RESEARCH REPORT

Technological Organization in Hunting/Scavenging and Butchering Sites of Megamammals in the Pampa Grasslands (Argentina)

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The objectives of this research were to evaluate different modes of lithic acquisition, use, and disposal at three single-component open-air sites associated with the hunting/scavenging and butchering of megamammal species, and to discuss strategies applied in human mobility in the Pampa grasslands of Argentina during the late Pleistocene and early Holocene. In the Paso Otero 5 and Campo Laborde assemblages, the last stages of the lithic-reduction sequence were associated with the context of tool use in a curated technological strategy. In La Moderna, the high frequency of quartz debitage, presence of expedient tools manufactured on-site, and close proximity to quartz outcrops are interpreted to represent a situational behavior produced in response to immediate and unanticipated conditions. During the late Pleistocene, at Paso Otero 5 humans exploited rocks from diverse regions, whereas at Campo Laborde and La Moderna hunter-gatherers displayed lower mobility during the early Holocene.

Keywords lithic technology, megamammal butchering site, stone acquisition and mobility, Pampa grasslands, late Pleistocene–early Holocene

1. Introduction

The study of technological organization in early archaeological sites of the Pampa grasslands (Figure 1) has gained increased relevance through research conducted during the last 30 years (Bayón and Flegenheimer 2003; Flegenheimer and Bellelli 2007; and references cited therein). In general, most of these studies were aimed at sites located in the Tandilia range system (e.g., Bayón et al. 1999, 2006; Bonnat and Mazzanti in press; Flegenheimer 1986–1987; Flegenheimer et al. 2003; Mazzanti 1999, 2003; Mazzanti et al. 2013; Mazzia 2011a, 2013; Valverde 2004) and less frequently in the Interserrana area (Armentano et al. 2007; Barros et al. 2014; Bayón et al. 2004; Leipus 2006; Martínez 2001, 2006; Mazzia 2011b; Messineo 2012; Politis and Olmo 1986). In the northern part of the Pampa grasslands, human burial sites from the early Holocene were found, such as Arroyo Frías, Laguna de los Pampas, and Laguna El Doce (Ávila 2011; Politis and Bonomo 2011; Politis et al. 2012), but technological studies were not done in detail, because stone materials were not directly associated with the human remains.

The functionality of the sites in the Tandilia range system and Interserrana area was quite diverse, with multiple-activity and short-term campsites, workshops of multiple activities, multiply-occupied rockshelters, and specific-activity sites, among others (Barros et al. 2014; Bayón et al. 2004; Flegenheirmer and Mazzia 2013; Mazzanti and Bonnat 2013; Politis et al. 2014). However, in the Pampa grasslands, two archaeological assemblages linked with specific-activity sites, Paso Otero 5 and La Moderna, have yielded information about the lithic technologies associated with the procurement (hunting or scavenging) and butchering of megamammals during the late Pleistocene and early Holocene (Armentano et al. 2007; Martínez 2001; Palanca et al. 1973; Politis and Gutiérrez 1998; Politis and Olmo 1986). Additionally, investigations carried out recently at Campo Laborde, a site related to the hunting and primary processing of a giant ground sloth (*Megatherium americanum*), have provided new evidence regarding the lithic technology linked to these specific activities (Messineo 2012; Messineo and Pal 2011).

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DOI 10.1179/2055556315Z.00000000018

