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Distributional archaeology in central San Jorge gulf sector (Santa Cruz Province, Patagonia, Argentina)

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ABSTRACT

In this paper, results of archaeological studies conducted in the central San Jorge gulf sector (north coast of Santa Cruz Province, Patagonia, Argentina) are presented. A distributional approach was employed, and a systematic surface sampling in several landscape units were performed, registering all lithic artifacts and other variables that could influence the archaeological visibility. The landscape units identified in this sector were: high plateau, plateau flank, *cañadón* León, temporary lagoons, and coast. The artifactual assemblage recovered is presented, analyzed and discussed in relation to several archaeological expectations derived from the resource availability of the different landscape units. Results are discussed in relation to ways in which these landscape units could have been used by hunter–gatherer populations that inhabited this sector during Late Holocene, considering the differential availability of resources of importance to Patagonian human groups. In this sense, the archaeological expectations were contrasted, with higher densities near the coast and lower densities on inland landscape units. Among the first, the availability of alimentary resources (mainly shellfish, fish and pinniped) would have produced longer residential settlement. Among inland landscape units, some differences were observed, which were related to variation in resources availability, such as fresh water sources and lithic raw materials. In this latter, more variability than anticipated according to the archaeological expectations was detected.

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1. Introduction

The aim of this paper is to bring a general characterization of the archaeological record of central San Jorge gulf in order to understand how the different spaces of this sector, especially the coastal and inland areas, might have been used in the past. This sector lacks a previous systematic archaeological background, and remains a poorly known area, especially the inland territory of the San Jorge gulf area. The information provided will be a significant contribution to the archaeology of this sector, and also will provide new data for discussion of peopling and use of resources in other sectors of coastal Patagonia and inland areas. Finally, we hope to contribute to the discussion related to ways that past human populations faced the variability in resource availability in space.

The central San Jorge gulf sector is part of the North Coast of Santa Cruz Archaeological Project (from now on NCSC), which includes roughly 400 km of coast and the territory that lies approximately 30 km inland (Castro et al., 2003; see Fig. 1). The environmental characteristics are similar to those in the Patagonian plateau (Cabrera, 1976; Cuadra and Oliva, 1996; Soto and Vázquez, 2000; see Zubimendi, 2010 for a more detailed characterization). The climate is arid to semiarid with average temperatures of 17°–4 °C. Rain is concentrated in the winter months with an average of 200 mm yearly. Strong winds blow from the west, generating evaporation and transpiration which results in extreme dryness (Soto and Vázquez, 2000). The terrestrial vegetation belongs to the Andean-Patagonian Province (Cabrera, 1976; Cuadra and Oliva, 1996), characterized by an arbustive-graminous steppe with coirones (*Stipa humilius* and *Stipa speciosa*) interrupted by mata negra bushes (*Verbena tridens*).

The coast of the San Jorge gulf has wide cobble and sandy beaches, mostly related to extensive intertidal surfaces formed by sedimentary rocks (Codignotto, 2000), where lives a rich and important fauna of molluscs (this kind of intertidal community is commonly known as *restingas* by local inhabitants). The most representative marine species include two sea lions species (*Otaria flavescens* and *Artocephalus australis*), mostly concentrated in some reproductive colonies, which are almost all nowadays extinct (Carrara, 1952; Schiavini et al., 1999). Among sea birds, cormorants

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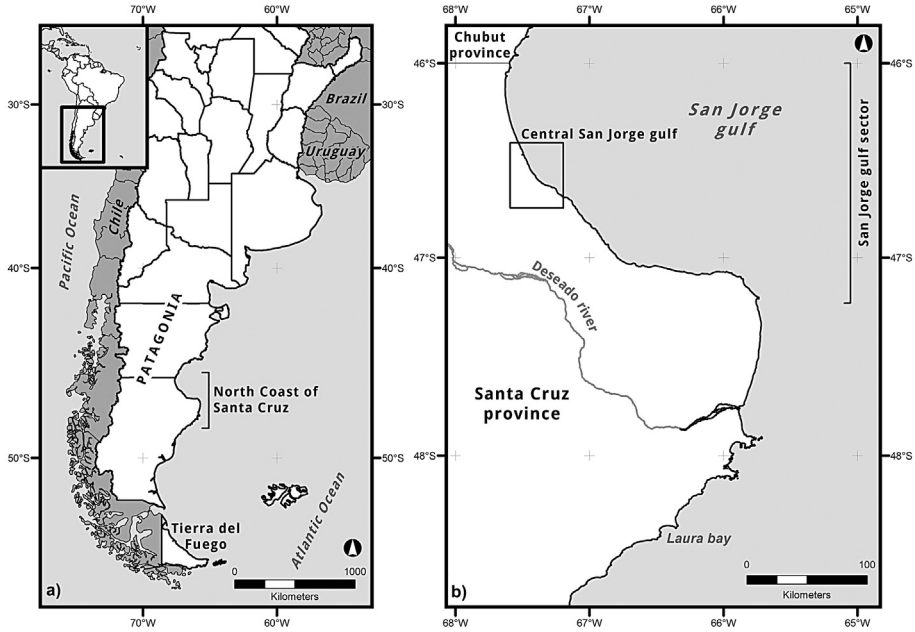

Fig. 1. a) Location of the north coast of Santa Cruz archaeological area, and b) central San Jorge gulf sector.

(*Phalacrocorax* sp.) and Magellanic penguins (*Spheniscus magellanicus*) are the most abundant species. In the *restingas* there are extensive banks of invertebrate species. Among gastropods, limpets (*Nacella magellanica*) are the most common in the archaeological record; and among bivalves the most common are the mussels (*Mytilus edulis* and *Aulacomya atra*). Also, there are large snails belonging to the genera *Adelomelon* (*Adelomelon ferrusacii*, *Adelomelon magellanica*), and in the sandy beaches, clams (*Ameghinomya antiqua*) (Zubimendi et al., 2005; Balech and Ehrlich, 2008; Zubimendi, 2012; Hammond and Zubimendi, 2013). The terrestrial fauna does not differ from those from the inland plateau of central Patagonia. The most common are guanacos (*Lama guanicoe*), mara or patagonic hare (*Dolichotis patagonum*) and choique (*Rhea pennata*), and within the introduced fauna by European populations, can be found sheep (*Ovis orientalis aries*) and European hare (*Lepus capense*).

During investigations in the central San Jorge gulf, a distributional pattern of the archaeological record was identified, which was interpreted as the result of coastal hunter–gatherer groups that exploited the marine resources available on the coast during the Late Holocene (Castro et al., 2003; Zubimendi et al., 2004; Moreno, 2009). This conclusion was reached from the study of coastal sites (mostly shell middens) characterized by an archaeological record rich in marine resources, especially mollusc shells and in a lesser degree pinnipeds and seabird bones, associated with charcoal remains and lithic artifacts. The concentrations of shell middens were associated with the most productive coastal areas (with the presence of colonies of molluscs and pinnipeds). In this sector, different types of human burials have been identified (Castro and Moreno, 2000; Zubimendi et al., 2011; Zilio et al., 2014). The ^{14}C dates reflects only human use during Late Holocene, with a continuous chronological signal since *ca.* 3500 cal AP until *ca.* 300 cal AP (Moreno and Castro, 1995; Castro et al., 2007; Zubimendi, 2010; Zubimendi et al., 2010, 2014a; Zilio et al., 2014).

2. Materials and methods

A systematic sampling was carried out in order to know the structure of the surface archaeological record of central sector of the Gulf San Jorge. We applied a distributional archaeology approach (Ebert, 1992 and also see Borrero et al., 1992; Belardi, 2003; Carballo Marina, 2007; Zubimendi, 2010), which conceives human behavior in its spatial continuity. The archaeological record is perceived as continuous in space, and temporally averaged (Dunnell and Dancey, 1983). One of objectives of these studies is to understand the differential attractiveness of diverse landscape units in relation to their economical availability (Binford, 1975; Borrero and Lanata, 1992). In this approach, it is conceived that the different ways of using the space and its resources will be reflected in the structure of artifactual assemblages (Shott, 1986; Bousman, 1993). There are many processes that affect the integrity of the surface archaeological record (such as density and distribution of remains). These processes vary, among other factors in accordance with the dynamics of the environments in which they are located (Binford, 1975). The minimum unit of analysis is the artifact, which is understood as any object that has an attribute as a result of human activity (Thomas, 1975). In this way, we can recognize the archaeological diversity in a large spatial scale and analyze different variables, such as artifact density, distributional structures, and instrument richness (Belardi, 2003; Carballo Marina, 2007; Zubimendi, 2010).

2.1. Landscape units

The space was differentiated into landscape units prior to fieldwork. These landscape units are analytical tools that were defined using a Geographical Information System (GIS), in which geomorphological units and land cover, landforms and vegetation associations, were analyzed (Ramón Puebla et al., 2009). Also, availability and variability of the regional structure of potential resources of interest to the hunter–gatherer populations were considered.

