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Coastal sites in southern Buenos Aires: A review of 'Piedras Quebradas'

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ABSTRACT: In this paper, a group of coastal sites in southwestern Buenos Aires Province is discussed. This area is interpreted as a source of lithic materials, related to procurement of coarse quartzite fluvial gravels. A depositional model for the Late Pleistocene-Holocene of the area is presented. In this model, the distribution of fluvial gravels is associated with the incision and filling of ancient valleys of the Río Sauce Grande as a result of relative sea level changes.

RESUMEN: En este trabajo se presenta un conjunto de sitios costeros del SW de la Provincia de Buenos Aires. Se interpreta el área como una zona de aprovisionamiento de materia prima lítica, vinculada con la disponibilidad localizada de rodados cuarcíticos fluviales. Se propone un modelo depositacional para el Pleistoceno Tardío-Holoceno del área. En este modelo la distribución de los rodados fluviales se vincula con la incisión y relleno de antiguos valles del Río Sauce Grande y con cambios relativos en el nivel del mar.

1 INTRODUCTION

The coastal sites of Buenos Aires province have been the subject of much controversy since the beginning of archaeological research in Argentina. Two areas have been the most controversial: The coastal cliff area between Mar del Plata and Miramar, and the Southwestern Monte Hermoso cliffs. Argument began at the beginning of the century when Florentino Ameghino (1913a), as well as others, reported the existence of archaeological materials at Monte Hermoso, that were significantly different from materials found in other coastal sites.

This area was visited repeatedly by many researchers until the 1940's (Ameghino 1913b, Hrdlicka 1912, Holmes 1912, Kantor 1922, Imbelloni

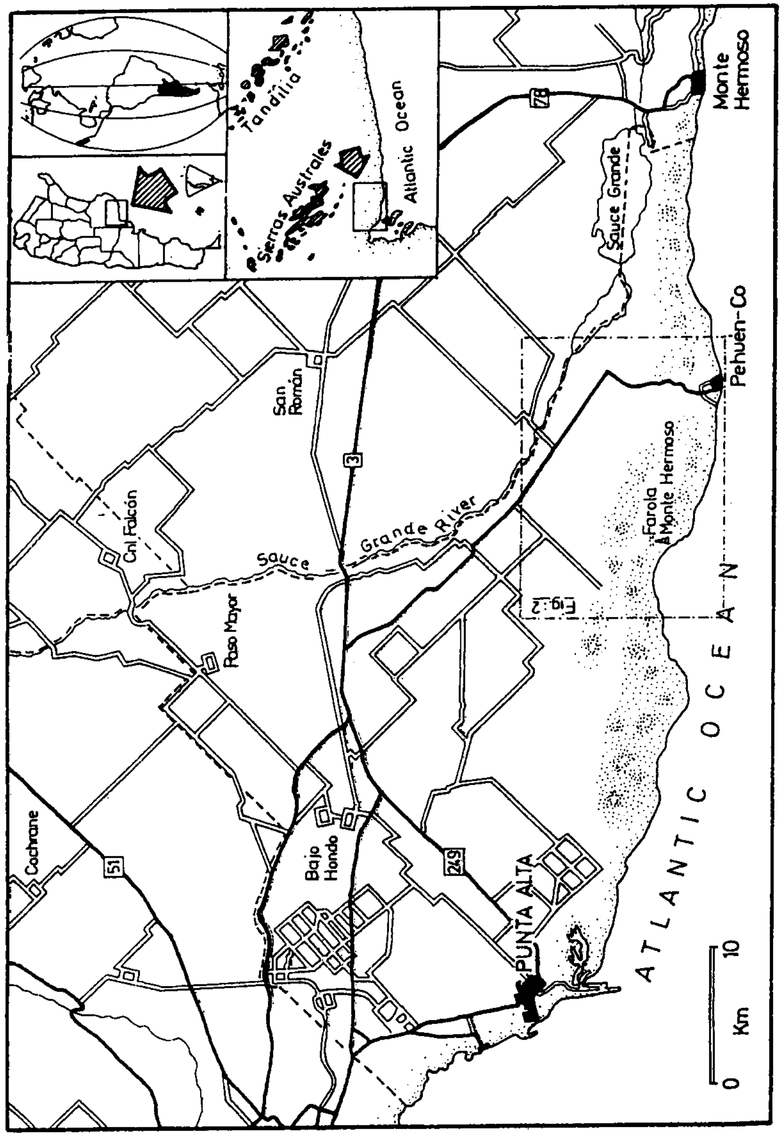

Figure 1. Location of the study area.

1931, Aparicio 1925, 1932, Vignati 1947), but the research conducted was not very systematic.

In 1989, we began our research, with the aim of solving this old issue. In this paper we propose the hypothesis that this coastal area was a source of lithic materials, related to procurement coarse quartzite fluvial gravels. Six very similar sites along 13 km of the coastline have been identified and their distribution coincides with the dispersion area of such gravels (Fig. 1). Previously, the materials from the Farola Monte Hermoso site have been subject to different interpretations. For Ameghino, they were the remnants of a very primitive and ancient industry. For Kantor, they were rocks fractured as a result of temperature changes. For Holmes and others, they were waste from a lithic workshop.

The sites we are presenting in this paper are characterized by the presence of flakes and cores manufactured from fluvial gravels. Artifacts made from coastal basaltic pebbles or fine-grain quartzite are scarce (Hrdlicka 1912). The main technique employed was direct percussion, with a low incidence of bipolar flaking.

These characteristics of the raw materials differentiate the Monte Hermoso sites from most of the coastal sites that have been published for the Southern Buenos Aires province. These are surface sites related to littoral dunes (Ameghino 1913c, Hrdlicka 1912, Aparicio 1925, 1932, Austral 1965, Conlazo 1983). In these sites, tools and debitage of basaltic pebbles and fine-grain quartzite are found. The quartzite was transported by man from the mountain ranges to the littoral dunes. The basaltic pebbles were collected in the coastal area and were often subjected to bipolar flaking.

Since the beginning of our research, we have been interested in geological and cultural site formation processes; our aim was to obtain information on the palaeoenvironmental conditions and landscape evolution, correlating the identified stratigraphic units at local, areal, and regional scales; to establish the chronological relationship among them; and to know the availability of raw material in the area. This research has resulted in the proposal of a model for the palaeoenvironmental evolution of the area during the Late Pleistocene.

2 BACKGROUND

As stated before, the archaeological research in the coastal area began with the work of F. Ameghino. In 1909 and 1910, he reported the existence of two 'industries' in the coastal area, which he named 'Industria de la Piedra Hendida' and 'Industria de la Piedra Quebrada'. He proposed the first 'industry' based upon sites near Mar del Plata (Ameghino 1913c), which contained coastal basaltic pebbles flaked by the bipolar technique. He considered this a very ancient and 'primitive' industry.

