (the high frequency of scrapers suggests leather processing). This record and the identification of one bone awl could indicate that it would be a context in which varied activities were performed. In this sense, the characteristics of hearth A would also be linked to the consumption of food resources.

Similar contexts have been identified mainly in shell middens on coastal dunes. This contrasts with the points made in previous studies in the Alero El Oriental and Peñón Azopardo rock shelters, which present evidence related to events of low-intensive reoccupation during the late Holocene. It was postulated that rock outcrops were structured as shelters of short duration in the daily range of activities of the hunter–gatherers who occupied the coastal sector (Ambrústolo et al., 2012b).

Moreover, in the articulation of the occupations in coastal shell middens and rock shelters during the late Holocene in the lower basin of the Deseado River, it is interesting to note the registration in Alero 4 not only of evidence of exploitation of marine resources, but also terrestrial. The location of the site within a network of canyons would have favored use of a variety of resources. The site is relatively close to the Atlantic coast and the Deseado estuary and its location would be strategic for hunting, consumption, and procurement of terrestrial and marine fauna.

The site could be considered as a space occupied within the ranges of mobility of the hunter gatherers who occupied the coast during the late Holocene. Whereas the coast recorded a high density of shell middens, reflecting an intensive exploitation of marine resources available there (Castro et al., 2003; Zubimnedi and Hammond, 2009; Zubimendi, 2010), sites such as Alero 4, located in rocky outcrops in canyons away from the coast, they could have been used in the context of the implementation of mobility strategies for obtaining resources not available in the coast. In this sense, Murdock (1969) argues that although in the fishing societies the home ranges are relatively small, the studies do not suggest sedentarism or reduced mobility. These are groups that move less than other hunter–gatherer societies, but more than most agricultural groups (Murdock 1969). On the other hand, Kelly (1983, 1995), based on ethnoarchaeological studies, suggests that reliance on aquatic resources is almost always associated with low residential mobility. Binford (2001) complements the work of Kelly (1995) and performed an analysis of mobility and territoriality from the ethnographic point of view, suggesting that both are related to the concept of "intensification", defined as a change or modification in the biotic community exploited by a population for subsistence. The intensification is caused by a decrease in the size of the area available to inhabit and exploit (Binford, 2001). In this sense, Binford (2001) suggests that groups with an emphasis on eating land animals would show a lower degree of intensification, so occupy larger areas annually. Exploitation of aquatic resources would be associated with reduced mobility and an increase in the population (Binford, 2001).

Borrero and Barberena (2006), based on stable isotope studies on human remains, the spatial distribution of marine items inside territory of Patagonia, and archaeofaunal analysis, suggest that coastal hunter–gatherers are groups with home ranges that are relatively small or small compared to other hunter–gatherer societies. They suggest that there is a negative correlation between the intensity of use of marine resources and the scope of the home ranges (Borrero and Barberena, 2006).

Preliminary analysis of Alero 4 suggests that during the late Holocene, the coastal hunter –gatherers who occupied the vicinity of the Deseado estuary used different housing contexts, dunes and

rock shelters, similarly. Probably, the variations that occur are related with distances to the sources of supply of resources, availability of spaces and/or ranges of action, etc. The use of the coastal environment occurred in the context of the implementation of selective strategies by human groups who occupied the area. The availability and accessibility of various marine resources would have constituted relevant variables when choosing settlement locations of these groups, so that they would have been located mainly on the coast, forming shell middens. Late Holocene coastal sites reflecting the intensive exploitation of marine resources have been recorded, such as Albatros (Zubimnedi and Hammond, 2009), La Cantera (Ambrústolo, 2011) and Cueva del Negro (Zubimendi et al., 2011), among others. However, it is important to note that stable isotope studies conducted on collagen and apatite of human skeletal remains from the NCSC suggest mainly mixed diets, with input from marine and terrestrial resources, throughout the late Holocene (Zilio et al., 2014). The archaeological record of Alero 4 suggests that in some cases, at least during the late Holocene, hunter groups who occupied the area would make a complementary and relatively intensive use of rock shelters in respect of coastal occupations. The evidence of reuse of these spaces, such as the hearths of varying intensity and variability of exploited resources, support this trend. This use would be related with functions of connection or structuring of spaces and activities within the range of action of human groups who occupied the coast. The supply and exploitation of non-local or not directly available resources, such as guanacos and obsidian, could be issues to be evaluated in the future about the functionality of the rock shelters in littoral spaces. Yesner (1980) suggests that coastal hunter–gatherers are characterized by the implementation of foraging strategies of "center place" used by semi-sedentary groups and that, based on the ethnographic record, have a higher degree of territoriality than other hunter–gatherer populations. The continuation of stratigraphic studies on this type of site will increase the number of samples from these contexts and complement the information with other lines of analysis.

Elsewhere in the world, coastal areas are interpreted, in distributional sense, as "demographic nodes" (Borrero and Barberena, 2006). In the late Holocene in the Australian continent, Mulvaney and Kamminga (1999) suggest that along the coasts where coastal and marine resources were abundant and accessible, human population density was three to four times greater than it was directly inland. The cases of the Cape York Peninsula in the northeast Cape Otway in southern Victoria, Arnhem Land, and southeastern Queensland can be mentioned (Lourandos, 1997; Mulvaney and Kamminga, 1999; Keen, 2003). However, the isotopic data available shows that land resources were as important as marine resources (Collier and Hobson, 1987). These isotopic results are similar to those of southern Patagonia (Borrero and Barberena, 2006). Southern Africa presents similar situations. On the Tsitsikama coast, at Klasies River and Cape Saint Francis, and on the southern Cape, contacts with the interior were important, with exploitation of marine resources after 6000 BP, with "increasingly smaller and more stationary home ranges" (Sealy and Pfeiffer, 2000; Mitchell, 2002). Stable isotope data indicate the existence of "many [burials] from the coast with signatures implying close on 100 per cent marine diets, as well as a few inland burials with strongly terrestrial signatures" (Mitchell, 2002). Therefore, for regions of Australia and Southern Africa, there is substantial evidence pointing to coastal areas as demographic nodes from which use of the larger surrounding landscape was articulated.

5. Conclusion

The location of the Alero 4 site and the study of the archaeological record suggest that the occupation would have worked as a strategic space in the context of expanding the home range of the hunter gatherers who occupied the coast during the late Holocene. This extension of the range of mobility would have arisen in the context of implementation of sourcing strategies of resources not available on the coast, such as guanacos or lithic raw materials. This could have favored contacts with populations from inside Patagonia.

Advances in the analysis of rock shelters and the territory near the coast will let us expand the understanding of the dynamics of use of the coast, the intermediate zone, and also the Patagonian interior. Existing data for the NCSC can be complemented and integrated with the information from rock shelters, allowing discussions on a broader, more regional and temporal-spatial scale. These studies will allow us to further evaluate the relationship between mobility and strategies of use of space carried on by human populations that inhabited the coast and the interior of Patagonia in the past.

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