The landscape units can then be hierarchized according to usage expectations, considering the availability and variability of several resources: freshwater sources, raw materials of good quality for knapping, vegetation, and terrestrial and marine fauna. These variables were used to establish a hierarchy of potential use of landscape units according to the hypothetical expectations derived from broad generalizations about the economic resources which are considered important and fundamental to the Patagonian

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hunter–gatherer populations (Borrero, 2001; Belardi, 2003; Carballo Marina, 2007), especially those who lived on the NCSC during the late Holocene (Castro et al., 2003; Zubimendi et al., 2004).

There are different landscape units in the central San Jorge gulf sector. A high plain plateau of nearly 300 m above sea level, and the plateau flank formed by soft slopes towards the sea (Fig. 2a), are characterized by herbaceous and shrubby plants and guanacos in a medium to low density. Lithic raw materials suitable for knapping are available in low density, but distributed homogeneously in the landscape, so they can be considered higher in relation to other landscape units due to their wide territorial extent (Table 1). It is expected that the archaeological record would present a homogeneous distributional pattern of low to very low lithic density, and evidence of a limited range of activities.

The *cañadones* (Patagonian name for valleys or small canyons which were formed by temporary streams) and temporary lagoons are characterized by a greater availability of fresh water (Fig. 2b and c). In the *cañadones*, the fresh water is found in *mallines* (a Patagonian name for wetlands) which exist generally in the headwaters (Mazzoni and Vazquez, 2004), or trapped on small channels or riverbeds after rains. The *mallines* are flat lands, generally in *cañadones*, and correspond to the more permanent source of fresh water in this part of Patagonia (Mazzoni and Vazquez, 2004). The temporary lagoons have fresh water, mostly in winter months when rains are more abundant (Soto and Vázquez, 2000). Higher densities of guanacos are found in these landscape units, because this species prefers areas with high shrub vegetation, irregular and steep sloping lands, proximity to freshwater, and pathways to escape from predators (Baldi et al., 1997). Along the *cañadones*, there are higher numbers of shrubby and taller plant species, some used for food (like algarrobillo *Prosopis denudans*) or fuel (molle, *Schinus* sp.). In these landscape units, the presence of lithic raw materials suitable for knapping (mainly translucent chalcedony and basalt to a lesser extent) is low, and considering that these are spatially bounded environments, their availability could be considered lower in relation with other landscape units. These characteristics qualify *cañadones* and lagoons as the landscape units with the largest availability of some resources, such as terrestrial fauna, freshwater, and concentrations of useful plants, but not in lithic raw material. Therefore, these would have been the most attractive inland landscape units for human settlement in the past, so a heterogeneous distributional pattern of artifacts, medium densities and higher variability of artifacts are expected, all associated with a redundant, but dispersed, use of space.

Finally, the coast of Lángara bay consists of a pebble beach, followed by an extensive land which is exposed during low tides and where an extensive colony of molluscs exists (Fig. 2d). This bay formerly supported colonies of pinnipeds (Carrara, 1952; Schiavini et al., 1999), so it had a large and a varied range of food resources. The main plant species are medium-sized shrubs which could have been exploited as fuel or for consumption. The availability of lithic raw materials suitable for knapping (mainly translucent chalcedony, and to a lesser extent basalts and rhyolites) is low, and mainly limited to the pebble beaches along the coast (sensu Ambrústolo, 2011). Due to the high offer of food resources (mainly marine shellfish, pinnipeds, and fish), the coast would have had concentrated human settlements, so that higher artifactual densities and variability of artifacts classes could be found, along with homogeneous distributional patterns and evidence of intensive and redundant use (Thomas, 1989; Schlanger, 1992).

2.2. Field survey and description of artifacts

The field survey methodology consisted of systematic transects of 10 m wide by variable length. Each transect was divided into Sampling Units (SU) of 100 m long (covering an area of 1000 m^2). Along the transect, some variables that influences the archaeological visibility were registered, as type of sediment, slope, but mainly vegetation cover; using different categories: excellent (0% vegetation cover); very good (1–25%); good (26–50%); regular (51–75%); and poor or null (76–100%) (Belardi, 2003). All lithic artifacts in each SU were recorded; the artifactual density, distributional pattern and the lithic assemblage structure were analyzed. The lithic density per transect was categorized as follow:1) low density, values between 1.00 E-04 to 9.99 E-04 artifacts per m^2, 2) medium density, between 1.00 E-03 to 5.99 E-03 artifacts per m^2, 3) high-density, 6,00 E-03 to 9.99 E-03 artifacts per m^2, and 4) very high density, more than 0.01 E-02 artifacts per m^2. According to the quantity of artifacts per SU (following proposals of Borrero et al.,

Fig. 2. View of some of the landscape units in central San Jorge gulf sector. References: a) plateau flank; b) middle part of *Cañadón* León; c) Escondida lagoon; and d) coast of Lángara bay.

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Table 1
Variables considered in the hierarchization of landscape units of central San Jorge gulf (see Zubimendi, 2010).

Resources		Plateau	Plateau flank	Cañadón León and Escondida lagoon	Lángara bay
Fresh water		Scarce and homogeneous distribution during the winter	Very scarce and heterogeneous distribution	Scarce and heterogeneous distribution, some permanent lagoons	Absent
Lithic raw materials		Chalcedony of regular quality for knapping, uniform and homogeneous distribution of low density	Chalcedony of regular quality and basalts of bad quality for knapping, homogeneous distribution of medium density	Chalcedony of regular quality for knapping, uniform and homogeneous distribution of media density	Chalcedony of regular quality and basalts of bad quality for knapping, heterogeneous distribution of low density
Vegetables (usefull for hunter–gatherers)		Heterogeneous and disperse distribution of low or very low density	Homogeneous distribution of low and very low density	Heterogeneous distribution of medium to high density along the *cañadón*	Homogeneous and disperse distribution of low density
Fauna	Guanacos	Homogeneous and disperse distribution of low and medium density	Homogeneous and disperse distribution of low and medium density	Homogeneous and disperse distribution of low and medium density	Homogeneous and disperse distribution of low and medium density
	Pinnipeds	–	–	–	Heterogeneous distribution of medium density
	Mollusks	–	–	–	Homogeneous distribution of high density
Ranking of the spatial hierarchy and archaeological expectations		4	3	2	1

1992; Borrero and Nami, 1996; Belardi, 2003), these were classified: 1) without findings, when no lithic artifacts were recorded, 2) isolated finding, when only one lithic artifact were registered in an SU, 3) lithic concentrations, when lithic assemblage have between 2 and 24 artifacts, and 4) sites, when more than 25 artifacts were registered. In each transect, the distributional pattern was analyzed. This variable allows visualization of differences in the continuity and the frequencies of the archaeological record, considering different types of patterns, such as homogeneous or heterogeneous of low or high density.

Lithic artifacts recovered were analyzed in the laboratory, describing several variables: raw material, size, and artifactual typological class (for a more complete description, see Zubimendi, 2010). The different raw materials were differentiated following physical and structural characteristics of the rocks at a macroscopic level (Ambrústolo, 2011). In the case of black obsidian, chemical analyses were performed to determine the source (Ambrústolo et al., 2012). In this paper, the emphasis is placed in quality for knapping and the local or non-local sources. Translucent chalcedonies are the most abundant rock type in this part of Patagonia, which have a good quality for knapping and is locally available in secondary sources (Arrigoni et al., 2008; Zubimendi, 2010). Other local raw materials have regular to poor quality for knapping and are also locally available in secondary sources (andesites, basalts, ignimbrites, rhyolites, tuffs, granites, sedimentary and metamorphic rocks). However, they can be used for the manufacture of certain types of instruments, including mortars, bolas or some end scrapers. Non-local raw materials have a better quality for knapping (dacite, black obsidian, opal and silica). We only know of black obsidians from Pampa del Asador, ~300 km distant (Ambrústolo et al., 2012). Others non-local raw material might came from sources at least 100 km distant from the central San Jorge gulf.

Artifacts were classified into three major artifact classes, following the classification widely used in Patagonian archaeology proposed by Aschero (1975, 1983; Aschero and Hocsman, 2004): 1) debitage debris, among which we consider: a) indeterminate debitage debris; b) external flakes, for those flakes with some degree of cortex, c) internal flakes, those which lack cortex; 2) cores, which are result of the detachment of one or more flakes from a raw material lump; 3) instruments, which are those artifacts that were used to carry out some concrete, manual or ideological activity, either from the intensive modification of an artifact or a simple flake with traces of use.

3. Results

The results of transects performed in the central San Jorge gulf sector are presented in Table 2, with a description of the most important variables analysed. In Fig. 3, transects performed in this sector are shown.

3.1. High plateau transects

In the high plateau, 135 SU were sampled through three transects in different directions. Archaeological visibility is generally good, depending mainly on the vegetation cover, lower where small shrubs are concentrated. Most of the artifacts were recorded as isolated findings (53.8%). In two transects (MA2 and MA3), homogeneous distributional patterns, low artifact density, and high percentages of SU without findings, were observed. The MA1 transect has the highest frequency of artifacts ($n = 39$; 66.1 of the landscape unit) and shows a dispersion of lithics that determines a cluster of various contiguous SU with artifactual remains (see Fig. 4, SU 19–30). In all transects, chalcedonies are the most abundant type of raw material, but in MA1, the basaltic rocks have the highest percentage of all transects of this landscape unit ($n = 12$; 30.8%), most from one lithic concentration at SU 27 ($n = 7$). Regarding the type of artifacts, lithic debitage debris is the most numerous class (86.4%), mostly internal flakes (74.5%). Low percentages of lithic cores and instruments (1.7% and 11.9%, respectively) were registered (see Tables 4 and 5); among the latter, informal instruments are more abundant (retouched flakes).