Ameghino did not take into account the presence of artifacts made from fine-grain quartzite in these sites, and totally dissociated them from the known sites in the hinterland. He designated the 'Industria de la Piedra Quebrada' on the basis of the findings at Farola Monte Hermoso. It is worth mentioning that the site has been known since the beginning of the 19th century by its palaeontological richness and was visited by Charles Darwin among others. In 1910 Ameghino stated: 'Es la industria de la piedra más primitiva que conozco y me resulta imposible imaginar algo más simple' ('It is the most primitive stone industry that I have ever seen and it is difficult to think of something simpler'; Ameghino 1913b). He characterized it by the presence of pebble fragments with evidence of impact, of numerous cortical flakes, and by the absence of tools. He compared these findings to others from his earlier visits to this site. In previous work, Ameghino (1913a) had made reference to the existence of materials of anthropic origin – flaked rocks, longitudinally splintered bones, and even hearths – in lower silty deposits. In his stratigraphic scheme, such layers were considered from the Miocene. He assigned the presence of man in the region to the Late Miocene.

These statements generated an interesting and prolonged controversy regarding the antiquity of man in the pampas (Daino 1979). His interpretations were revised, at first by Outes (1909) and Hrdlicka (1912). The former reviewed the sites further along the northern coast, which will not be summarized here. A. Hrdlicka, who together with B. Willis and F. Ameghino examined the coastline from Mar del Plata to the Río Negro, also differentiated the materials in Farola Monte Hermoso from those in the rest of the coastline. He stated that he could find artifacts made from neither coastal basaltic pebbles ('black', according to his denomination) nor from fine-grain quartzite ('white'). Also, no anvil-artifacts associated with the bipolar technique were found. He disagreed with the age proposed by F. Ameghino and attributed the sites to more recent times. According to Holmes (1912), who studied the lithic collection gathered by A. Hrdlicka, in Farola Monte Hermoso a variety of quartzites were flaked, that were generally used for tool such as anvils, grinding stones and hammerstones. He interpreted the debitage in the site as the byproducts of such activity. He proposed that this type of debitage is frequently found in other places, such as along some rivers of the United States. In turn, Willis (1912) disagreed with any claim of antiquity and suggested that the sites were related to the historical natives who used the coast as a route for their attacks upon white settlements. Kantor (1922) even proposed that the quartzite fragments from Monte Hermoso were the results of temperature variations. In the following years, all the findings made along the coast of Buenos Aires were subject of strong controversy. The more questioned sites were those of Miramar and Farola Monte Hermoso.

In 1924, F. Aparicio, J. Imbelloni and J. Frenguelli, reviewed the southern Atlantic littoral, hoping to give a 'definitive explanation' of the polemical findings. Imbelloni (1931) and Aparicio (1925, 1932) agreed that the 'Industria de la Piedra Quebrada' was nothing but the waste from prehistoric workshops, and similar to all other sites of the Atlantic littoral. They proposed that the settlement was located on the denuded surface of ancient dunes and had been covered by more recent dunes. Regarding its antiquity, they stated that it could not be as old as suggested by F. Ameghino or as recent as proposed by American researchers. Vignati (1947) proposed that the gravel layer containing the archaeological materials was of fluvial and not of aeolian origin, as initially believed. However, he agreed that the materials represented workshop waste.

A common concern of the researchers who visited the Monte Hermoso cliffs was the stratigraphic situation of the archaeological materials, which were related to the gravel unit. However, no excavations were conducted at the site to assess their position. Another particularly controversial subject concerned the age of the different strata.

Later, the site was visited for its palaeontological importance (Kraglievich 1946, Bonaparte 1960, Fidalgo & Tonni 1982), but these studies did not result in contributions concerning human settlement.

Another subject involving the coastal issue is the association between coast and plain, which was interpreted in very different ways in Pampean archaeology. This subject has been reviewed by Daino (1979) and Politis (1984). Several authors have postulated the presence of specifically coastal 'industries' completely different from those of the plains (Bórmida 1964, Menghin 1963, Conlazo 1983). Austral (1965) proposed that in southwestern Buenos Aires a 'mixed' situation with coastal and hinterland influences would have developed. The sites reported as having this 'mixture' are located in the continental limits of the coastal dune range.

For other authors the coastal area of Buenos Aires has been a source of raw materials for the inhabitants of the plains, who would make use of the coastal pebbles transported from Patagonia by littoral drift (Holmes 1912, Hrdlicka 1912, Aparicio 1925, 1932, Imbelloni 1931, Vignati 1947).

Also, utilization of marine mammals (Holmes 1912) and coastal pebbles by the plains' groups was proposed as an embedded strategy. This hypothesis was developed by Politis (1986). The findings at the La Olla site, where several dozen seals are represented (Politis & Lozano 1988, Politis et al. 1994) support this proposal.

3 DESCRIPTION OF THE COAST BETWEEN PUNTA TEJADA AND MONTE HERMOSO

The area under study extends along the Atlantic coast between long. 61° and 62°W. Geologically, it is adjacent to the NW margin of the Río Colorado Geologic Basin.

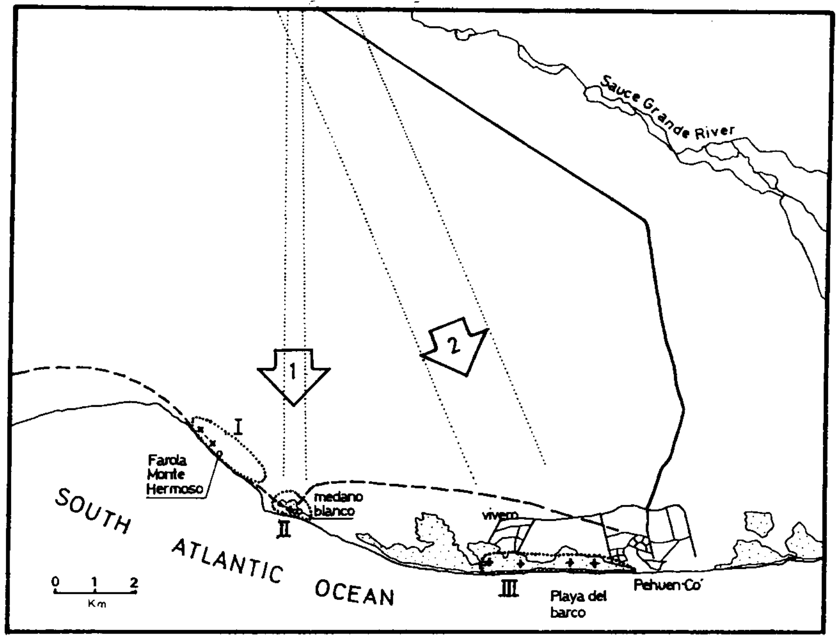

Figure 2. Location map of the three archaeological areas studied.

The littoral morphology presents three well defined areas: Shoreline, marine-cliffs, and coastal sand-dunes. The shoreline exhibits few irregularities. Sporadically, Plio-Pleistocene rocks outcrop in the abrasion platforms. Occasionally, scattered quartzite pebbles can be recognized. These are localized in three areas (Fig. 2).

The marine cliffs are located only in the area of Farola Monte Hermoso (Fig. 2, I). Their maximum height is 12 m, and they extend for 3 km. They have a predominant lineal NW-SE arrangement. They are made up of two sections separated by about 600 m, where the littoral dunes reach the present abrasion platform. The NW section is more extensive with thicker outcrops.

Stratigraphic analysis of the cliffs (Zavala 1993) enabled us to recognize three geologic formations: the Monte Hermoso Fm., the Puerto Belgrano Fm., and the Punta Tejada Fm (Fig. 3).

