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Core technology from Maripe Cave site (Santa Cruz, Argentina): Implications for rocks provisioning processes and lithic production

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ABSTRACT

This paper discusses provisioning strategies of lithic raw materials at Maripe Cave site (province of Santa Cruz, Argentina). The archaeological sequence represents different moments of human occupation at the cave and in the study area, which show different lithic technologies. The morpho-typological analysis of the lithic cores recovered contributes to our knowledge about the strategies related to procurement and provisioning of the lithic raw materials used for artifacts production.

We identified different raw materials from the analyses of lithic cores and other artifacts from the site. This allowed analyzing trends in selection and provisioning processes and interpreting the mobility strategies of the groups that inhabited the Deseado Massif since the Pleistocene–Holocene transition. Trends suggest that, during the Pleistocene–Holocene transition and early Holocene, abandoned cores from Maripe Cave mainly indicate people provisioning strategies. During middle Holocene, the cores shows blades extractions and raw material use from long distance, discarded with remaining potential utility. Finally, at late Holocene the cores were mainly prepared for blade extractions. Our results do not fully agree with Kuhn's proposal, probably due to both the theoretical polarization between the provisioning strategies and the palimpsest effect.

1. Introduction

Within the variety of lithic artifacts resulting from the activities of hunter-gatherers societies, cores are artifacts with a great potential for generating inferences about technology and the use of raw materials (Franco, 1991, 2002; Aschero and Hocsman, 2004; Cardillo and Nuviala, 2004; Charlin and Cardillo, 2005; Paulides, 2006; Colombo, 2011). Core analysis allows a better understanding of the provisioning process (selection, transport and use of raw materials) and blanks extraction, as well as assessing the differential trajectory possibilities, with respect to the product with less volume and potential utility (vg. shaped artifacts, non-shaped artifacts). In this sense, we understand that cores present a high inferential potential to understand the technological choices associated with the initial stages of operational chains. Given the quality of the information provided by these artifacts, in this paper we present the results of techno-morphologic and metric analysis of lithic cores from Maripe Cave, a site located in the central plateau of Santa Cruz (Argentina). The main objective of this study is to evaluate the provisioning strategies and use of lithic raw materials through the study of cores recovered from different occupations identified in Maripe Cave site. This will also make possible to understand the use of the space of the mobile groups at the Deseado Massif, in a regional scale of analysis.

2. Provisioning strategies

The ways in which human groups choose and use raw material are associated with their mobility and the use of space. Thus, the study of procurement, circulation and abandonment of lithic raw materials contribute to our knowledge about mobile societies of the past.

We discuss the use of raw materials and its abandonment as cores following the perspective proposed by Kuhn (1995, 2004), who considers a series of alternatives that mobile groups can choose to maintain raw materials provisioning of people and places, according to the needs, occasional or planned, of using stone tools. In this sense, forager societies' planning materializes through two types of strategies: provisioning individuals, analogous to the

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personal gear of Binford (1979) and to the toolkit of Kelly (1995), and provisioning places. Each of these strategies involves different steps.

The first one must face transport between several places where tools will be used, minimizing transport costs as much as possible. In this way, assemblages resulting from individuals provisioning strategies should vary between finished instruments (which transport costs are low, but with a reduced versatility in case of unifunctional instruments) and raw material in flexible forms (with a somewhat higher transport cost).

On the other hand, the provisioning of places would be related to a maximization of raw material utility and versatility and: "… should favor maximizing the utility and versatility of the technological potential materials available there … " (Kuhn, 1995:24). The expected assemblages resulting from this strategy would be composed by potential material for tools manufacturing (Kuhn, 1995).

Other expectations related to mobility and the duration of sites occupations are that, in short occupations, provisioning places strategies would be less frequent than the input of instruments from toolkits; while in long term occupations a greater frequency of place provisioning is expected. The increase in the depositional frequency of artifacts in long duration events would difficult the identification of artifacts from personal gear in places where both short and long-term occupations took place, because of the palimpsest effects. How it is possible to recognize such strategies in the archaeological record?

According to the proposals mentioned above, among the cores that entered to the site as part of provisioning individuals strategy, we expect the presence of raw materials from different origins (i.e. raw materials from long or short distance that are part of the provisioning area used by the group or which may have been obtained by exchange), relatively small core dimensions, and their discard mainly due to depletion. On the other hand, we expect for provisioning of places that the cores present a low variety of raw materials, mainly with a short life history and large dimensions that allow a remnant of exploitation.

However, we should be aware that reality is often much more complex than theoretical models. The problem is that only two strategies are assessed here and these are only two of a variety of possible behaviors and "life histories", which does not necessarily cover the whole events that may explain the presence of a core in an archaeological site (i.e. used inside and outside the cave).

The main features of Maripe Cave site, its proximity to permanent water and other resources such as lithic raw materials of good knapping quality; led to a recurrent use of the site in the past by mobile hunter-gatherer societies. The study of lithic artifacts from different site occupations allowed the identification of different technological traits along time. Taking into account the model proposed, we present the following assumptions:

H1. We expect for the early Holocene occupations (with a lesser knowledge of the area, low population density, and high group mobility) a low provisioning of places; so the assemblages should be composed by raw materials in flexible forms with higher trajectories.

H2. In the following moments of occupation (middle and late Holocene), when people had some knowledge of the area and the available resources, and lower mobility and an increase intensity of occupations of the cave was suggested, we expect an increment in provisioning places. This would be represented at archaeological record with various stages of the operational sequence, from cores to tools production. Regarding the quality of raw materials, it is expected that those with a good quality for artifact manufacture and identified as "non-local" are associated with resource maximization strategies due to their relative abundance and costs.