3.2. Flank plateau transects

A total of 227 SU were sampled in four transects, carried out in two sectors of the flank plateau (see Fig. 5): the first on a plain sector with greater vegetation cover, and the second on a slightly sloping part with fine sediments and low vegetation cover. The archaeological visibility tends to be good, although different situations are observed according to vegetation cover. Most transects shows homogeneous distributional patterns of low density, with a predominance of artifacts found as isolated findings (between 69.6% and 92%; Table 2). The exception of this tendency is the FMP2 transect in which a medium density (1.44E-03 artifacts per m^2) and a heterogeneous distributional pattern were registered (Fig. 5). In this transect, all artifacts came from only two lithic concentrations

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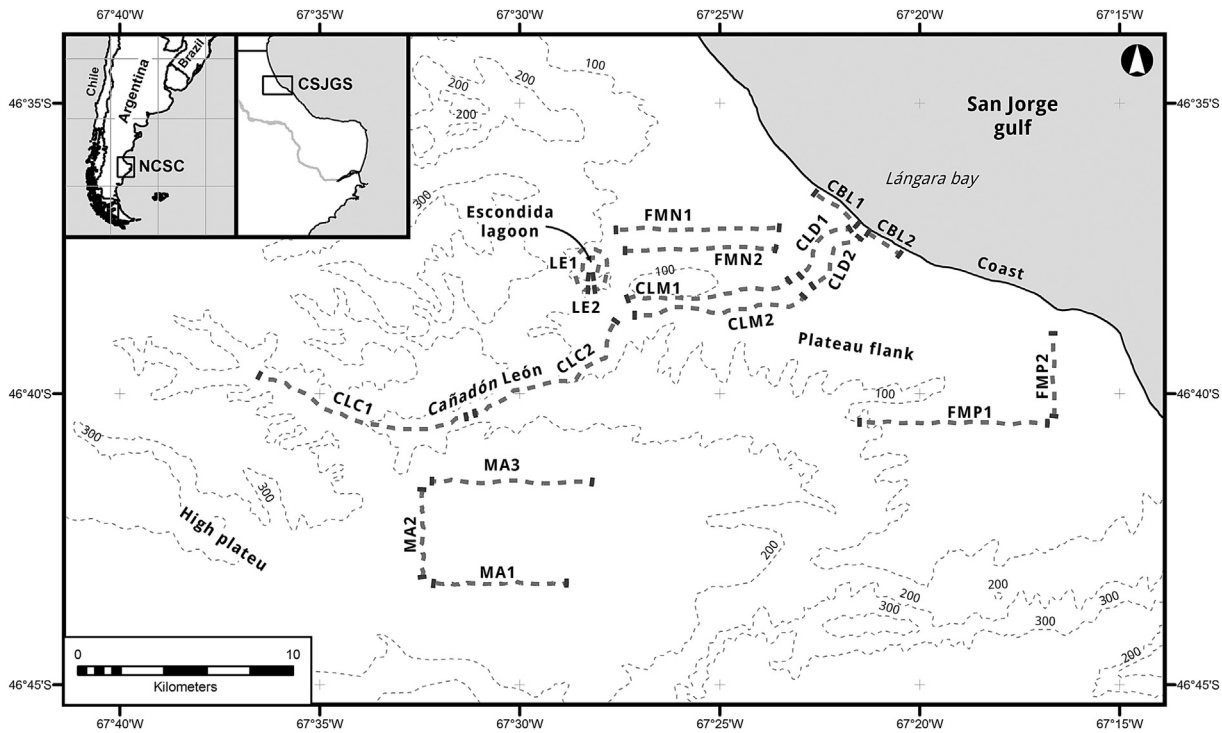

Fig. 3. Location of transect performed in central San Jorge gulf sector.

in the SU 4 ($n = 17$; 47.2%) and SU 6 ($n = 19$; 52.8%). In transect FMP1, SU9, nearly 7 km off the coast, some shells of gastropod *N. magallanica* were registered. Regarding lithic raw materials, two different patterns were observed: transects FMN2 and FMN1 have a strong predominance of chalcedony (more than 91%); transects FMP2 and FMP1 shows a higher heterogeneity of lithic raw materials, especially FMP1, which also have a high percentage of basaltic rocks (34.3%; Table 3). In this landscape unit, debitage debris has the lowest mean percentage of all landscape units (68.9%). Some differences are found in relation to artifactual classes (Table 4): in transects FMN1 and FMN2 a higher proportion of lithic debitage debris was registered (~80%); while in FMP1 and FMP2 high proportions of cores (~25%) and instruments (~12%) were also recorded. In all cases, the proportion of indeterminate debitage debris, and especially external flakes, are relatively low (11.9% as a mean for all transects; Table 5). The presence of instruments was highly variable between the different transects (Table 6), ranging from 6% to 24% of all the artifacts. Different types of instruments, some related to hunting (projectile points and bolas; see Fig. 6a and e respectively), as well as some associated with domestic activities (denticulate, mortar; see Fig. 6d), were found.

3.3. Cañadón León transects

The *cañadón* León was sampled over all its extent by 6 transects in groups of 2, divided into: headwaters, middle plain section or central riverbed part, and final section or *cañadón* mouth, close to Lángara bay. It constitutes the landscape unit with the highest sampled surface (Table 2). The extent of transects varies according to the characteristics of each part. The first two transects (CLC1 and CLC2) were carried out in the headwaters, where an extensive *mallín* is developed, surrounded by steep slopes of the high plateau. The following transects (CLM1 and CLM2) were conducted parallel to the meandering riverbed and run through the plateau flank. The last two transects, near *cañadón* mouth (CLD1 and CLD2), were carried out over an extensive flood plain, with several channels and deep gullies (Fig. 2b).

Archaeological visibility varies across transects: in CLC1 transect the visibility is low and poor due to *mallín*; it increases slightly in CLC2 transect as the herbaceous plants of the *mallín* diminish; the other transects were performed in a sector where the *mallín* has disappeared and the *cañadón* has a meandering shape, with deep gullies. The archaeological visibility in the transects of the middle and mouth part of the *cañadón* mouth is regular, due to a higher vegetation cover of larger shrubs than in the other landscape units, and also varies according to alterations produced by erosion of occasional rains.

Along the *cañadón* León, differences in artifactual densities were observed: very low density in CLC1 and CLM1 transects, medium densities in CLM2 and CLC2, and higher densities at the *cañadón* mouth (CLD1 and CLD2). These differences seem not to be related to archaeological visibility, as there is no correlation between this variable and artifactual density. Most transects present heterogeneous distributional patterns, with some clusters of various SU with large numbers of lithic artifacts. In transect CLM2, SU 50, 56% of all the lithic artifacts ($n = 46$) were found (Fig. 7). The percentage of UMs without findings is highly variable, with lower values in those transects with higher densities of lithic artifacts (Table 2), reflecting a wide distribution of the archaeological record. In most transects, SU with lithic concentrations predominate. Some sites were registered, especially in transects close to the coast, from which were recovered most of the artifacts ($n = 343$; 51.9% of total artifacts found in this landscape unit; Table 2). In some SU ~3 km off the coast, mollusc shells were found associated with lithic artifacts, which reflect the use and transportation inland of this coastal resource. Among lithic raw materials, chalcedonies of good quality for knapping predominates (66.6%), followed by basaltic rocks which are presented in high percentages in some transects (CLC2, CLM1 and mainly CLM2; see Table 3). The variability of raw materials is higher in *cañadón* mouth transects, including some non-

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Table 2
Results of distributional analysis performed in central San Jorge gulf.