The Monte Hermoso Fm. outcrops in the abrasion platform and in the lower part of the cliff forms a step (Fig. 4C). It comprises 6 meter-thick grayish-orange coloured muddy siltstones and fine-grained sandstones. This unit is interpreted as having been deposited in a meandering fluvial environment with a high suspended-sediment load (Fig 5A). Its age is Early-Middle Pliocene.

The Puerto Belgrano Fm. is located in the middle part of the cliff (Fig. 4C). It is composed of gray medium-to-coarse sandstones, and is 4.5 m

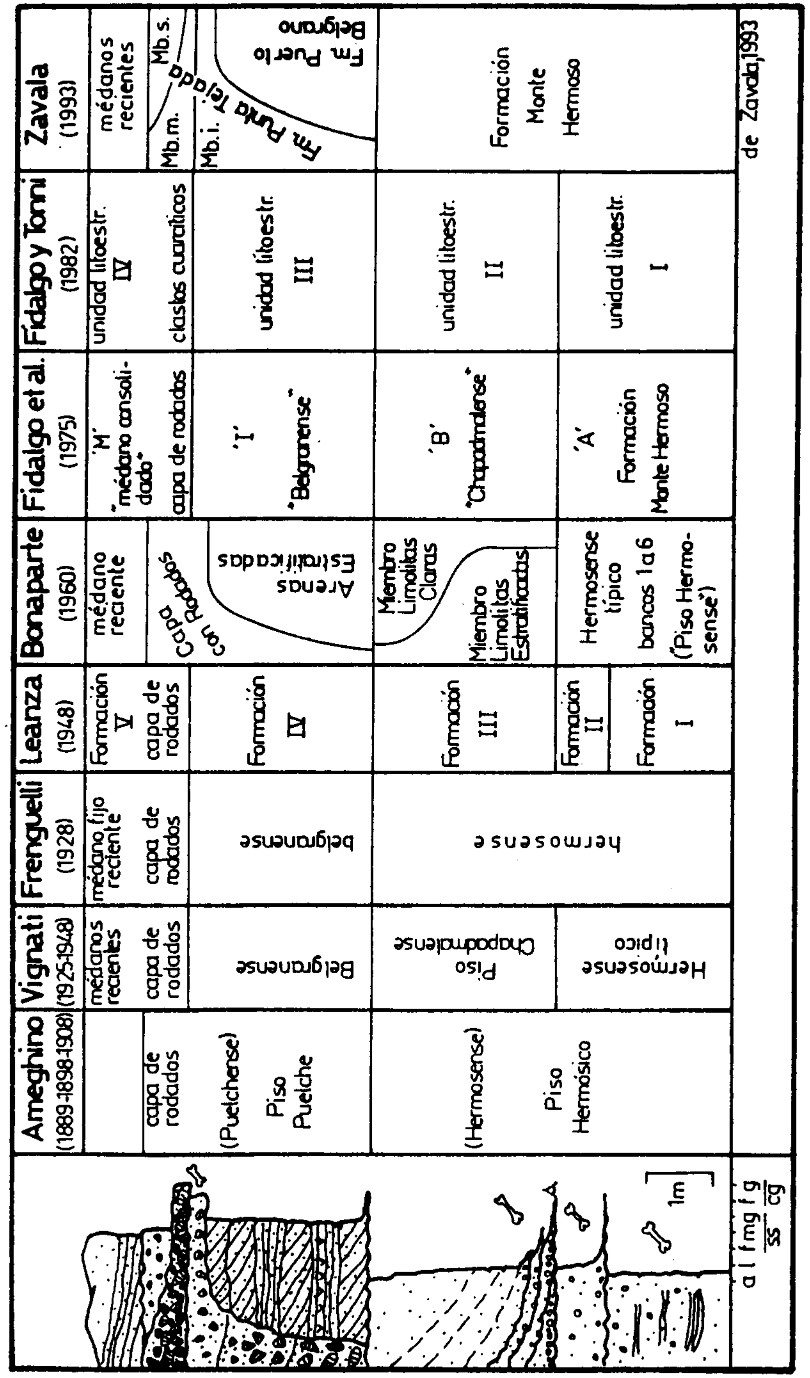

Figure 3. Farola Monte Hermoso (Area I), stratigraphy of the site.

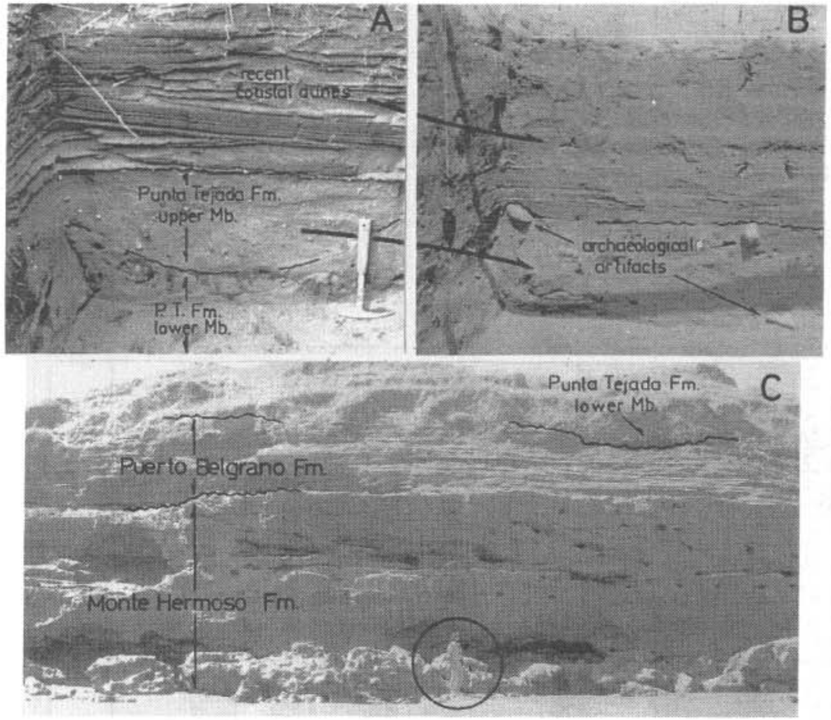

Figure 4. Farola Monte Hermoso stratigraphy.

thick. This sandy unit lies unconformably over Monte Hermoso Fm. It is interpreted as having been deposited in an aeolian environment (Fig. 5B). Its age is Pleistocene.

The Punta Tejada Fm. has three members (Fig. 3). The Lower Member (Pleistocene) rests with a strongly erosive base on the Monte Hermoso and Puerto Belgrano Formations. It corresponds to matrix supported breccias with big intraclasts of the lower units. It is interpreted as having been deposited by debris flows generated by erosive processes and has a marked relief (Fig. 5C).

The Middle Member (Pleistocene) is integrated with clast support conglomerates. The clasts are mainly of the Puerto Belgrano Fm. and contain quartzite pebbles. It is interpreted as having been deposited by ephemeral fluvial currents coming from the northeast (Fig. 5D).