3. Raw materials availability around Maripe Cave

The Deseado Massif is a geological province composed mainly of volcanic rocks with high silica content. Most important for this study are the Chön Aike, Bajo Pobre and La Matilde geological formations, which origins date back to the Jurassic period. The rocks of these formations correspond to 50% of the total outcrops in the area (Panza, 2001; Moreira, 2005; Magnin this volume).

Numerous raw material sources have been recorded near the study site, such as Cantera del Rojo (with ignimbrites outcrops of the Chön Aike formation with different silicification degrees), Rocky (located in front of Maripe Cave, is a vein of good quality dark brown porphyry), Cantera del Verde (small outcrop of silicified breccia with green colors predominantly) and Cantera La Primavera- Pedimento 1 (secondary source of siliceous rocks nodules with greater variability of raw materials suitable for knapping) (Hermo, 2008, 2009). Table 1 summarizes the characterization of these sources:

Table 1
Provisioning sources near Maripe Cave. References: CDR: Cantera del Rojo; CDV: Cantera del Verde; LP-P1: La Primavera Pediment 1.

	CDR	Rocky	CDV	LP-P1
Relative dimensions	Widespread	Short	Short	Very large
Visibility	High	Low	Low	High
Rock types	Rhyolitic ignimbrite	Rhyolitic ignimbrite	Silicified breach	Varied lithologies
Presentation	Clasts	Clasts	Clasts	Peebles
Cortex development	Minor	Minor	Minor	Total
Source type	Primary	Primary	Primary	Secondary
Use evidence	Abundant	Very scarse	Medium	Very scarse
Distance to Maripe Cave	12 km	0.2 km	7 km	5 km

The Maripe Cave (Fig. 1) site is a rock shelter located in the middle course of La primavera canyon (Santa Cruz province) and presents a comprehensive sequence of occupations from the Pleistocene–Holocene transition to the late Holocene (Hermo, 2008; Miotti et al., 2014). Maripe cave is divided in two sectors by a rocky wall [North chamber, (NC) and South chamber (SC)], which present different tafonomic and archaeological contexts (Miotti et al. 2007, 2014; Hermo, 2008; Carden, 2009; Marchionni et al. 2012; Lynch, 2013; Marchionni, 2013).

The initial occupation corresponds to the Pleistocene–Holocene transition and the early Holocene, between 11,100 cal. BP (9518 ± 64 ^{14}C) and *ca.* 8000 cal. BP (7153 ± 50 ^{14}C). Component 1 is stratigraphically distributed in layer 5 from NC and AU4 from SC (Miotti et al., 2014). The material culture consists mainly of unifacial made on flake blanks, with high frequency of long edges. The more diagnostic tools are scraper planes, side-scrapers and triangular projectile points. The debitage were mostly flakes, many of these (an average of 33, 39%) showed cortex in some extent and were mainly made on local raw materials (ISG1), with the exception of obsidian that it is in very low proportions (Hermo et al. 2014). No Pleistocene fauna were recorded in these early occupations, and the main exploited faunal resource was guanaco (*Lama guanicoe*) (Marchionni, 2013).

Component 2 consists of layer 4 from NC and AU3 from SC and comprises middle Holocene occupations dated between 8584 cal. BP (7703 ± 47 ^{14}C) to 3272 cal. BP (3210 ± 60 ^{14}C) (Miotti et al., 2014). The lithic assemblage is characterized by blade technology and by the presence of "bolas". Blades production is reflected on

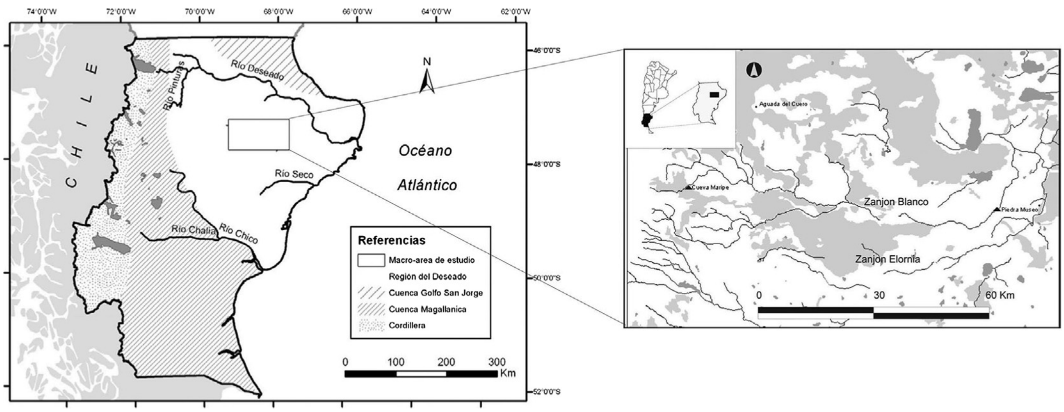

Fig. 1. Study area and Maripe Cave site location (modified from Marchionni, 2013).

tools manufacturing and on debitage. In this component, a high percentage of cortex (an average of 48.7%) on debitage was registered. Such amount would be probably related to different reduction stages. The most represented raw materials in Component 2 are mainly local with a slight increase in the use of obsidian as non-local raw materials. The obsidian would mostly represent on debitage (flakes/blades) rather than tools. There is also a tendency toward reduction on size tools with some standardization in their shapes that would be accentuated towards the Component 3 (Hermo et al. 2014). The faunal remains correspond mainly to guanaco, but a complementary use of Rheidae was proposed based on the presence of eggshells fragments (Marchionni, 2013).