Transects		UMs	General visibility	Artifectual frequency	Density	Distributional form	UM				Artifacts		
							Without findings	Isolated finds	Concentrations	Sites	Isolated finds	Concentrations	Sites
High plateau	MA1	46	Regular	39	8.48E-04	Heterogeneous	27 (58.7%)	13 (28.3%)	6 (13%)	–	21 (53.8%)	18 (46.2%)	–
	MA2	32	Good	13	4.06E-04	Homogenous	23 (71.9%)	6 (18.8%)	3 (9.4%)	–	10 (76.9%)	3 (23.1%)	–
	MA3	57	Good	7	1.23E-04	Homogenous	52 (91.2%)	4 (7%)	1 (1.8%)	–	4 (57.1%)	3 (42.9%)	–
	Total	**135**	–	**59**	**4.37E-04**	–	**102 (75.6%)**	**23 (17%)**	**10 (7.4%)**	–	**35 (59.3%)**	**24 (40.7%)**	–
Plateau flank	FMN1	51	Good	17	3.33E-04	Homogenous	43 (84.3%)	5 (9.8%)	3 (5.9%)	–	9 (52.9%)	8 (47.1%)	–
	FMN2	56	Regular	34	6.07E-04	Homogenous	39 (69.6%)	11 (19.6%)	6 (10.7%)	–	13 (38.2%)	21 (61.8%)	–
	FMP1	70	Very good	35	5.00E-04	Homogenous	57 (81.4%)	7 (10%)	6 (8.6%)	–	11 (31.4%)	24 (68.6%)	–
	FMP2	25	Good	36	1.44E-03	Heterogeneous	23 (92%)	–	2 (8%)	–	–	36 (100%)	–
	Total	**202**	–	**122**	**6.04E-04**	–	**162 (80.2%)**	**23 (11.4%)**	**17 (8.4%)**	–	**33 (27%)**	**89 (73%)**	–
Cañadón León	CLC1	83	Poor	68	8.19E-04	Heterogeneous	58 (69.9%)	10 (12%)	15 (18.1%)	–	24 (35.3%)	44 (64.7%)	–
	CLC2	51	Regular	55	1.08E-03	Homogenous	28 (54.9%)	9 (17.6%)	14 (27.5%)	–	24 (43.6%)	31 (56.4%)	–
	CLM1	67	Regular	8	1.19E-04	Homogenous	62 (92.5%)	4 (6%)	1 (1.5%)	–	5 (62.5%)	3 (37.5%)	–
	CLM2	66	Regular	84	1.27E-03	Heterogeneous	52 (78.8%)	8 (12.1%)	5 (7.6%)	1 (1.5%)	8 (9.5%)	30 (35.7%)	46 (54.8%)
	CLD1	38	Regular	212	5.57E-03	Heterogeneous	18 (47.4%)	3 (7.9%)	14 (36.8%)	3 (7.9%)	15 (7.1%)	60 (28.4%)	137 (64.5%)
	CLD2	39	Good	234	6.00E-03	Heterogeneous	22 (56.4%)	3 (7.7%)	11 (28.2%)	3 (7.7%)	7 (3%)	89 (38%)	138 (59%)
	Total	**344**	–	**660**	**1.92E-03**	–	**240 (69.8%)**	**37 (10.8%)**	**60 (17.4%)**	**7 (2%)**	**57 (8.6%)**	**261 (39.5%)**	**343 (51.9%)**
Escondida lagoon	LE1	22	Regular	75	3.41E-03	Heterogeneous	11 (50%)	5 (22.7%)	4 (22.7%)	1 (4.5%)	9 (12%)	20 (26.7%)	46 (61.3%)
	LE2	25	Good	110	4.40E-03	Heterogeneous	10 (40%)	3 (12%)	11 (44%)	1 (4%)	7 (6.4%)	53 (48.2%)	50 (45.5%)
	Total	**47**	–	**185**	**3.94E-03**	–	**21 (44.7%)**	**8 (17%)**	**16 (34%)**	**2 (4%)**	**23 (12.6%)**	**72 (38.9%)**	**90 (48.5%)**
Lángara bay	CBL1	23	Poor	197	8.57E-03	Heterogeneous	11 (47.8%)	1 (4.3%)	9 (39.1%)	2 (8.7%)	5 (2.5%)	68 (34.5%)	124 (62.9%)
	CBL2	13	Regular	234	1.80E-02	Heterogeneous	4 (30.8%)	1 (7.7%)	5 (38.5%)	3 (23.1%)	3 (1.3%)	32 (13.7%)	199 (85%)
	Total	**36**	–	**431**	**1.20E-02**	–	**15 (41.7%)**	**2 (5.6%)**	**14 (38.9%)**	**5 (13.9%)**	**8 (1.9%)**	**100 (23.2%)**	**323 (74.9%)**
Total		**764**	–	**1457**	**1.90E-03**	–	**540 (70.7%)**	**93 (12.2%)**	**117 (15.3%)**	**14 (1.8%)**	**175 (12%)**	**543 (37.3%)**	**739 (50.8%)**

local rocks of very good to excellent quality for knapping (black obsidian, silicas, and dacites). In the middle riverbed transects, chalcedonies and basalts represent 95%–100% of the total artifacts, and a lower variability of raw materials were found. Regarding the artifactual classes, in all transects a predominance of lithic debitage was found (80%). In transects of the central part of the *cañadón*, and to a lesser extent in the mouth, the proportions of external flakes are higher (19%–50%). External flakes in *cañadón* León have the highest mean value of all landscape units (22.1%). The cores are relatively abundant in all transects, while instruments were recovered in different proportions, varying between 26.5% and 3%. Instruments shows higher values in transects CLC1 and CLD1

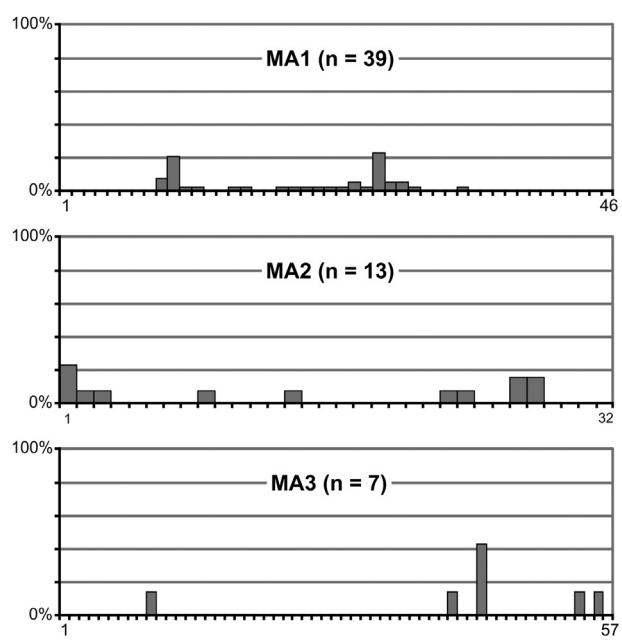

Fig. 4. Distributional forms of transects performed in high plateau of the central San Jorge gulf. The *X* axis corresponds to the SU, and the *Y* axis corresponds to percentage of total lithic artifacts registered in transects.

(n = 18 and 21 respectively). Some are associated with domestic activities (end scrapers, knifes) and knapping activities (hammers or bifacial preforms). A small lithic bead of malachite was found in transect CLD1. The closest sources of this raw material are located in northern Patagonia (Neuquén and La Pampa provinces), 800 km distant (Angelelli et al., 1983).

3.4. Escondida lagoon transects

The Escondida lagoon, located on the plateau flank approximately 5 km from the Atlantic coast, was sampled with two parallel transects of similar length. These transects showed heterogeneous distributional patterns and medium values of artifactual densities (a mean value of 3.94E-03 artifacts per m^2), similar percentages of SU without findings (44.7%), isolated findings (17%) and sites (4%). The outer transect has a higher percentage of SU with lithic concentrations (n = 11; 44%). Despite the low percentage of SU with sites (4%), most of the lithic artifacts (n = 90; 48.5%) were recovered in these SU (Table 2 and Fig. 8). Artifact density seems to be correlated to archaeological visibility. A high richness of lithic raw materials is observed (Table 3), the most abundant types of rocks (basalts in transect LE1 and chalcedonies in LE2) represent ~ 80% of the total artifacts, a lower proportion than in other transects of the landscape units. The presence of various non-local raw materials of good to excellent quality for knapping (dacite, black obsidian, opal and silica; an internal flake of silex in Fig. 6f) was recorded. The artifact classes show a high proportion of debitage debris (80%; Table 4), mainly internal flakes (73.6%). Both transect have the lowest percentage, of all the landscape units, of indeterminate knapping debris (6.8%; Table 5). Cores and instruments were registered in low proportions in both transects (with a mean value of 9.7% and 10.3% respectively). There is a low instrumental richness, with a predominance of knifes and end scrapers (Table 6).

3.5. Lángara bay transects

On the coast of Lángara bay, two short transects were measured (Table 2), both approximately 100 m parallel to the shoreline, over a

Table 3
Lithic raw materials identified in the distributional analysis performed in central San Jorge gulf. References: *in this category have been grouped other rocks of bad to regular quality:granitic, metamorphic and sedimentary rocks.