The Upper Member (Early?-Middle Holocene) rests unconformably on the previous unit, with wedge-like geometry (Fig. 4A). It is composed of sandy material with dispersed gravel. Scarce shells of *Brachidontes rodriguezi* (D'Orbigny), *Amiantis purpurata* (Lammark), and remnants of indeterminate bivalve shells are also present (E. Farinatti, pers. comm.). The

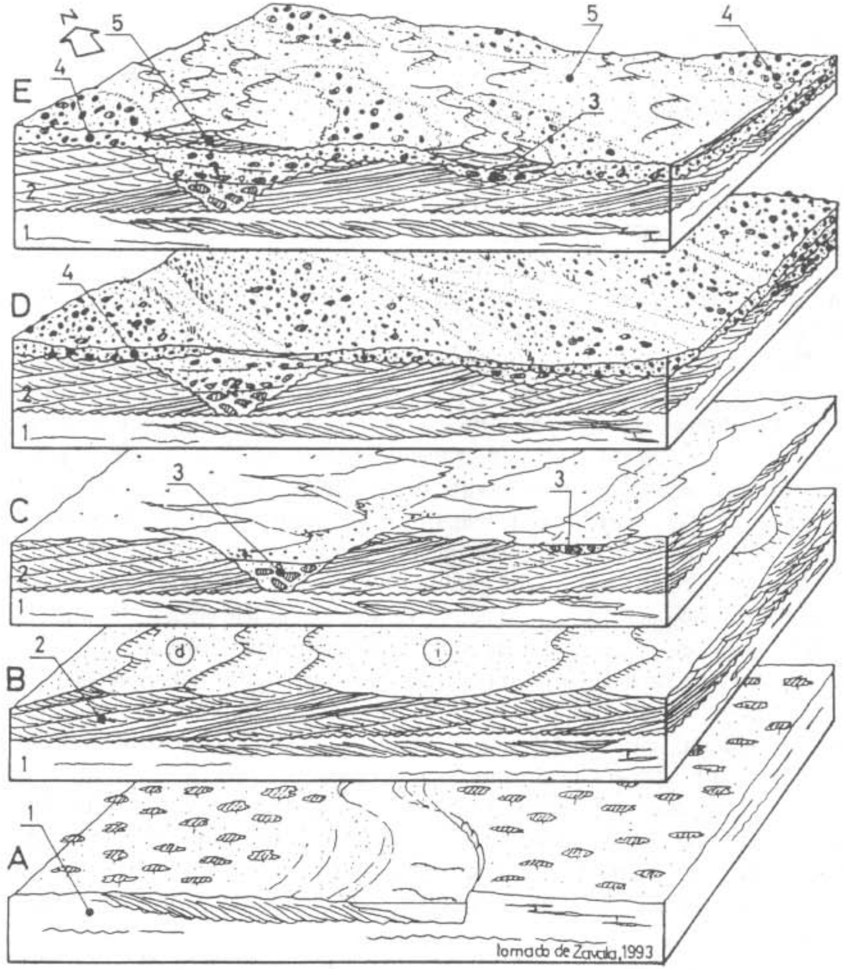

Figure 5. Farola Monte Hermoso, showing the major stratigraphic units: A) Early-Middle Pliocene; B-D) Late Pleistocene; E) Early (?)-Middle Holocene. 1. Monte Hermoso Fm; 2. Puerto Belgrano Fm; 3. Punta Tejada Fm (Lower Member); 4. Punta Tejada Fm (Middle Member); 5. Punta Tejada Fm (Upper Member).

gravel is integrated by small-sized quartzite pebbles of the lower unit and archaeological material (Fig. 4B), which is distributed vertically throughout the unit. The findings consist of flakes, cores, and chunks. They are interpreted as residual deposits of aeolian origin and anthropic clastic supplies (Fig. 5E).

The present fixed dunes are located on these units.

Coastal sand-dunes exhibit a wavy relief. The dunes are mainly of the barjan type with an amplitude of 8 to 10 m and a wave length of a few hundred meters. The interdune areas are low and dry, and have experienced deflationary processes. The interdunal areas in Sections II and III (Fig. 2) show superficial accumulations of quartzite pebbles, many of which are flaked. Dunes with and without incipient vegetation are recognized.

4 DEPOSITIONAL MODEL FOR THE LATE PLEISTOCENE – HOLOCENE OF THE AREA

In order to achieve the goals set at the beginning of the research for the geoarchaeological work, a depositional model for the area is presented.

The clastic materials used by prehistoric groups were transported to this site by the Río Sauce Grande, which is the main waterway in the region (Fig. 1). It flows out into the Atlantic Ocean after covering over 218 km from its source at the eastern side of the Ventana Range. Many authors have already suggested that ancient mouths of the Río Sauce Grande were located westward of the present one (Bonaparte 1960, Frenguelli 1928, Vega et al. 1989, Schillizzi et al. 1992, Quattrocchio et al. in press). In the proposed model the distribution of fluvial pebbles used as raw materials is associated with the incision and filling of ancient valleys of the Río Sauce Grande, related to relative sea level changes during the Pleistocene-Holocene.

The first incision has been recorded in Area II, Médano Blanco (Fig. 2), 2500 m west of Farola Monte Hermoso. This incision is attributed to an episode of relative sea level fall during the Pleistocene. The erosion level did not exceed the elevation of the present coastline.

The filling occurred during a following stage of relative sea level rise. These are deposits of braided rivers (Middle Member of the Punta Tejada Fm.), which are correlated to older gravelly fluvial terraces, recognized in the middle valley of the Río Sauce Grande (Furque 1967, 1974, Borromei 1989).

The second incision is located further to the west – Area III – (Fig. 2). This incision is associated with a relative fall in sea level, that is more pronounced than the previous one, during the Pleistocene. The base of the valley is located under the present shoreline.

The filling of this valley occurred during the onset of the relative sea level rise. These deposits correspond to braided rivers. They are correlated with similar deposits located in terraces in the valley of the Río Sauce Grande (Borromei 1989, Rabassa 1989). In the area of Playa del Barco – Area III – (Fig. 2), marine deposits unconformally overlie the fluvial deposits (Vega et al. 1989) with a ravinement surface. This is recognized as a transgression and later regression event. This transgression excavated a palaeocliff that partially coincides with the one exposed at present at Farola Monte Hermoso. Figure 2 shows the inferred extent of these palaeocliffs.

The Holocene transgression also excavated abrasion palaeo-platforms.

Overlying the platforms, thin consolidated residual deposits of coarse sandstone with quartzite pebbles and shell detritus were found.

This transgression had great importance in the conformation of the present coast. The abrasion platforms were covered progressively by littoral dunes as the sea level dropped. Occasionally, fluvial pebbles were introduced from the palaeocliffs by ephemeral fluvial waterways.

The main advance of littoral dunes coincided with the retreat of the Holocene transgression. This in turn is linked with a regional climatic deterioration occurred during the last 3500 years (Borromei 1992).

The major part of the clastic material utilized by the prehistoric communities comes from the fluvial deposits of the ancient incisions.

5 THE ARCHAEOLOGICAL SITES

Archaeological material appears in three areas between Farola Monte Hermoso and Pehuen-Có. Its location coincides with the dispersion areas of the quartzite pebbles – I, II and III – (Fig. 2) originating from the fill deposits of the fluvial valleys of the Río Sauce Grande and their removal. In Areas II and III (Fig. 2), superficial sites were located; in Farola Monte Hermoso (Fig. 2, I), part of the materials appear in a stratigraphic situation.