The upper unit, Component 3, was assigned to the late Holocene (see Miotti et al., 2014) based on archaeological traits of layers 2 and 3 from NC and AU2 from SC. A main characteristic of the lithic assemblage is the high frequency of blade blank tools (end scrapers, retouched blades) and retouched edges designed for specific tasks: gouge-, chisel-, and wedge-like shapes (*sensu* Aschero, 1975, 1983). In Component 3, the percentage of cortical debitage is the lowest of the sequence: 38.89%. As in the above component, the variability of raw materials includes rocks represented on the analyzed cores. The tool size is lower than the recorded in the previous components (Hermo et al. 2014). Guanaco is the most common faunal evidence.

Similar technological tendencies were registered along the Deseado Massif in some archaeological localities, such as Los Toldos (Cardich et al. 1973), La María (Skarbun, 2011), El Ceibo (Cardich, 1987), including Río Pinturas area (Aschero, 1987). In the next sections, we present the cores sample of Maripe Cave archeological site and a discussion of the technological strategies related to the use of different raw materials in the lithic artifacts manufacturing process.

4. Materials and methods

The analyzed sample consists of 35 cores from different sectors and layers of the Maripe Cave site. In the North chamber, we recorded 18 of these artifacts and 17 in the South chamber.

The associated context consists of variety of stone tools including the most representative morphologies: projectile points, scrapers/side-scrapers, retouched flakes, retouched blades, knifes and *rabots* (scraper planes). The artifacts production process included raw materials from different sources, using rocks immediately available as silicified ignimbrite; or from up to 100 km away as the obsidian (Stern1999; Belardi et al. 2006).

We consider cores as those lithic artifacts in which at least one flake scar that could have provided a useful flake blank can be clearly distinguished (Bayón and Flegenheimer, 2003, 2004). These artifacts are part of the archaeological assemblages of hunter-gatherers societies and have been recovered in all the occupations identified at Maripe Cave. Techno-morphological analysis was carried out according to the proposals of Andrefsky (1994) and Aschero (1975, 1983).

To analyze the cores and determine possible differences in raw material provisioning strategies we recorded the following variables for each event: A) cores frequencies identified at the different occupations; B) morphological type (*sensu* Aschero, 1975, 1983); C) raw materials diversity D) type and shape of the extractions (blades, flakes, both); E) Cortex percentage; F) Main measures (volume and mass); and G) Negatives size.

4.1. Raw materials characterization

The local raw materials classification was carried out through geological and petrologic studies of the sources and of archaeological samples of Maripe Cave and other nearby sites (Hermo, 2008, 2009). This categorization can be summarized as follows:

Chalcedony: includes Group 1 (CG1: microcrystalline rock, translucent white without inclusions) and CGx: other types of chalcedony. Pebbles of this raw material were found in LP-P1 (~5 km from Maripe Cave).

Opals: includes PG1 (variety of crystalline opal, mainly black) and PGx (other varieties of this rock). Different opals were registered in LP-P1.

Silicified Ignimbrites: two groups are included here. ISG1: is a silicified ignimbrite recorded at Cantera del Rojo (CDR) and LP-P1, at 12 km and 5 km in a straight line respectively from Maripe Cave and ISG2: that includes other varieties of silicified ignimbrite, recorded in the stone quarry called the Rocky (at 200 m from Maripe Cave). This raw material goes from dark brown to reddish color and it does not have inclusions visible to the naked eye.

Siliceous rocks: RSG1: corresponds to a black colored microcrystalline rock, with whitish to brown stains. RSG2: rhyolitic rocks, mostly of brown tonalities; and RSG3: siliceous rock without inclusions, exclusively brown, it may or not be banded and have zonal stains (spots). RSGx: includes varieties of siliceous rocks that do not correspond to the groups mentioned above. Pebbles of these varieties were found in LP-P1.

Other types of rocks that do not exhibit varieties were identified, such as obsidian, basalt and petrified wood, but no evidence of use related to other varieties of these rocks has been found (see Table 1).

5. Results

The sample analysis was carried out according to the determined layers as it was established in previous works (Marchionni et al., 2012; Miotti et al., 2014;). Therefore, in the North chamber (NC), six stratigraphic layers were recognized; three of them had abundant materials that were clearly associated to human occupations. In the case of the South chamber (SC) layers were identified following the artificial levels through several analysis carried out on different materials (taphonomic studies, lithic analysis and intrasite GIS) that allowed identification of three analytical units (AU) with human occupation evidence.

5.1. North chamber

This sector has a total of 18 lithic cores, 6 (33%) of which correspond to layer 3; 10 (56%) to layer 4; and 2 (11%) to layer 5. Layer 4 shows the use of a greater variety of raw materials. According to the morphological designation (sensu Aschero, 1975, 1983) (Fig. 2) the partial prismatic bidirectional cores are the most representative forms (30%), followed by other morphologies such as the irregular pyramidal (20%), and the indeterminate (20%). Represented in lower frequencies are the varieties bifacial, multifaceted and pyramidal (10%), being the ISG1 raw material the most represented (33%).

In general, in layer 4 lithic cores show the use of long fronts of extraction from 1 or 2 platforms, for producing blades and laminar flakes (see Fig. 2). Cores were reduced from a single flaking surface and in other cases removing perimeter flakes producing pyramidal and prismatic shapes. The most characteristic elements of these morphologies were manufactured in ISG1 ($N = 2$) and CG1 ($N = 1$). An overshot ("outrepassé") blade from one of these cores which matched with one flaking scar was recovered; the removal of most of the core mass would have caused its abandonment (Fig. 2 F).