Transects		Andesite	Basalt	Chalcedony	Dacite	Ignimbrite	Malachite	Obsidian	Opal	Rhyolite	Silex	Tuff	Other rocks*	Total
High plateau	MA1	–	12 (30.8%)	25 (64.1%)	1 (2.6%)	–	–	–	–	–	1 (2.6%)	–	–	**39**
	MA2	–	2 (15.4%)	10 (76.9%)	–	–	–	–	1 (7.7%)	–	–	–	–	**13**
	MA3	–	1 (14.3%)	5 (71.4%)	1 (14.3%)	–	–	–	–	–	–	–	–	**7**
	Total	–	**15 (25.4%)**	**40 (67.8%)**	**2 (3.4%)**	–	–	–	**1 (1.7%)**	–	**1 (1.7%)**	–	–	**59**
Plateau flank	FMN1	–	1 (5.9%)	16 (94.1%)	–	–	–	–	–	–	–	–	–	**17**
	FMN2	–	2 (5.9%)	31 (91.2%)	1 (2.9%)	–	–	–	–	–	–	–	–	**34**
	FMP1	1 (2.9%)	12 (34.3%)	16 (45.7%)	–	–	–	1 (2.9%)	–	–	4 (11.4%)	–	1 (2.9%)	**35**
	FMP2	–	4 (11.1%)	28 (77.8%)	–	–	–	–	–	1 (2.8%)	3 (8.3%)	–	–	**36**
	Total	**1 (0.8%)**	**19 (15.6%)**	**91 (74.6%)**	**1 (0.8%)**	–	–	**1 (0.8%)**	–	**1 (0.8%)**	**7 (5.7%)**	–	**1 (0.8%)**	**122**
*Cañadón*León	CLC1	–	7 (10.3%)	51 (75%)	–	–	–	–	2 (2.9%)	2 (2.9%)	6 (8.8%)	–	–	**68**
	CLC2	–	20 (36.4%)	31 (56.4%)	–	–	–	2 (3.6%)	–	1 (1.8%)	1 (1.8%)	–	–	**55**
	CLM1	–	3 (37.5%)	5 (62.5%)	–	–	–	–	–	–	–	–	–	**8**
	CLM2	–	58 (69%)	21 (25%)	–	–	–	2 (2.4%)	–	3 (3.6%)	–	–	–	**84**
	CLD1	–	30 (14.2%)	154 (72.6%)	9 (4.2%)	4 (1.9%)	1 (0.5%)	1 (0.5%)	2 (0.9%)	4 (1.9%)	6 (2.8%)	–	1 (0.5%)	**212**
	CLD2	1 (0.4%)	32 (13.7%)	178 (76.1%)	–	–	–	2 (0.9%)	–	17 (7.3%)	4 (1.7%)	–	–	**234**
	Total	**1 (0.2%)**	**150 (22.7%)**	**439(66.6%)**	**9 (1.4%)**	**4 (0.6%)**	**1 (0.2)**	**7 (1.1%)**	**4 (0.6%)**	**27 (4.1%)**	**17 (2.6%)**	–	**1 (0.2%)**	**660**
Escondida lagoon	LE1	–	32 (42.7%)	26 (34.7%)	6 (8%)	1 (1.3%)	–	–	–	3 (4%)	5 (6.7%)	2 (2.7%)	–	**75**
	LE2	–	23 (20.9%)	68 (61.8%)	7 (6.4%)	1 (0.9%)	–	2 (1.8%)	1 (0.9%)	2 (1.8%)	5 (4.5%)	1 (0.9%)	–	**110**
	Total	–	**55 (29.7%)**	**94 (50.8%)**	**13 (7%)**	**2 (1.1%)**	–	**2 (1.1%)**	**1 (0.5%)**	**5 (2.7%)**	**10 (5.4%)**	**3 (1.6%)**	–	**185**
Lángara bay	CBL1	–	78 (39.6%)	101 (51.3%)	1 (0.5%)	–	–	1 (0.5%)	–	8 (4.1%)	7 (3.6%)	–	1 (0.5%)	**197**
	CBL2	–	47 (20.1%)	113 (48.3%)	1 (0.4%)	–	–	2 (0.9%)	2 (0.9%)	53 (22.6%)	16 (6.8%)	–	–	**234**
	Total	–	**125 (29%)**	**214 (49.7%)**	**2 (0.5%)**	–	–	**3 (0.7%)**	**2 (0.5%)**	**61 (14.2%)**	**22 (5.3%)**	–	**1 (0.2%)**	**431**
Total		**2 (0,1%)**	**364 (25%)**	**879 (60.3%)**	**27 (1.9%)**	**6 (0.4%)**	**1 (0.1%)**	**13 (0.9%)**	**8 (0.5%)**	**94 (6.4%)**	**58 (4%)**	**3 (0.2%)**	**3 (0.2%)**	**1458**

paleo-cliff formed after the middle-Holocene transgressive maximum (Pedoja et al., 2010). This transects were not carried out near the current beach, as it was greatly modified and altered by recent anthropic action (Zubimendi et al., in press). In both transects, the archaeological visibility could be considered poor due to intense human disturbance, mainly by unpaved roads and city trash, which favor an intense removal of sediment by the strong winds of this region. Despite the poor visibility, these transects have the higher artifactual densities of the central San Jorge gulf sector, and also shown heterogeneous distributional pattern. There are some differences: in CBL1 almost all of the lithic pieces ($n = 96$; 48.7%) come from SU 2; while in CBL2, various concentrations and sites with numerous artifacts were recorded (Fig. 8). In comparison with other landscape units of the sector, the lowest percentages of SU without findings (41.7%), the highest proportion of SU with lithic concentrations and sites (38.9% and 13.9% respectively), and also, the highest proportion of artifacts found in SU with sites (74.9%), were registered (Table 2). In relation to raw material, some differences can be observed, as in CBL1 there are a preponderance of chalcedony and basalt (90.9%) and in CBL2 these two rocks constitute a lower percentage of the sample (68.4%; for instance, with a small concentration of internal flakes of chalcedony in Fig. 6b), with a high proportion of rhyolite (22.6%), and silica in lesser extent (6.8%; Table 3). Among the lithic artifacts classes, debitage debris are the most abundant (82.1%), including a high and similar proportion of indeterminate knapping debris and internal flakes (39.3% and 20.6% respectively; Table 4). Cores are present in a relatively high proportion (13.7%), while instruments are found in the lowest proportion of all landscape units (4.2%). However,

Table 4
Artifacts classes identified in the distributional analysis performed in central San Jorge gulf.

Transects		Debitage debris	Cores	Instruments	Total
High plateau	MA1	33 (84.6%)	–	6 (15.4%)	**39**
	MA2	11 (84.6%)	1 (7.7%)	1 (7.7%)	**13**
	MA3	7 (100%)	–	–	**7**
	Total	**51 (86.4%)**	**1 (1.7%)**	**7 (11.9%)**	**59**
Plateau flank	FMN1	15 (88.2%)	1 (5.9%)	1 (5.9%)	**17**
	FMN2	25 (73.5%)	1 (2.9%)	8 (23.5%)	**34**
	FMP1	22 (62.9%)	9 (25.7%)	4 (11.4%)	**35**
	FMP2	22 (61.1%)	9 (25%)	5 (13.9%)	**36**
	Total	**84 (68.9%)**	**20 (16.4%)**	**18 (14.8%)**	**122**
Cañadón León	CLC1	45 (66.2%)	5 (7.4%)	18 (26.5%)	**68**
	CLC2	46 (83.6%)	7 (12.7%)	2 (3.6%)	**55**
	CLM1	6 (75%)	1 (12.5%)	1 (12.5%)	**8**
	CLM2	66 (78.6%)	15 (17.9%)	3 (3.6%)	**84**
	CLD1	163 (76.9%)	28 (13.2%)	21 (9.9%)	**212**
	CLD2	203 (86.8%)	24 (10.3%)	7 (3%)	**234**
	Total	**528 (80%)**	**80 (12.2%)**	**52 (7.8%)**	**660**
Escondida lagoon	LE1	61 (81.3%)	10 (13.3%)	4 (5.3%)	**75**
	LE2	87 (79.1%)	8 (7.3%)	15 (13.6%)	**110**
	Total	**148 (80%)**	**18 (9.7%)**	**19 (10.3%)**	**185**
Lángara bay	CBL1	164 (83.2%)	28 (14.2%)	5 (2.5%)	**197**
	CBL2	190 (81.2%)	31 (13.2%)	13 (5.6%)	**234**
	Total	**354 (82.1%)**	**59 (13.7%)**	**18 (4.2%)**	**431**
Total		**1166 (80%)**	**178 (12.2%)**	**114 (7.8%)**	**1458**

Table 5
Types of debitage debris artifacts identified in the distributional analysis performed in central San Jorge gulf.

Transects		Indeterminate	External flakes	Internal flakes	Total
High plateau	MA1	5 (15.2%)	6 (18.2%)	22 (66.7%)	**33**
	MA2	–	–	11 (100%)	**11**
	MA3	1 (14.3%)	1 (14.3%)	5 (71.4%)	**7**
	Total	**6 (11.8%)**	**7 (13.7%)**	**38 (74.5%)**	**51**
Plateau flank	FMN1	1 (6.7%)	1 (6.7%)	13 (86.7%)	**15**
	FMN2	4 (16%)	4 (16%)	17 (68%)	**25**
	FMP1	3 (13.6%)	2 (9.1%)	17 (77.3%)	**22**
	FMP2	6 (27.3%)	3 (13.6%)	13 (59.1%)	**22**
	Total	**14 (16.7%)**	**10 (11.9%)**	**60 (71.4%)**	**84**
Cañadón León	CLC1	18 (40%)	4 (8.9%)	23 (51.1%)	**45**
	CLC2	13 (28.3%)	6 (13%)	27 (58.7%)	**46**
	CLM1	–	3 (50%)	3 (50%)	**6**
	CLM2	14 (21.2%)	26 (39.4%)	26 (39.4%)	**66**
	CLD1	56 (34.4%)	31 (19%)	76 (46.6%)	**163**
	CLD2	54 (26.6%)	47 (23.2%)	102 (50.2%)	**203**
	Total	**155 (29.3%)**	**117 (22.1%)**	**257 (48.6%)**	**529**
Escondida lagoon	LE1	6 (9.8%)	10 (16.4%)	45 (73.8%)	**61**
	LE2	4 (4.6%)	19 (21.8%)	64 (73.6%)	**87**
	Total	**10 (6.8%)**	**29 (19.6%)**	**109 (73.6%)**	**148**
Lángara bay	CBL1	70 (42.7%)	27 (16.5%)	67 (40.9%)	**164**
	CBL2	69 (36.3%)	46 (24.2%)	75 (39.5%)	**190**
	Total	**139 (39.3%)**	**73 (20.6%)**	**142 (40.1%)**	**354**
Total		**324 (27.8%)**	**236 (20.2%)**	**606 (52%)**	**1166**