5.1 *Methodology*

Survey from Area II to Area III followed a transect parallel to the coastline. In zones containing concentrations of archaeological material, 2 × 2 m sampling areas were set up and all the lithic artifacts were gathered. Test pits were excavated.

Survey of Area I, which coincides with the outcrops of Farola Monte Hermoso, was more complex: 2 × 2 m sampling stations were set up every 50 m at the front of the cliff, along the length of the outcrop; and 1 × 1 m probing stations every 100 m in a transect parallel to the outcrop. Also, three 2 × 2 m grids were excavated following natural stratigraphic units. The materials were recovered in their vertical and horizontal positions.

5.2 *Area I (FMH)*

The distribution of the materials in the front of the cliff is continuous along 750 m, to the West of the beacon. There are two main areas of concentration separated by 350 m. There are no archaeological remains in the surface of the dunes or in the interdunes along the whole outcrop (Fig. 2, I).

Archaeological remains are in stratigraphic position. The presence of exposed archaeological materials at the front of the cliff is a consequence of the differential retraction of the unconsolidated sandy sediments.

5.3 *Area II – Médano Blanco*

The archaeological materials appear only surficially, on an outcrop of fluvial deposits originated in the first incision. This is an elevated section and is located at the front of an active dune. It occupies an area of about 3000 m^2. The surficial pebbles are of big size, some of which have been flaked. The thickness of the fluvial deposit has been assessed by means of a test pit. Over 2,70 m of gravel and fluvial sands were recognized, laying in unconformity on Pliocene deposits. In the area covered by Areas II and III no gravel material was found (Fig.2, II).

5.4 *Area III*

Archaeological remains appear in the interdunes of the littoral dunes along approximately 3500 m. Four main concentrations have been detected (Fig. 2, III). The pebbles were introduced by ephemeral currents and concentrated in the interdune by deflationary processes.

6 ANALYSIS OF THE MATERIALS

The excavation area at Farola Monte Hermoso (Area I) and the surficial site of Médano Blanco (Area II) were selected for the comparison of the materials from the different sites. The latter was chosen for being the farthest from the touristic residential area of Pehuen-Có and therefore the less disturbed site. We will describe the most significant features of the flaked materials, which are common to all the aforementioned sites.

6.1 *Raw materials*

The artifacts were separated according to different types of raw material. Six types were recognized: Quartzite, milky quartz, subarkose, chert?, chalcedonies and basalt. The quartzites, which are the most plentiful group, were subdivided into six varieties. Macroscopic criteria used are quality of the conchoidal fracture, grain size and colour.

Metaquartzite: It comprises varieties 1 to 5. It includes a set of rocks that present a typical quartzite aspect; they are massive, fine to medium grained, of variable colours – purple, gray, beige – and of irregular to slightly conchoidal fracture. In thin sections they are mainly composed of quartz, up to 95% – and of variable quantities of recrystallized matrix: 5 to 25%. They show evidence of deformation and recrystallization with development of anisotropies by preferential mineral orientation, slip surfaces, inter- and intracrystalline fractures and associated effects; therefore, they are a raw material of low quality. Tentatively they are assigned to degree 4.5 to 5.5 of the Callahan scale (Callahan 1979). This would be a 'regular' raw material in the sense used by Nami (1986).

Orthoquartzite: Variety 6. Massive, medium grained very cohesive rock, with a white glassy translucent shine and conchoidal fracture. Formed almost exclusively by quartz grains and totally cemented by secondary quartz preserved as rims of the original grain. Although it shows evidence of deformation and recrystallization, the strong siliceous cementation gives a good conchoidal fracture. Tentatively, it is assigned to degree 4 of the Callahan scale.

Subarkose: Massive rocks of quartzite aspect, subconchoidal fracture, dark green in color and fine to medium grained. A sample presents primary anisotropies (stratification surfaces). The composition in thin sections shows a high proportion of quartz – up to 70%, feldspar: Plagioclase and scarce microcline (20%) and chloritoid matrix. A degree of 4.5 of Callahan scale is tentatively assigned.

Basalt: Microporphyric textured rock, homogeneous, black in color and with conchoidal fracture. Degree 4 of Callahan scale.

Chalcedonies: A variety of microcrystalline fibrous silica; very good conchoidal fracture; translucent and of homogeneous texture. Degree 3.5 of Callahan scale.

Chert: A variety of micro silica or a cryptocrystalline; beige in colour, homogeneous, dense, with very good conchoidal fracture; with argillaceous and carbonitic (?) impurities. Degree 3 of Callahan scale.

Milky Quartz: Degree 4.5 of Callahan scale.

The utilization of the several varieties of quartzite was differential (Table 1).

Table 1. Rocks diversity.

Type		FMH		MB	
		Flakes	Cores	Flakes	Cores
Quartz		2	–	–	–
Basalt		1	–	–	1
Chalcedony		1	–	–	–
Chert		–	–	1	–
Subarkose		9	6	7	4
Quartzite:	var. 1	55	6	25	2
	var. 4	36	4	15	7
	var. 3	26	2	10	1
	var. 5	26	5	3	0
	var. 2	20	5	16	2
	var. 6	3	–	–	–

Farola Monte Hermoso (FMH) N = 217; Médano Blanco (MB) N = 94

Five of the varieties of quartzite, the subarkose and the quartz are originated in pebbles from rocks of the Ventania system carried over by the Río Sauce Grande during the first and the second incisions of the valley and redistributed all over the area during the Holocene.

The basalt was redistributed by the littoral dynamics from the mouth of the Río Colorado towards this region. The basaltic materials are more abundant in the sites of Area III. At present the possibility of gathering basaltic pebbles in the area is low. During a survey over 3 km of shore we only found 12 clasts of adequate size.

Quartzite variety 6 and chert apparently do not belong to this region, and can be considered as allochthonous raw materials. Variety 6 presents some petrographic features similar to those observed in quartzites of the Tandilia system.

The allochtonous materials are very scarce: In Farola Monte Hermoso they constitute 1.38% (N = 217) of the total sample, whereas in Médano Blanco this percentage is 1.06% (N = 94).

In all cases the total is given as cores and flakes. Chunks were not considered.

6.2 *Tools*

Tools constitute 5.06% of the findings in Farola Monte Hermoso (N = 217). The few that have been recovered present a marginal retouch: An alternate sidescraper made from a flake of red quartzite – Variety 4 – (Fig. 6e), an endscraper on a cortical basalt flake (this was the only finding made of this raw material) (Fig. 6b), a pink quartzite flake – Variety 3 – (Fig. 6d) with wavy cutting edge. Also, eight flakes with marginal edge retouch were found (Fig. 6c). In the surface sites the proportion is similar. In Médano Blanco – Area II – a small yellow chert endscraper (Fig. 6a) and three flakes with marginal retouch were recovered: 4.25% (N = 94).

6.3 *Cores*

These are made from pebbles and big nodular flakes (Figs 7-10). In Unit E, Farola Monte Hermoso, no pebbles large enough to be flaked were found, nor are they visible along the outcrop (Table 2).