Noteworthy the single obsidian core, despite being the smaller in this layer, shows a similar extraction technique to the mentioned above. It also shows an incidental fracture (thermal damage?) showing differences with patina formation only on the external surface (but not in the fracture surface).

In layer 3, morphological varieties are mostly represented by prismatic partial and globular cores (33% each) followed in low

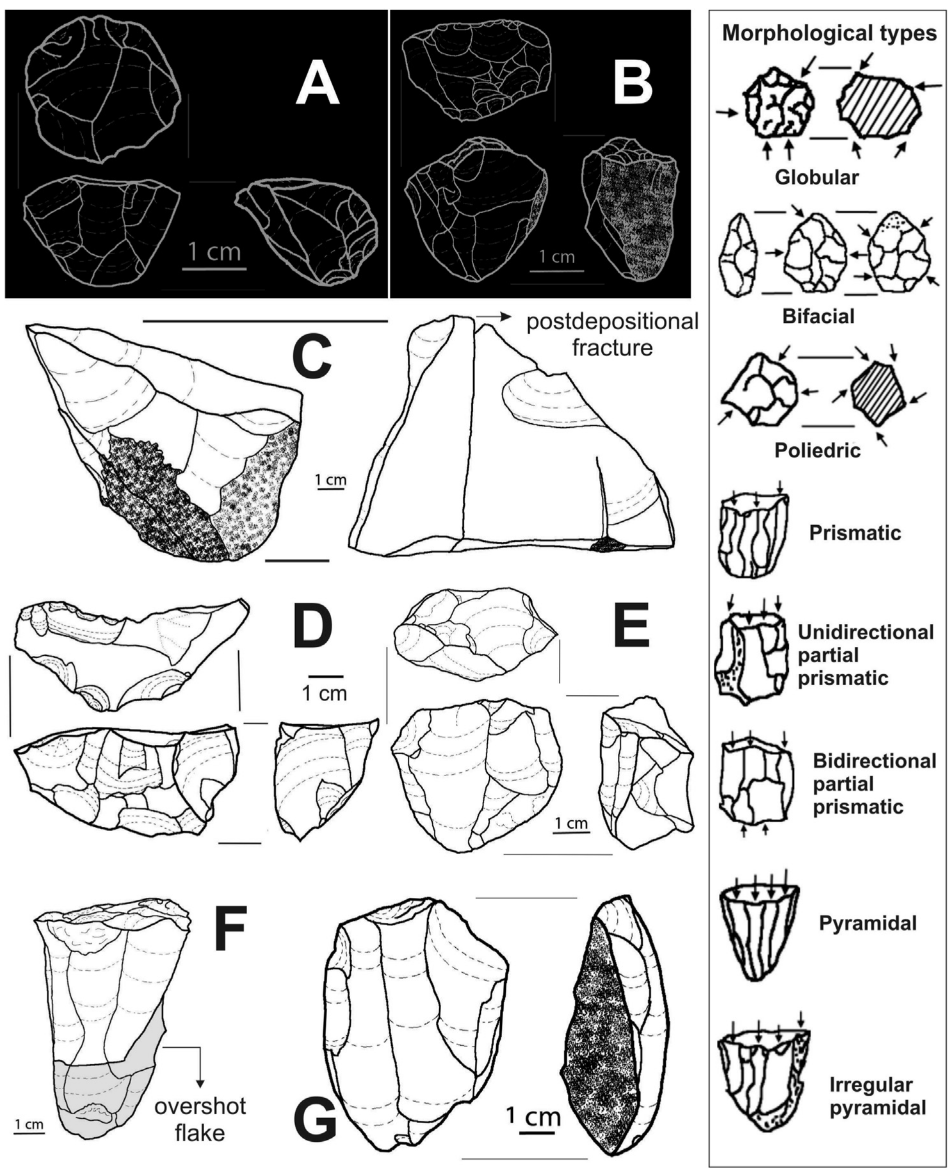

Fig. 2. Cores from Maripe Cave. A and B: obsidian cores from South chamber (AU4); C: Core on RSG2 from South chamber (AU4); D: core on ISG1 from layer 5 of North chamber; E: core on ISG1 from layer 3 of North chamber; F and G: blade cores from layer 4 of North chamber. Right column: Morphological types modified from Aschero (1975).

Fig. 3. Cores from Maripe Cave. A: Blade core on ISG1 (Fig. 2G); B: Core on RSG2 from South chamber (Fig. 2C); C: Blade core from layer 4 of North chamber (Fig. 2F); D–E: Obsidian cores from South chamber (AU4, Fig. 2A–B); and E: Obsidian core from North chamber (layer 4).

frequencies by bi-directional and partial prismatic types in similar frequencies (17%).

As in the previous layer, the most represented raw material corresponds to the variety ISG1. Both cores of this raw material show extractions from more than one platform, mainly used for removing elongated shapes (blades and laminar flakes) and while one of them is exhausted, the other still has potential utility. Several flakes of this raw material were collected at the same layer, which evidence the process of decortication and core shaping.

Other cores at this layer were discarded for other reasons as exhaustion, heat damage and the presence of impurities in the rock. Only one chalcedony core shows a typical prismatic shape. Layer 5 has two lithic cores of undetermined morphology manufactured from ISG1 raw material (Fig. 2 D and E; see details in Table 2). One shows flake scars on its three faces, removed from three percussion platforms, which indicate multidirectionality of the extractions and show an exhausted core (Fig. 3).