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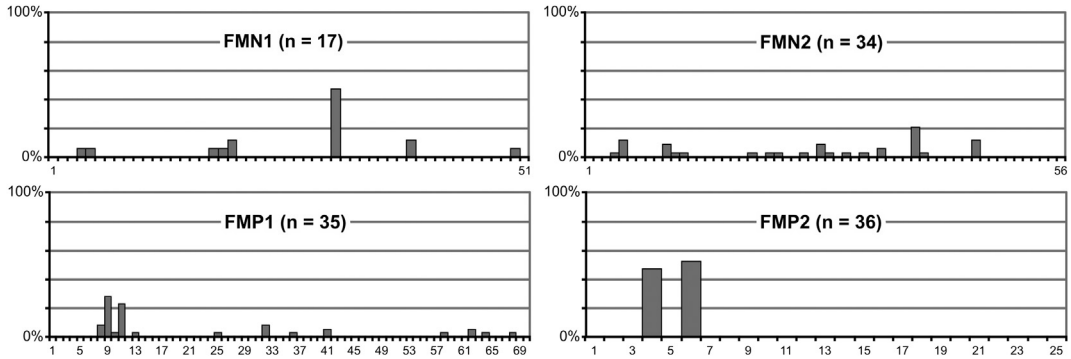

Fig. 5. Distributional forms of transects performed in plateau flank of the central San Jorge gulf. The *X* axis corresponds to the SU, and the *Y* axis corresponds to percentage of total lithic artifacts registered in transects.

among the instruments, several classes are observed (Table 6), among these some informal instruments (lflakes with retouched edges, flakes with notches and large scrapers), and also projectile points and denticulate, but mostly knifes and end scrapers. In SU 2 and 3 of transect CBL2, different types of ceramic shreds were registered (Fig. 6c; see Zubimendi, 2010; Zubimendi et al., 2010; Trola and Ciampagna, 2011).

4. Discussion

To discuss the way that different landscapes units were used by ancient hunter–gatherers of Patagonia, we analyse some general trends in the archaeological record of central San Jorge gulf sector. For instance, there are no relationships between archaeological visibility and artifactual density ($p > 0.001$; $r = -0.298$) or

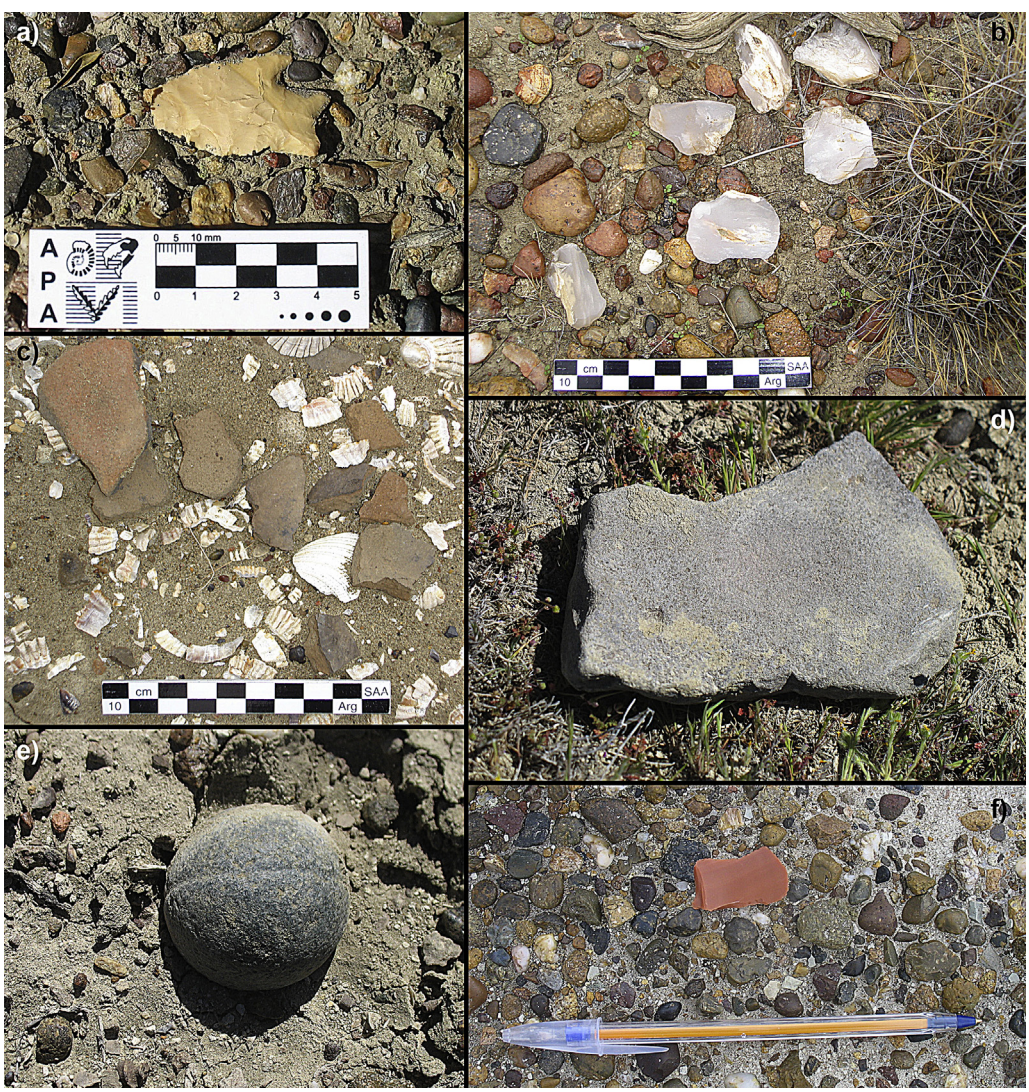

Fig. 6. Example of artifacts found in central San Jorge gulf sector. References: a) projectile point found in FMN1; b) chalcedony flakes from CBL2; c) pottery shreds from CBL2; d) mortar in FMP1; e) bola from FMP1; and, f) internal flake from LE2.

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frequency ($p > 0.001$; $r = -0.339$). There is a correlation between sample size and total richness ($p < 0.001$; $r = 0.839$); but not considering frequency and richness of instruments ($p > 0.001$; $r = 0.851$). According to this, and considering all artifacts, 70% of the variation in the richness can be explained by sample size; but not considering instruments, which did not show a correlation with sample size. Also, the total richness registered is 18, with a mean of 6.82 ± 2.27; but considering only instruments, the richness is 14, with a mean of 3.11 ± 1.9. Among these, the relationship between total richness and mean richness shows that most of assemblages do not have all classes, and most of them are present in low proportions, or concentrated in certain transects. Some kinds of instruments, such as bolas, mortars, hammerstones or perforators, are only found in one sample, whereas knifes and end scrapers were recovered in most ($n = 14$; 82.3%). In order to analyze the technological structure of all transects assemblages, artifactual diversity indexes were performed. This information is presented in Table 7 from the calculation of the indices of richness and evenness. The values of richness index (H) range between 0.54 and 1.75, with an average of 1.33 ± 0.32. This suggests a predominance of certain artifactual classes, such as internal and external flakes, which are the most common classes in all samples. Regarding the evenness index (e^H/S), this gives information about heterogeneity, which has an average of 0.59 ± 0.10, showing that the distribution of the artifacts in samples tends to be equitable, but with a tendency to lower values on coastal transects and higher in transects with lower frequencies of artifacts. These results, together with sample size correlation, indicate that diversity of an assemblage can be directly related to the size of the sample, and not with the developed behaviors because as the sample size increases, the number of classes represented also increases.

However, if we relate these indexes with instruments richness and distributional results, we can see some differences in artifactual structure of the different landscape units. In this sense, taking into account the archaeological density, together with distributional pattern and structure of surface archaeological record, we can observe remarkable differences between the coast and the other landscape units: for instance, artifactual density is greater in the former, while in the remaining spaces there is a lower density and a higher artifactual variability. These differences seem not to be related to archaeological visibility, as there is not a correlation between artifact densities or frequencies and general visibility (Table 2). Also, we were able to verify that the intensity of use, indicated by artifactual densities, is consistent with the defined expectations about use of different landscape units (Table 1), although some differences were observed, especially related to the variation inside some landscape units, particularly the flank plateau and *cañadón* León. As result, these last cannot be considered as totally uniform and homogeneous landscape units.