Table 2. Cores.

Type	FHM	MB
Pebbles	22	12
Nodular flakes	7	5
Tabular clast	1	0

Farola Monte Hermoso (FMH) N = 30; Médano Blanco (MB) N = 17.

6.4 *Platforms*

The extractions were preferently made using natural surfaces (Table 3, Figs 7, 8b and 9a-c). Also, in the 50% of the cores from Farola Monte Hermoso and 29.41% from Médano Blanco, impact points of repeatedly failed percussions were observed (Fig. 7, photo).

6.5 *Reduction techniques*

Cores with multifacial multidirectional extractions are predominant (Figs 7, 8b, 9a-c and 10b). They have polyhedric form or are amorphous (Farola Monte Hermoso: 44,12 %, Médano Blanco: 76,47%). Though the bipolar technique has been also applied for the reduction of some quartzite cores (Figs 8b and 10a) (Farola Monte Hermoso:11,76%, Médano Blanco: 17,65%).

6.6 *Core size*

The size of the cores is between 33 and 130 mm, with a mean value of 65 mm.

6.7 *Flake size*

In all the cases flakes were removed. In Farola Monte Hermoso the mean flake length is 34 mm; the mean width is 31 mm. The most frequent length index (l/w) is 1.22. In Médano Blanco the mean length is 39 mm, the mean width 38 mm and the l/w index is 1.10.

6.8 *Cortex*

The flakes were classified according to their extraction sequence in primary (cortical and with partial cortex) and secondary. The cortex index, is the percentage of primary flakes over total flake number: 44.38% in Farola Monte Hermoso; 42.85% in Médano Blanco.

6.9 *Desert varnish*

All the surface materials show a strong desert varnish, produced by windborne particles (Figs 6a, 9a-c and 10a, b). Among the materials recovered from excavations the varnish is slight. In some cases in a same surface a different intensity of desert varnish is observed on different flake scars (Fig. 10b).

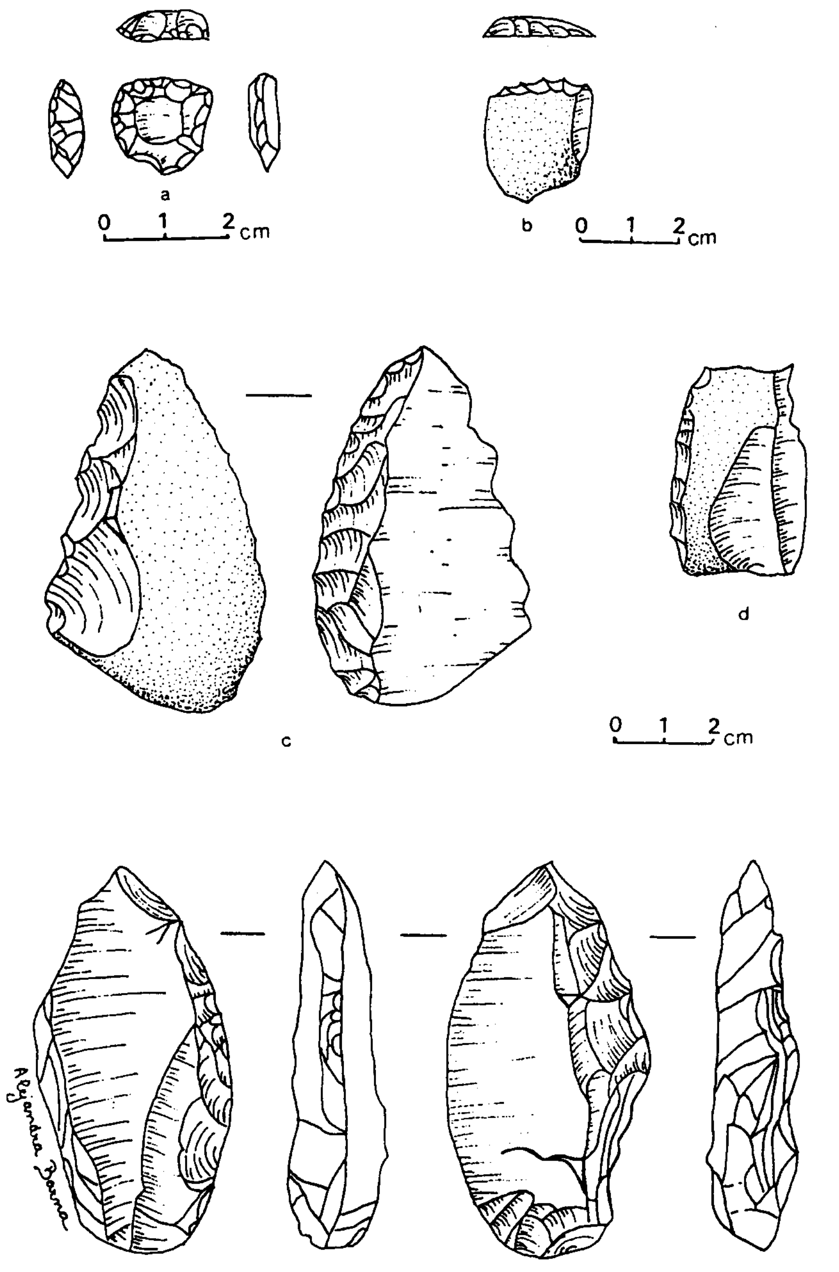

Figure 6. Tools: a) Small chert endscraper from Area II (Médano Blanco); b) Basalt endscraper (Farola Monte Hermoso); c-d) Marginal tools on primary flake (Farola Monte Hermoso); e) Side scraper (Farola Monte Hermoso).

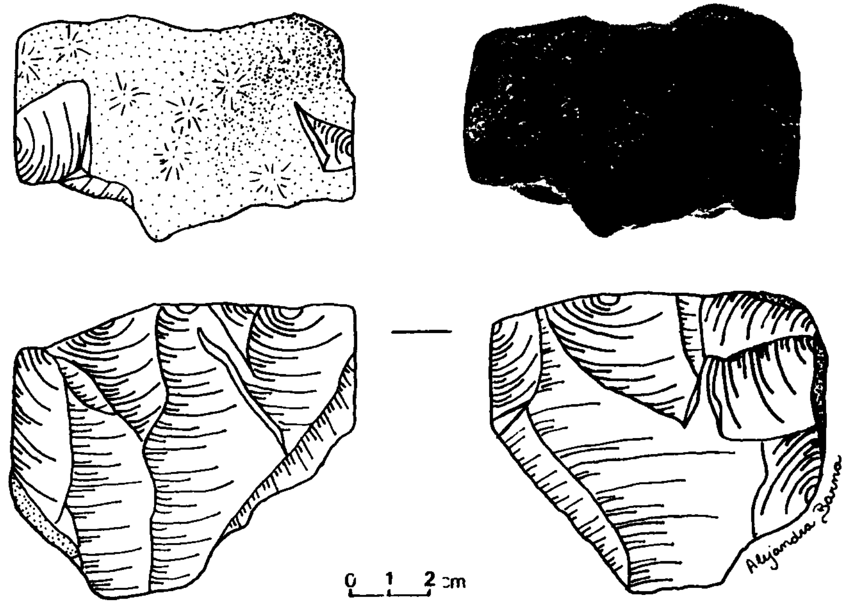

Figure 7. Amorphus core from Area I (Farola Monte Hermoso), showing impact points of failed percussions.