The same description can be made for the other identified lithic core that presents peripheral extractions from six platforms, but due to the absence of a clearly differentiable edge it has not been classified as discoidal core. Besides its high degree of exhaustion, this second core shows color changes and craquelé from thermal damage.

In layer 3, although the most represented raw materials correspond to the ISG1, the heaviest core would be of the RSG2 variety with an average of 433 g.

In layer 4, the single obsidian core has the lowest mass (17 g). However, the minimum number of extractions is the same as in lithic cores from ISG1 (with an average mass of 107.6 g) with a similar extraction strategy. This suggests that this obsidian core, despite being small, has been highly used due to its good quality. Of the 18 cores of this chamber only 5 exceed 150 g. Four are in layer 3 (the same layer with the only heavy core: 433 g), while the other is located in layer 4 (Fig. 4).

Regarding length and maximum width of the extractions, there is a statistically significant correlation with the mass of the cores ($R = 0.88$; $p = 0.000001$; $n = 18$). The largest negatives scars were recorded in layer 3 and correspond to CG1 raw material (average of 2107.9 mm^2), followed by indeterminate (1778.2 mm^2) and RSG2 (612.5 mm^2). In layer 4, the RSG3 presents the longest and widest negative scars with an average of 1714.5 mm^2. In this layer, the obsidian core has the smallest extractions (242 mm^2) within the sample, while the average area recorded in scars from two cores of ISG1 at layer 5 is 869 mm^2. Regarding the minimum extractions frequencies for each raw material, layer 5 presented more flake scars than the other layers (a mean of 12 extractions in cores of ISG1) which is consistent with the high degree of exhaustion. Regarding frequencies of extractions, Layer 4 has an average of 10 flake scars per core; and the core with more extractions is from a raw material darkened by thermal damage. Cores of petrified wood have an average of 11 extractions and obsidian, chalcedony and RS63 cores have 10 extractions each; finally the ISG1core has 8 extractions.

Layer 3 presented a maximum average of 11 extractions, of which the higher number of extractions (15) corresponds to raw materials not determinate because of thermal damage. This record

Table 2
Raw materials and core morphologies of the North chamber's core sample.

Raw material	Layer 3					Layer 4							Layer 5		Grand total
	Globular	Prismatic	Unidirectional partial prismatic	Bidirectional partial prismatic	Total 3	Bifacial	Poliedric	Pyramidal	Irregular pyramidal	Bidirectional partial prismatic	Non-differentiated	Total 4	Non-differentiated	Total 5	
CG1		1			1	1			1			2			3
IND				1	1					1		1			2
ISG1	1		1		2		1	1			1	3	2	2	7
OB1									1			1			1
RSG2			1		1										1
RSG3										1	1	2			2
XL	1				1					1		1			2
Total	2	1	2	1	6	1	1	1	2	3	2	10	2	2	18

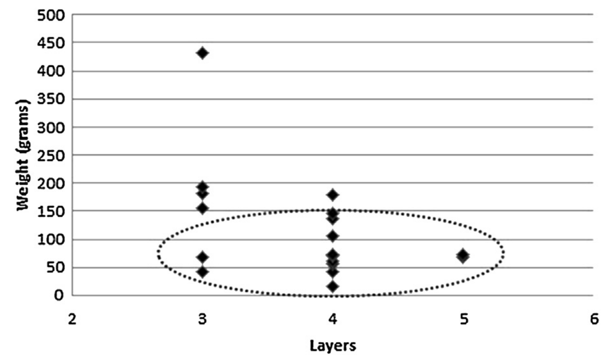

Fig. 4. Core masses in g for each layer.

is consistent with the observations on mass, i.e. there is a direct relation between the smaller elements and the lower extraction frequencies.

Regarding scar morphologies, layer 3 shows a higher proportion of mixed cores (flake and blade extractions, 33%), followed by blade cores (17%) and lower frequencies of flake cores (17%). The opposite occurs in layer 4, where the highest frequency corresponds to cores with flakes extraction (57%). In layer 5, there were only flake cores. These results show a tendency towards an increment in the extraction of elongated artifacts (e.g. blades) throughout the Holocene.

Regarding the number of striking platforms, we found a significant correlation between core volume and the number of platforms ($R = 0.40$; $p = 0.09$; $n = 18$), however, there is no correlation between the number of striking platforms and core mass ($R = 0.40$; $p = 0.12$; $n = 18$). This ambiguity in the relation between these variables can be explained by the differences in the extraction techniques that, in some cases, are oriented to blade production. Some morphological varieties, like pyramidal conical cores, irregular pyramidal cores, prismatic bidirectional and unidirectional cores, show 1 to 3 platforms, whereas other morphologies (partial prismatic and non-differentiated) include 4 to 7 platforms.

Layer 3 yielded mostly cores with 3 striking platforms (50%), made from CG1, RSG2 and petrified wood, the higher number of identified striking platforms was 5 (17%) and occurs in a single case. Layer 4 shows mainly cores with 1 or 2 striking platforms (29%) on CG1, ISG1 and RSG3 varieties. Cores with 3, 4 and 7 platforms were registered in smaller proportions (14%). In layer 5 two cores of ISG1 presented 3 and 6 platforms.

The use of ISG1 shows that in layers 3 and 4 extractions were made from a few striking platforms (1 and 2), while in layer 5 cores from this raw material have more striking platforms (3 and 6) (Table 3).

Table 3
Platform frequencies versus core morphologies (sensu Aschero, 1975, 1983).