4.1. Use of inland spaces

Inland, with the exception of some parts of *cañadon* León and Escondida lagoon, a very low density and a similar artifactual structure were registered, along with the predominance of homogeneous distributional pattern and high percentages of SU without findings. On the plateau flank, high plateau and middle parts the *cañadón* León, artifactual density is low to very low, and this spaces recorded mainly lithics debitage debris, cores, end scrapers and lithic knives. These appear to be landscape units where small limited activities *loci* were performed by the Patagonian ancient hunter–gatherer populations. However, they differ in the ways they were used. The former appears to have been used as a potential source of very low density of lithic raw materials, mainly basaltic rocks and translucent chalcedonies. In these, nodes or rocks

Table 6
Instruments identified in the distributional analysis performed in central San Jorge gulf.

Transects		Bead	Bolas	Big scraper	Denti-culate	Retouched flake	Indeter-minate	Mortar	Flake with notch	Hammerstone	Perfo-rator	Bifacial preform	Arrow-head	Knifes	End scraper	Total
High plateau	MA1	–	–	–	–	2 (33.3%)	–	–	–	–	–	–	–	3 (50%)	1 (16.7%)	**6**
	MA2	–	–	–	–	1 (100%)	–	–	–	–	–	–	–	–	–	**1**
	MA3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Total	–	–	–	–	**3 (42.9%)**	–	–	–	–	–	–	–	**3 (42.9%)**	**1 (14.3%)**	**7**
Plateau flank	FMN1	–	–	–	–	–	–	–	–	–	–	–	–	–	1 (100%)	**1**
	FMN2	–	–	–	1 (12.5%)	2 (25%)	–	–	–	–	–	–	–	3 (37.5%)	2 (25%)	**8**
	FMP1	–	1 (25%)	–	–	–	–	1 (25%)	–	–	–	–	–	1 (25%)	1 (25%)	**4**
	FMP2	–	–	–	–	–	1 (20%)	–	–	–	–	–	1 (20%)	–	3 (60%)	**5**
	Total	–	**1 (5.6%)**	–	**1 (5.6%)**	**2 (11.1%)**	**1 (5.6%)**	**1 (5.6%)**	–	–	–	–	**1 (5.6%)**	**4 (22.2%)**	**7 (38.9%)**	**18**
Cañadón León	CLC1	–	–	–	–	–	–	–	1 (5.6%)	–	1 (5.6%)	1 (5.6%)	–	6 (33.3%)	9 (50%)	**18**
	CLC2	–	–	–	–	–	–	–	–	–	–	–	–	1 (50%)	1 (50%)	**2**
	CLM1	–	–	–	–	–	–	–	–	–	–	–	1 (100%)	–	–	**1**
	CLM2	–	–	–	–	–	1 (33.3%)	–	–	–	–	–	–	1 (33.3%)	1 (33.3%)	**3**
	CLD1	1 (4.8%)	–	–	1 (4.8%)	–	–	–	–	1 (4.8%)	–	3 (14.3%)	1 (9.5%)	7 (33.3%)	6 (28.6%)	**21**
	CLD2	–	–	–	1 (14.3%)	–	–	–	–	–	–	–	–	3 (42.9%)	3 (42.9%)	**7**
	Total	**1 (1.9%)**	–	–	**2 (3.8%)**	–	**1 (1.9%)**	–	**1 (1.9%)**	**1 (1.9%)**	**1 (1.9%)**	**4 (7.7%)**	**2 (5.8%)**	**18 (34.6%)**	**20 (38.5%)**	**52**
Escondida lagoon	LE1	–	–	–	–	–	–	–	–	–	–	–	–	2 (50%)	2 (50%)	**4**
	LE2	–	–	–	–	–	–	–	–	–	–	2 (13.3%)	–	6 (40%)	7 (46.7%)	**15**
	Total	–	–	–	–	–	–	–	–	–	–	**2 (10.5%)**	–	**8 (42.1%)**	**9 (47.4%)**	**19**
Lángara bay	CBL1	–	–	–	1 (20%)	1 (20%)	–	–	1 (20%)	–	–	–	–	1 (20%)	1 (20%)	**5**
	CBL2	–	–	1 (7.7%)	–	1 (7.7%)	–	–	1 (7.7%)	–	–	–	1 (7.7%)	5 (38.5%)	4 (30.8%)	**13**
	Total	–	–	**1 (5.6%)**	**1 (5.6%)**	**2 (11.1%)**	–	–	**2 (11.1%)**	–	–	–	**1 (5.6%)**	**6 (33.3%)**	**5 (27.8%)**	**18**
Total		**1 (0.9%)**	**1 (0.9%)**	**1 (0.9%)**	**4 (3.5%)**	**7 (6.1%)**	**2 (1.8%)**	**1 (0.9%)**	**3 (2.6%)**	**1 (0.9%)**	**1 (0.9%)**	**6 (5.3%)**	**5 (4.4%)**	**39 (34.2%)**	**42 (36.8%)**	**114**

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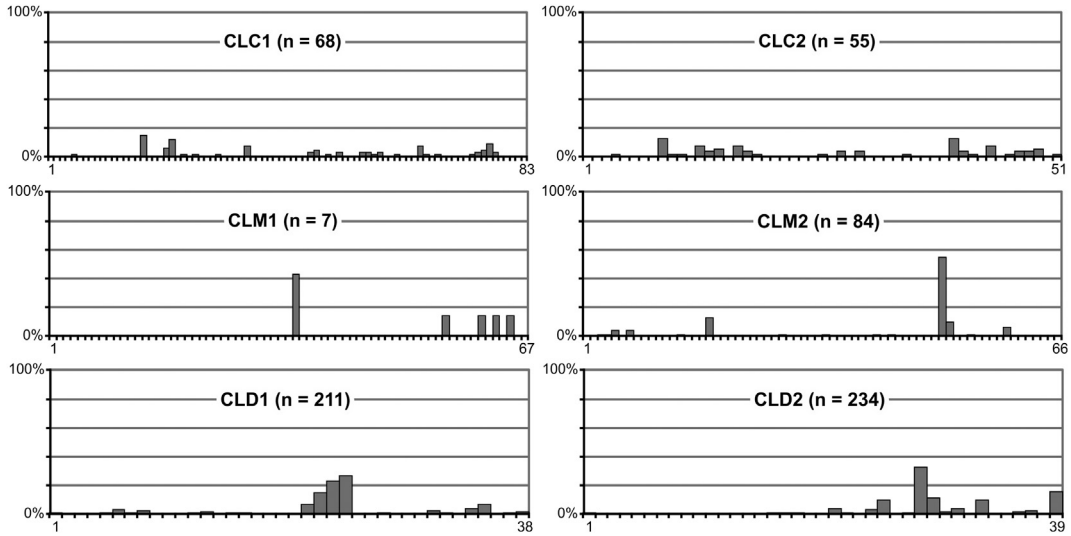

Fig. 7. Distributional forms of transects performed in *cañadon* León of the central San Jorge gulf. The *X* axis corresponds to the SU, and the *Y* axis corresponds to percentage of total lithic artifacts registered in transects.

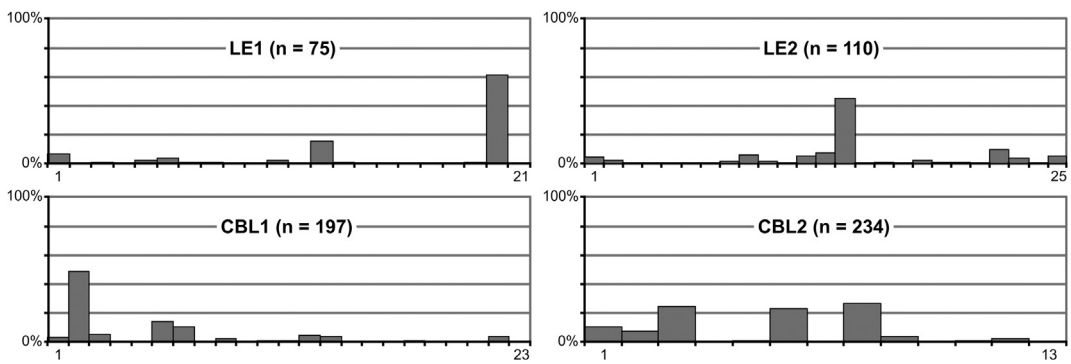

Fig. 8. Distributional forms of transects performed in Escondida lagoon and Langara bay of the central San Jorge gulf. The *X* axis corresponds to the SU, and the *Y* axis corresponds to percentage of total lithic artifacts registered in transects.

could have been selected to be transported to other areas, such as lagoons or coast, where the sequence of lithic production would have been continued in places where residential activities were performed.

Table 7
Richness and artifactual homogeneity of the assemblages. References: H: richness index; e^H/S: evenness index.