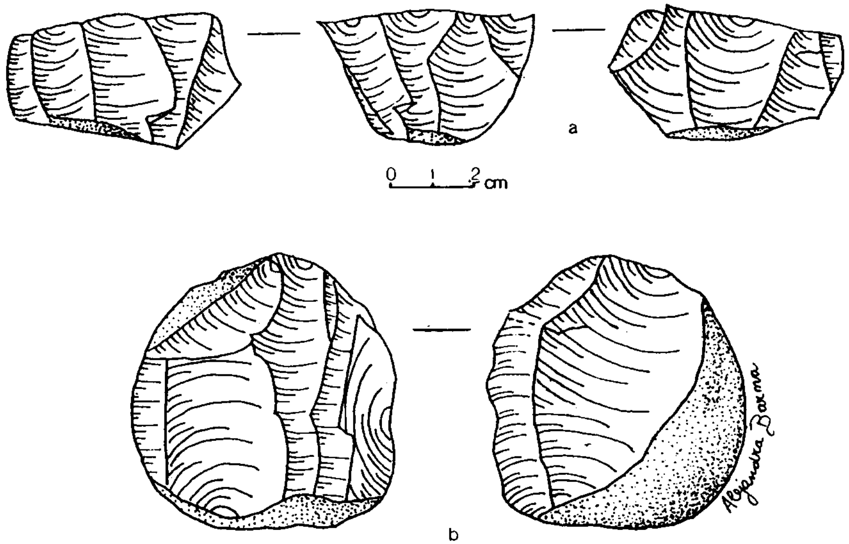

Figure 8. Cores from Area I (Farola Monte Hermoso): a) Single platform core; b) Bipolar core.

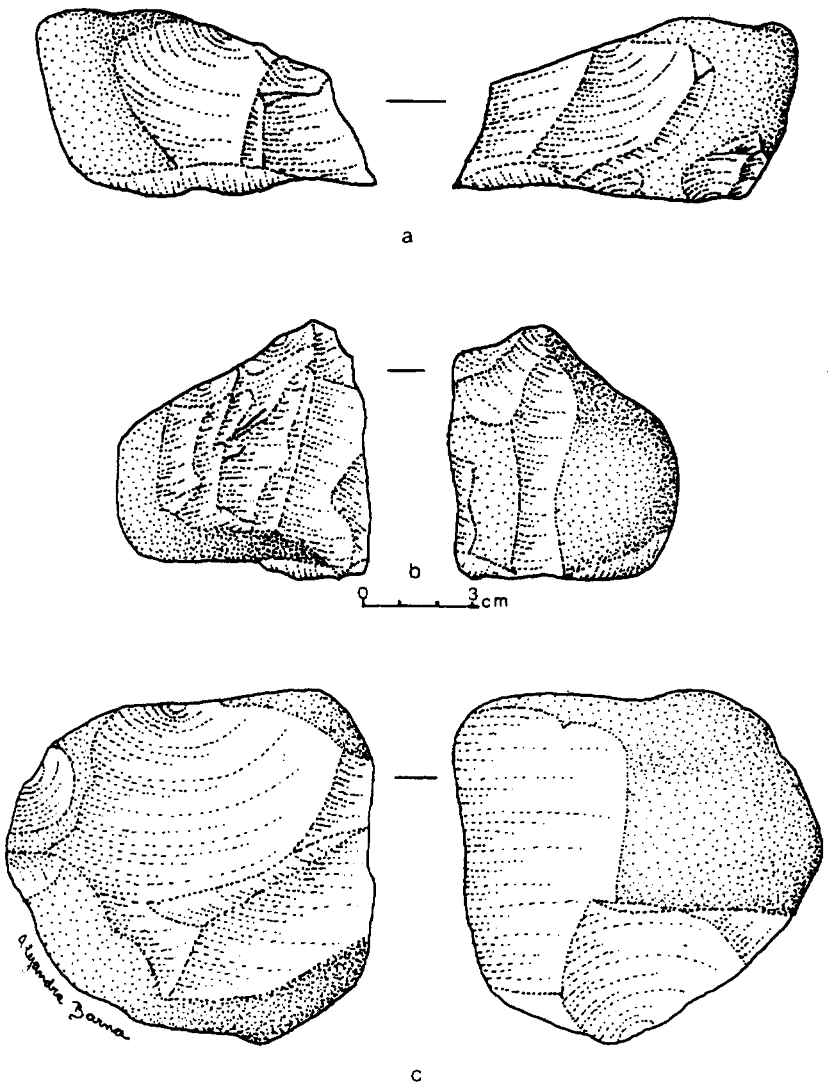

Figure 9. a-c) Cores from Area II. All of them show strong desert varnish.

Table 3. Natural surfaces selection.

Type	FHM	MB
Cortical flake plat.	73.80 %	84.41 %
Nat. perc. platform	83.33 %	70.59 %

Farola Monte Hermoso (FMH): Cores N = 30, flakes N = 187; Médano Blanco (MB): Cores N = 17, flakes N = 77.