Morphologies	Amount of striking plataforms							Total
	1	2	3	4	5	6	7	
Bifacial		1						1
Poliedric	1							1
Globular		1	1					2
Pyramidal	1							1
Irregular Pyramidal	2							2
Prismatic			1					1
Unidirectional partial prismatic		1	1					2
Bidirectional partial prismatic			1	1	1		1	4
Non-differentiated	1	1	1			1		4
Total	5	4	5	1	1	1	1	18

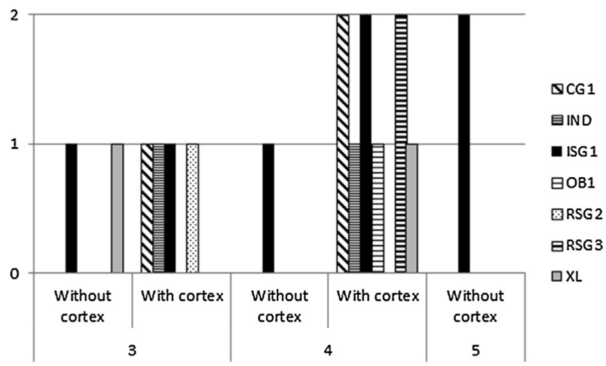

Fig. 5. Cortex remnant per raw material.

Moreover, the amount of cortex remnants shows in layers 3 and 4, cores with at least 50% of cortex (67% layer 3 and 4 layer 90%) and to a lesser extent cores without cortex (33% and 10% respectively). In layer 5, the two recovered cores have no cortex remnants.

Fig. 5 shows that in layers 3 and 4 cores from all raw material types present cortex remnant. This would be expected due to the provisioning of pebbles; however, there are some exceptions. In the case of ISG1, the presence of cortex suggests that the provisioning process would have been in LP-P1 and not in CDR (due to the lower cortex development, see Table 1), while the absence of cortex does not allow us saying otherwise. With this in mind, we propose that the provisioning of LP-P1 started at Layer 4 having no determination possibilities of prior use of this source through core analysis.

5.2. South chamber

A total of 17 cores were recovered from this chamber, 10 from AU2 (65%), 5 from AU3 (29%), and in AU4 there was a single core of ISG2 (6%) (see Table 4).

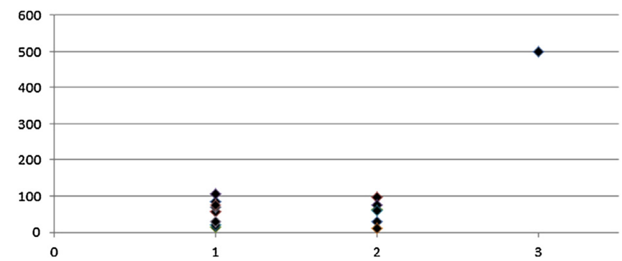

Fig. 6. Mass distribution at South chamber.

In relation to the minimum number of flake scars, in AU2 we recorded a maximum of 10 and 8 extractions per core of ISG1 and RSGX respectively. However, the main percentage represented at the sample corresponds to a minimum of 6 extractions on obsidian, RSG1 and PG1 (30%) cores. In AU3 the maximum number of flake scars identified corresponds to 7 extractions on a RSG3 core and another manufactured from an undetermined rock. However, cores with 4, 5 and 7 extractions are equally represented in the sample (33% each). Furthermore, in AU4 a minimum of 4 negative scars was recorded.

Mass distribution in cores from the South chamber shows a clear distinction: while the core from AU4 has a very high value (>500 g), those of the remaining layers do not exceed the 100 g (just one exception of 106.75 g (Fig. 6)).

We observed a significant correlation between mass and maximum length of flake scars ($R = 0.75$; $p = 0.0004$; $n = 1$, see Fig. 7). This would suggest that cores with higher mass would allow the widest and longest extractions of the total sample from South chamber.

Table 4
Raw materials and core morphologies from the South chamber's core sample.

Raw material	AU2						AU3				AU4		Grand total
	Isolated scars	Discoidal	Irregular discoidal	Irregular pyramidal	Partial prismatic	Total AU1	Irregular discoidal	Pyramidal	Irregular pyramidal	Total AU2	Isolated scars	Total AU3	
Ind	1		1			2		1		1			3
ISG1		1			1	2			1	1	1	1	4
ISG2							1			1			1
Obsidian				2		2			1	1			3
PG1			1			1							1
RSG1				1		1							1
RSG3	1					1			1	1			2
RSGx				1		1	1			1			2
Total	2	1	2	4	1	10	2	1	3	6	1	1	17

Regarding core morphologies AU2 presented a greater diversity, being irregular pyramidal cores the most represented in the sample ($n = 4$; 40%). Those classified as pyramidal are the smaller and characterized as partial, with extractions from a few platforms and in some cases with cortex remnants. In AU3, this variety is slightly more restricted being the irregular pyramidal and discoid irregular morphologies widely represented (40%); while AU4 presented a single core with isolated scars (Fig. 2C). In relation to raw materials, AU2 presents more variety, with a relatively high percentage of obsidian (28%), followed in minor proportions by ISG1 and indeterminate raw materials (18% each). All varieties of raw material from AU3 are also represented by a single specimen on each group (varieties of silicified ignimbrites and others rocks and indeterminate – 20%).