Transects	Frequency	Richness	H	e^H/S
MA1	39	6	1.32	0.62
MA2	13	3	0.54	0.57
MA3	7	3	0.8	0.74
FMN1	17	5	0.87	0.48
FMN2	34	8	1.61	0.62
FMP1	35	8	1.48	0.55
FMP2	36	7	1.63	0.73
CLC1	68	9	1.75	0.64
CLC2	55	6	1.34	0.64
CLM1	8	4	1.26	0.88
CLM2	84	7	1.49	0.63
CLD1	211	11	1.65	0.47
CLD2	234	7	1.39	0.57
LE1	75	6	1.24	0.58
LE2	110	7	1.34	0.54
CBL1	197	9	1.42	0.46
CBL2	234	10	1.56	0.47

This selection of rocks might have been done during the performing of other activities, such as search of food resources (guanacos), or while these territories were used as transit areas. On this landscape unit, near the coast, there is a greater variability, associated with the presence of small lithic concentrations that show the performing of domestic activities (and also some tools like mortars) and use of some coastal resources, including molluscs. On the high plateau, a sparsely and scattered distribution of artifactual remains were recorded, which could be interpreted as an area of specific and marginal use in archaeological terms of intensity. These spaces could have been used logistically to obtain food by hunting, which might have used manufactured lithic artifacts or flakes that have been used expeditiously.

On the headwaters of *cañadón* León, Escondida lagoon and even some parts of the plateau flank near the coast, the artifactual densities and the structure of lithic assemblages supports the hypothesis that they could have been used through short-term residential camps. In these landscape units, specific activities have been inferred, such as extraction of external flakes from cores of certain raw materials locally available, and knapping of instruments of different raw materials.

Lagoons have the highest values of artifact density along with heterogeneous distributional pattern, and also low percentage of SU without findings. The evidence suggests the realization of

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intermediate stages of lithic reduction on a higher variability of raw materials (some non-local rocks), while the first stages were probably performed in other landscape units or outside this sector. Lagoons seem to have been used recursively, through short-term residential camps, in which a wider range of activities were developed, including knapping of artifacts of various lithic raw materials, some of them non-local.

The *cañadón* León has an average artifactual density, slightly lower than in Escondida lagoon. It also has a higher dispersion of the archaeological record, although with significant differences along the *cañadón*. Lower densities are recorded in the headwaters and the middle riverbed of the *cañadón*. Higher densities were recorded in the *cañadón* mouth, near the sea, with clear heterogeneous distributional patterns, presence of SU with sites, and evidence of marine resource exploitation. These spaces were used in different ways, considering the intensity and the probable activities undertaken in these landscape units. The headwaters were occupied by short-duration residential camps, where some domestic activities were performed, probably related to the higher availability of fresh-water in the *mallín*. The middle riverbed of the *cañadón* has very scarce archaeological evidence related to limited activity *loci*, where the high proportion of external flakes suggest the reduction of cores of lithic raw material directly available. The *cañadón* mouth would have been occupied through residential camps. Also, non-local raw material would have been knapped, while nodules of rocks directly available in the middle part of the *cañadón*, but mainly in the plateau flank, have been reduced from cores to get internal flakes or to manufacture some instruments. These latter landscapes units could have been used as potential low-density secondary sources of raw material, but due to their extensive surface, the availability could be considered high.

4.2. Use of coastal spaces

The archaeological record of the mouth of the *cañadón* León and the coast of Lángara bay share similar characteristics, such as artifact density, distributional shapes, percentages of SU without findings, and percentages of categories of SU by artifactual frequencies, so they can almost be considered as a unit in relation to lithic evidence of use in prehistoric times. In these landscape units, clear evidence of residential bases was found. Some are large scale *loci*, forming a landscape that presents an almost uninterrupted succession of archaeological remains along the coast and the *cañadón* mouth. In these, denser occupations are recorded, probably also associated with longer stays and more residential activities.

Ceramic sherds and mortars were also registered. In this part of the coast, the presence of large numbers of ceramic shreds is common (see Zubimendi, 2010; Trola and Ciampagna, 2011). Ceramic containers may have served for storage and cooking, and the presence of mortars, which were observed outside transects (Zubimendi, 2010; Zubimendi et al., 2010), also indicates longer stays and probably different occupations at the same location over time (Gómez Otero, 2007). These types of artifacts could also be related to spaces' equipment in relation to recurrent use and anticipated occupation (sensu Kent, 1992). The transport of shellfish to several *loci* in the interland, at least 3 km from its source, would indicate direct movements from the coast to the inland along the *cañadón*, where shellfish were consumed and discarded. Within a lower intensity, this may have occurred in some parts of the plateau flank, as reflected by the scarce shell fragments and a mortar found in transect FMP1.

On the coast, several resources of importance for past populations coexist, including high availability, predictability and concentration of molluscs, and to a lesser degree fish and pinnipeds. These resources allowed the coast to be used in a recurrent manner along the whole coastline. This is reflected by the almost continuous distribution of the archaeological record. The structure of lithic artifact assemblages reflects a wide variety of raw materials and artifact classes. Different activities may have been conducted on the coast, such as intensive exploitation of rock nodules of regular quality raw materials obtained in the nearby landscape units; intermediate and final stages of lithic knapping; and consumption of marine resources (molluscs, fish, or pinnipeds). Artifacts associated with a possibly reduced mobility were found, such as mortars and ceramic potsherds. Thus, the coast would have been used with residential camps, probably with more permanent settlements than those inferred on other landscape units, such as the lagoons and some parts of *cañadón* León.

5. Conclusions

Distributional studies performed in central San Jorge Gulf allowed us to contrast a series of archaeological expectations about the archaeological record derived from availability and variability of existing resources in this sector. In the Late Holocene, the landscape units located inland, more specifically the high plateau and plateau flank were used in low intensity and for limited activities, but with some differences. In the high plateau, marginal and logistical use is inferred, whereas the plateau flank would have served as a regular quality raw material potential source, but its availability could be considered higher in accordance to its wide distribution. Both high plateau and plateau flank would also have been used for food supply by hunting, as they are wide open spaces where guanacos can be found. Some evidence also shows differences inside the flank plateau landscape unit, related to a slightly more residential use near the coast: this last result was not anticipated. Other inland landscape units -*cañadones* and temporary lagoons-have a greater supply of resources (freshwater, guanacos, plants) and would have been the most attractive inland spaces for patagonian hunter–gatherers in this area. However, some differences are also recorded: for instance, Escondida lagoon has a higher artifactual density than *cañadon* León. The latter also shows differences along its course, with some parts with very low and high artifactual densities. This result was not expected, and it is interesting in relation to know the way that this landscape unit was used along its extent, especially considering that acts as a connector between coast and inland territories. Finally, as outlined in the initial hypothesis, the greater availability and variability of resources on the coast is reflected in the archaeological record, showing not only higher densities in coastal transects but also in the *cañadon* mouth.

In relation to the artifactual record, we can propose the existence of complementarity between different landscape units. In some, rock nodules would have been selected, and performed initial stages of reduction. Later, these artifacts would have been transported to other landscape units where the reduction sequence might have continued. Presence of malacological remains in *cañadón* mouth and to a lesser extent the plateau flank, also indicate the mobility of human groups and complementary use of landscape units. It is likely that guanacos hunted in other units of the landscape entered, as a whole or some parts, settlements located on the coast or the *cañadón* mouth. On a larger spatial scale, non-local and distant sources of raw materials, such as black obsidian from Pampa del Asador (Ambrústolo et al., 2012) and malachite from northern Patagonia (Zubimendi, 2010), indicate extensive regional and extra-regional exchange networks (Borrero, 2001; Gómez Otero, 2003, 2007).

Studies support a reduction in mobility on the coast, where human groups would have moved along and settled for periods of

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time. This result is consistent with previous studies in the coastal landscape unit of NCSC (Castro et al., 2003; Zubimendi et al., 2004; Moreno, 2009), as well as in other parts of the Patagonian coast (among other, Belardi, 2003; Borrero and Barberema, 2006; Gómez Otero, 2007; Favier Dubois et al., 2008). Nevertheless, terrestrial components, including fauna and instrumental assemblages, were important and critical to populations that inhabited NCSC(Moreno et al., 2011; Zilio et al., 2014).

New results presented from distributional studies presented in this paper allow us to state that inland landscape units would have been used by small groups almost exclusively for a limited range of activities, especially those related to the acquisition of certain resources of interest, including lithic raw materials or guanacos. Within these, the highest intensities and some evidence of residential uses (however of several orders lower than those recorded in the coast) were practically limited to certain locations with fresh water availability, such as *cañadones* headwaters and temporary lagoons. High availability of resources on the coast has hierarchized this landscape unit, and also certain surrounding areas, such as the *cañadón* mouth. In this sense, we can propose that the availability of coastal resources is not only related to the intensity of occupation of the coast, but also determined the way that nearby spaces were used (sensu Borrero and Barberema, 2006). Despite this, we believe that the occupations that were recorded in central San Jorge gulf sector were part of broader mobility ranges, which includes other parts of NCSC and probably also some parts of Patagonia. Similar results were obtained on the north coast of Chubut province and south of Río Negro and Santa Cruz provinces, where higher densities are concentrated close to the coast, and lower densities inside, so that mobility and settlement would have been restricted mostly to the perimeter of the coast (among others, Belardi, 2003; Borrero and Barberema, 2006; Gómez Otero, 2007; Favier Dubois et al., 2008). Future studies will allow us to advance in the definition of the limits of home ranges of coastal settlement, and explore the relations between different spaces that were inhabited by the Patagonian populations during the Late Holocene.

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