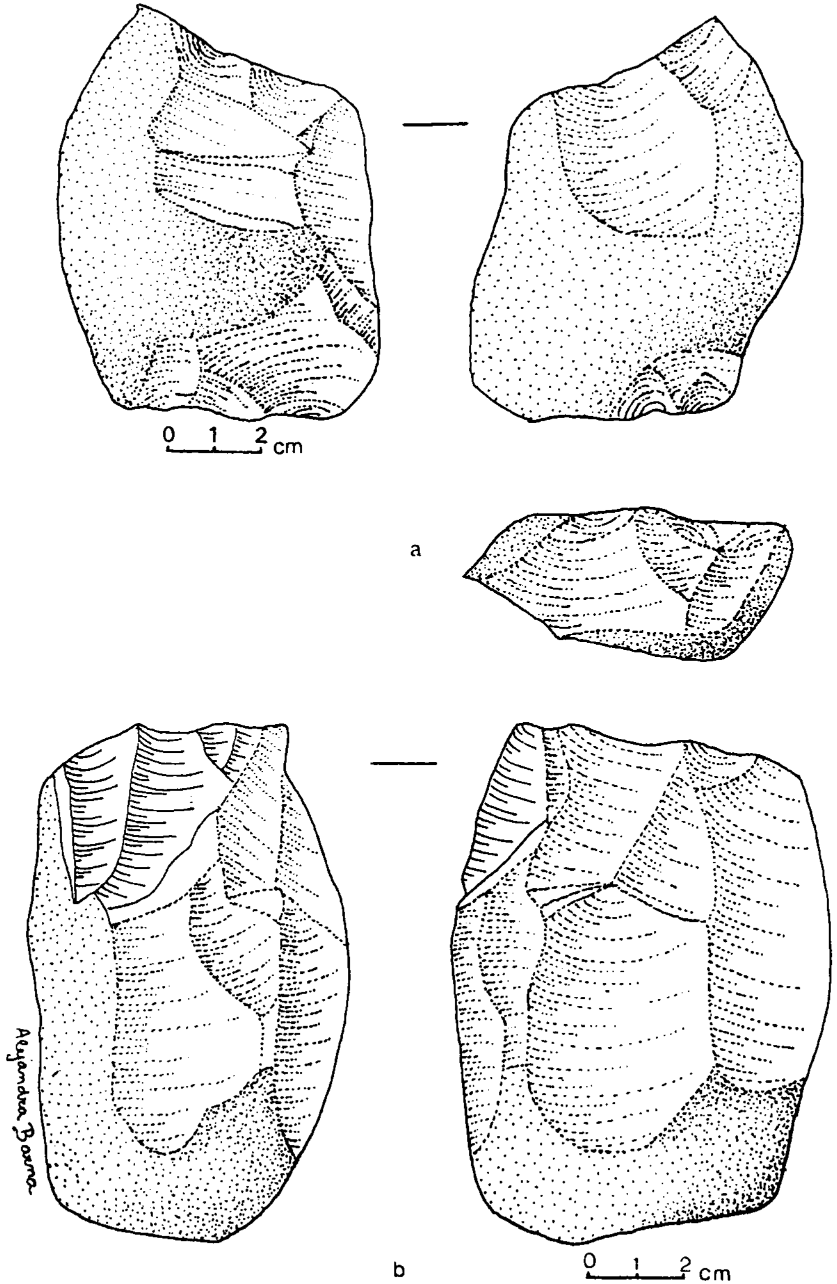

Figure 10. Cores from Area III: a) Bipolar core; b) Single cortex platform core and differential desert varnish in scars.

7 CONCLUSIONS

The stratigraphic position of the studied sites reveals that they were not occupied simultaneously. The unit containing the archaeological materials in Farola Monte Hermoso, by its position in the sequence, dates back to more than 3500 years, the estimated date for the dune advance in the area. The presence of detritus of marine fauna together with the archaeological material, indicates the presence of an adjacent coastline.

In Médano Blanco (Area II) the pebbles from an outcrop of fluvial origin corresponding to the first incision of the valley were utilized. These pebbles are reconcentrated by deflation in the surface and their availability would have been temporarily very high.

On the other hand, the other surficial sites (Area III) are younger than the marine regression and the dune deposition. It is proposed that the utilization of the lithic material exposed in the low interdune areas took place during the last centuries. The pebbles were introduced into the dune area by fluvial ephemeral currents from palaeocliffs located towards the North and later, reconcentrated in the interdune by deflationary processes.

The dune dynamics have controlled the availability of lithic material in Areas II and III.

The postdepositional movements were important in all the sites. The materials have been exposed on the surface during long periods as confirmed by the desert varnish. In Farola Monte Hermoso the desert varnish is slighter than in other places but anyway it indicates surficial exposition.

The formation processes involved were different. In Farola Monte Hermoso the flakeable materials were introduced by man to the site, as in the deposit there are no pebbles of a size similar to the ones selected to be flaked. According to the areal distribution of the clastic materials the specific source must be near, and could correspond to the fluvial outcrops correlated with area II. In the surface sites, the pebbles were distributed by natural dynamics and were flaked where originally found. However, in spite of these chronological and locational differences of the raw materials, there are no significative differences in the extraction techniques or in the flake and core sizes in the studied sites. The proportional relationship among the raw material varieties used is also similar.

We will now try to explain the existence of these workshops and quarries in terms of the possibilities of the lithic raw material supply within the region (Ericson 1984) to understand the structure of the resource base. This is important because the materials for making lithic tools are a resource in the same sense in which plants and animals are (Bamforth 1986) and because the production of lithic artifacts was a basic economic activity to obtain the necessary means for the procurement of food, clothing and shelter (Luedtke 1984).

In the case of the SW Pampean region, the possibility of rock supply for the production of lithic tools is conditioned by the scarcity of its availability, restricted to the borders of the Ventania and Tandilia Ranges (at a distance of 80 and 250 km respectively from the study area). Supply source of different rocks have been reported for both systems (Politis & Tonni 1983, Flegenheimer 1986, 1991, Flegenheimer & Zárate 1988, Oliva & Barrientos 1988, Lozano 1991, Franco 1991).

Outside of the mountain range, it is only possible to get flakeable rocks in the boulder deposits located within the fluvial valleys (Oliva et al. 1991) and the coast. A human society that occupied this part of region during the Holocene had available raw materials in the terrace levels of the coarse conglomerates of the psefitic Lower Member of the Agua Blanca Formation (Rabassa 1989), at least in the main valley of the Río Sauce Grande. In the coast, in general, there was supply of basaltic coastal pebbles carried over by littoral dynamics. And in the SW coast there was fluvial pebbles removilized, which correlate with the aforementioned deposits in the valley.

We think that the study area was a localized supply of lithic materials where there was an intense use of the available quartzite pebbles during an extended period, probably of several millennia.

This hypothesis of a supply area is supported because the materials that appear to have been discarded are composed almost exclusively of cores and flakes; because among the artifacts the proportion of cores is important and because the utilized raw materials are mainly the local ones (Table 1).

Regarding the intensity of utilization we think that it is related to the extension of the area. Along the 13 km of Atlantic littoral where the pebble deposits are available, there are evidences of their utilization. We also think that the supply area might have been greater than the one we can see at present, as the pebbles appear in the deflation holes which are the result of present erosion in the semifixed dune that covers the area.

On the other hand, the intensity of utilization is also a consequence of the recurrence of the occupations. When the supply is known and predictable, the expectations are the place will be repeatedly visited (Purdy 1984). In our case, the presence of differential desert varnish in scars of the same face may be revealing that some of the cores were reutilized. However, given the movement of the dunes, the predictability of the availability of raw materials is valid for the area in general as such, not for each specific location in particular. Besides, the chronological difference already stated among the different sites reinforces this proposal.

Regarding the method or manner of making use of the supply of raw materials, different ways of acquiring the rocks in the region would have been employed. These are related with the needs that should be catered for, the location of the deposits and the quality of the raw material (Collins 1975). In our case there are evidences for three methods of using the supply. The first and prevailing one is the gathering of quartzite pebbles in the gravelly deposits. In the second place, occasional findings of isolated rocks

(Gould 1978), along the coastline were using, as is the case of the basaltic pebbles. For both these cases this area is considered as a secondary supply in the sense used by Nami (1992). A third method would be represented by the presence of highly selected allochthonous rocks that should have been carried over, as is the case of three flakes of variety 6 of quartzite, or the small chert endscraper. The latter is one of the few tools found.

We think that the acquisition of local rock was associated to the performance of another activity, which coincides with Binford's (1979) hypothesis that the provision of raw materials is an embedded strategy. In this coastal region the availability of lithic raw materials was predictable, but their quality was moderate (Nami 1986) and did not justify travelling important distances to gather them. On the other hand, and as already stated, rocks of similar features were available all along the fluvial valley. Probably the main activity has been the use of some coastal resource. Politis (1986) proposed the utilization of seals in the coastal area. In the site named 'La Olla' (Politis & Lozano 1988), 20 km West of the studied area, the remnants of seals are abundant, but the dating of this site (7315 ± 55 BP, 6640 ± 90 BP, Politis et al. 1994) makes it temporally different from the sites presented in this paper. On the other hand, we have not found faunal remains in any of them.

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