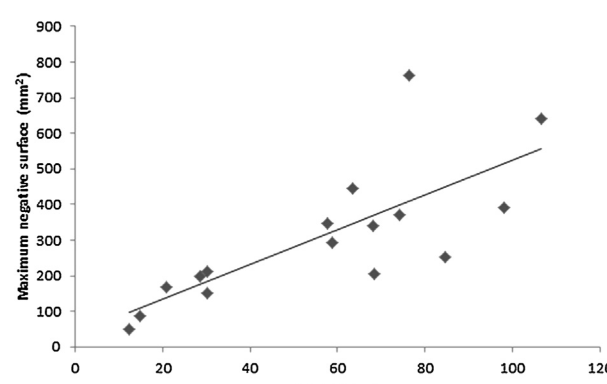

Fig. 7. Scatter graph showing correlation between volume and area of extractions.

According to the morphology of the extractions, at AU2 and AU3, flakes cores were the most represented at the sample (40% and 83% respectively). However in AU2 three types of cores (blade, flake and mixed cores) were recorded, while in AU3 mixed cores (with flakes and blades extractions) are not present, and in AU4 we only recovered a flake core.

Regarding the amount of striking platforms (Table 5), in the upper levels there is a slight increase in the number of platforms used, three being the maximum number identified in an obsidian core (AU2). In AU3 there are equal proportions of cores with 1 and 2 platforms (50%), while at the lower levels the ISG2 core recovered from AU4 had 2 platforms.

Table 5
Striking platforms frequencies versus core morphologies (sensu Aschero, 1975, 1983).

Morphologies	Amount of striking platforms			Total
	1	2	3	
Isolated scars	1	2		3
Discoidal	1			1
Irregular discoidal	2	2		4
Pyramidal	1			1
Irregular Pyramidal	4	2	1	7
Partial prismatic		1		1
Total	9	7	1	17

The amount of cortex remnant registered in each core shows that these artifacts had at least 50% cortex, while in AU2 just one core of indeterminate raw material due to thermal alteration processes exceeded this percentage (Fig. 8). In AU2 and AU3, as in the north chamber, ISG1 cores both with and without cortex remnants were recorded. This suggests that since the middle Holocene, raw materials from LP-P1 would have been used as a source of supply. It was not possible to make this assertion regarding CDR due to the minor cortex development (see Table 1). The reduction sequence of the obsidian cores shows that cortex removal was not an essential step, as cores of the two upper Analytic Units show cortex remnants, while its absence in other obsidian cores would be a result of use through perimeter removals.

6. Discussion

The cores assemblages recovered from Maripe Cave site have allowed us identifying certain differences concerning the diverse human occupations, which respond to differential behaviors relative to intrasite space use, regional resources management, and raw material availability through time. At the early occupations recorded at Component 1, cores frequencies identified in both chambers are lower than in subsequent occupations. The low frequency of cores in this period is consistent with the low artifact frequency registered at a regional scale (Miotti and Cattáneo, 1997; Cattáneo, 2004; Paunero et al. 2004, 2007; Frank et al. 2007; Skarbun et al. 2007; Skarbun, 2011). The uneven distribution of cores inside the cave is striking. The North chamber cores were knapped from well distributed raw material (ISG1), are highly exhausted and assignable to a provisioning individuals strategy (*sensu* Kuhn, 1995); while an ISG2 core was deposited in the South chamber with great potential utility. As mentioned, this raw material is available at 200 m distance, and practically it was not used in following occupations. Considering that at the North chamber the sample of cores is divided between those abandoned with potential utility and the exhausted cores at 150 g, how to interpret the presence of a single massive core in the South Chamber at AU4? This situation can be interpreted as part of a place provisioning strategy, due to its high mass, few extractions and the absence of flaking products; furthermore the presence of a single core at Component 1 is insufficient to consider it as evidence of either provisioning strategy. However, these results are consistent with expectations about high mobility during Pleistocene–Holocene transition and early Holocene at Patagonia (Borrero, 1989–1990; Franco, 2002; Civalero and Franco, 2003; Miotti and Salemme, 2004). Thus, the ISG2's core could be thought as the abandonment of the object at the first cave occupation, with the aim to mark the inner space with a rock sample from the nearest source.

The high availability of good quality raw materials at the Deseado Massif (Magnin this volume) makes difficult to raise the hypothesis of a differential selection of raw material. However, at the initial occupations of the cave, the presence of cores from immediately available raw materials, such as ISG1 from CDR, would be indicating a preferential selection related to a lower cost of production. At later times, and following the hypotheses raised at the beginning of this work, the hunter-gatherer groups would have acquired a greater knowledge of the area, generating a territorial consolidation process that would be associated to an increment in the interactions with other mobile groups (Borrero, 1999; Miotti and Salemme, 2004). At Maripe Cave site this interaction would be represented by non-local objects such as obsidian, raw material that usually indicates mobility or exchange from the Andean region (Espinosa and Goñi, 1999; Stern, 1999, 2000, 2004; Civalero and Franco, 2003; Franco and Aragón, 2004; Belardi et al. 2006; Miotti, 2008; Hermo and Miotti, 2011; Hermo and Magnin, 2012; Miotti et al., 2014). The higher diversity of both core morphology and raw material types occurs during mid-Holocene, when according to the other recovered materials, the human occupation intensity at the cave would have been higher (see Hermo and Magnin, 2012; Lynch, 2013; Miotti et al. 2014; Hermo et al. 2014).

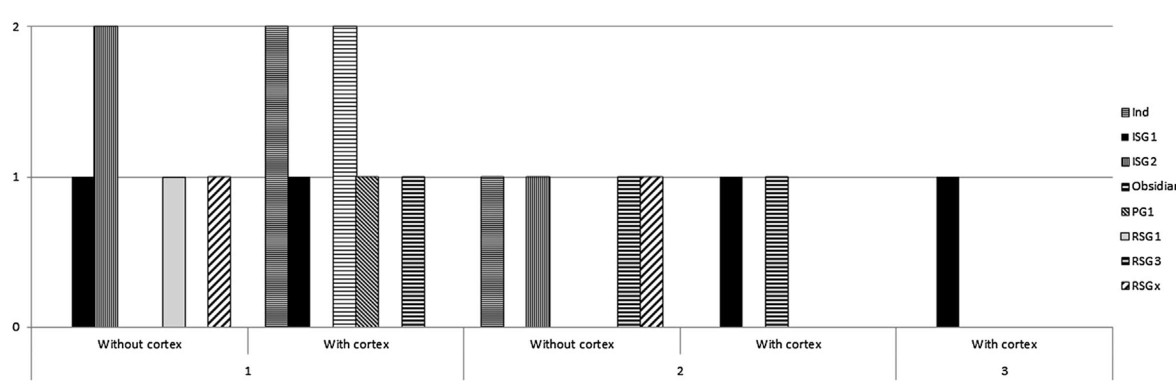

Fig. 8. Distribution of cortex presence and raw materials in South chamber.

This period shows cores prepared to remove elongated shapes (e.g. blades) from few platforms and perimeter or frontal extractions, although cores used to remove flakes still predominate. It is also in Component 2 that the presence of cortex was detected in ISG1 cores, which may suggest the beginnings of the use of more than one provisioning source (CDR and LP-P1). Other analyses (i.e. refitting) need to be carried out to corroborate this idea, since in North Chamber (Hermo et al., 2014) the cortical debitage proportions of ISG1 from layers 4 and 5 are similar (near 17.5%).

How was non-local raw material such as obsidian used? The cores elaborated on this rock correspond to those with less mass and volume. Would this be a characteristic trait of this raw material in its natural state? Or would it be a result of the intensive use of this resource because of its good qualities? According to our current knowledge, it is possible to consider that the main form of provisioning and distribution of this rock would be in small pebbles from Pampa del Asador (Espinosa and Goñi, 1999; Stern, 1999, 2000, 2004; Civalero and Franco, 2003; Franco and Aragón, 2004; Belardi et al. 2006). Both the presence of cortex, which in all cores from Maripe Cave corresponds to less than 50% on each piece, and the remainder of the lithic artifacts, show a trend toward small sizes and cortex presence, which validates the previous idea. Regarding the extraction morphologies, we can say that during first moments of human occupations, exclusively flake extractions would have been made. Towards the middle and late Holocene an increase in blade frequencies is recorded (see Hermo and Magnin, 2012; Hermo et al. 2014; for more regional information). Many researchers consider that this type of extraction is associated to a resources maximization technique (Kelly, 1988; Nelson, 1991; Kuhn, 1995), however due to the high availability of raw materials at the Deseado Massif; it is difficult to support this hypothesis. Blade technology would not be related to critical resources issues but rather to their shapes and functions. More intense human occupations, corresponding to middle Holocene, show cores of larger sizes with an increment of mass and volume. In these levels two cores whose mass exceeded 500 g were recorded; the particular characteristics of these elements indicate that the ability to obtain blanks would not have been invested in them, which would support the idea of a place provisioning (Kuhn 1995, 2004).

Regarding Component 1, UA2 cores had masses less than 150 g, while at Layer 3 of CN masses are higher. We interpret these differences as result of the original mass volume, and not because of their exploitation, due to the CN cores show higher use intensity (i.e. more quantities of platforms and frequencies of negative scars). In turn, the frequencies of obsidian cores are equal to Component 2, representing the continuity of goods circulation with Andean region.

Therefore, there are some differences in core morphologies in each chamber: while at CN most forms correspond to the extraction of elongated shapes, on CS these morphologies represent half of the whole. This indicates an interdigitation between the extreme strategies of provisioning proposed by Kuhn.

7. Final considerations

Considering the model proposed above of different strategies of raw material provisioning in hunter-gatherer groups; the Maripe Cave assemblages suggest that in the early occupations, the scarcity of cores would be related to the use of "personal gear" *sensu* Binford (1977, 1979). However, they may have acted as a signal indicating the nearby availability of raw material. The analysis of cores recovered at Maripe Cave site, leads to the conclusion that there is a relation between the duration of occupational events and their frequencies.

The set of cores with remaining potential utility, here treated as result of place provisioning, were registered in Component 1, where also cores which cause of discard was probably exhaustion are present, and that we interpreted as related to personal toolkits. Thus, these cores would arrived to Maripe Cave as part of the toolkits discarded by the first occupants, while they would had pointed out the possibility of obtaining raw materials in the vicinity. During the middle Holocene, with more redundant occupations, showing an importance in blade extraction and long distance raw materials, core discard would be mainly associated to personal artifacts disposal as well as of elements with remaining potential utility, mainly in the North chamber. Finally, the assemblage from Component 3 shows a greater frequency of cores prepared for blade removal. The set of cores contains similarities in size with what we observed for the previous temporal block, even with the presence of an element of high mass interpreted as raw material reserve.

Finally, the theoretical expectations about human mobility indicate that the decrease of residential mobility and an increment in the duration of human occupation would increase the dependence on the provisioning of places and the mean transport distances and as a result, the provisioning of individuals decreases. In this sense, individuals' provisioning distances would be greater in relation to the transportation cost. Our results do not entirely accord with Kuhn's model, probably due to the characteristic polarization of the theoretical models.

To conclude, we think that the ideas here presented constitute an interesting start point to evaluate the ways in which lithic resources were used by past societies. The next steps in our research will be to check these ideas, reducing possible palimpsest effects, through intrasite comparisons.

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