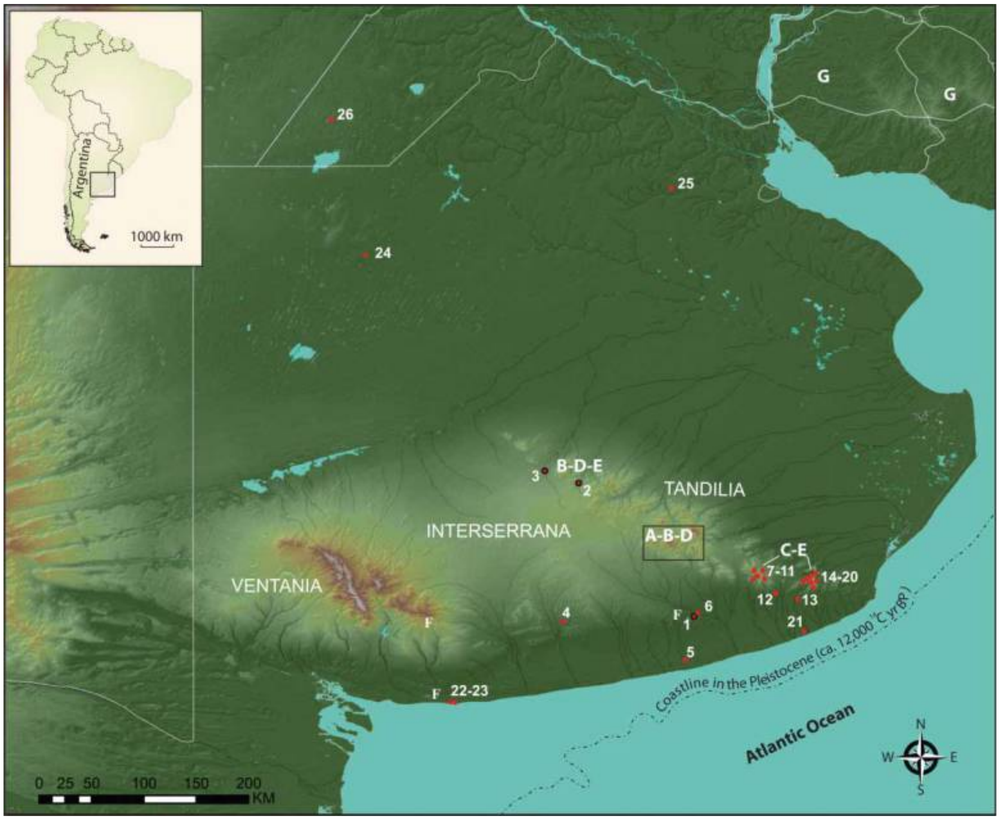

Figure 1 Map showing the Pampa grasslands and the location of the sites mentioned in the text. (1) Paso Otero 5, (2) La Moderna, (3) Campo Laborde, (4) Arroyo Seco 2, (5) El Guanaco Locality, (6) Paso Otero 4, (7) Cerro La China Locality, (8) Cerro El Sombrero Locality, (9) Los Helechos, (10) Cueva Zoro, (11) El Ajarafe, (12) Lobería 1, (13) Amalia site 2, (14) Cueva Tixi, (15) Cueva El Abra, (16) Cueva Burucuyá, (17) Cueva La Brava, (18) Abrigo Los Pinos, (19) El Mirador, (20) La Grieta, (21) Meseta de Chocorí, (22) La Olla 1, (23) Monte Hermoso 1, (24) Laguna de Los Pampas, (25) Arroyo Frías, (26) Laguna El Doce; (A) orthoquartzite of Sierras Bayas Group; (B) chert; (C) orthoquartzite of Balcarce Formation; (D) silicified dolomite; (E) quartz; (F) metaquartzite; (G) reddish silicified limestone of Queguay Formation.

Different sites around the world associated with megamammal kill/scavenge events have offered extensive information on subsistence strategies, hunting techniques, and technologies used. These kinds of sites often contain the remains of one or a few animals associated with few artifacts (e.g., Frison 1986; Hannus 1989; Pinson 2011); however, a small number of sites show abundant lithic assemblages in close association with several carcasses of extinct animals (see discussions in Delagnes et al. 2006; Surovell and Waguespack 2008). Taking this into account, the main objective of the present research is to identify the technological strategies employed by hunter-gatherers during the hunting/scavenging and butchering of megamammal species, on both an areal and regional scale. Before discussing the effects of lithic raw-material availability on lithic technology and mobility, I briefly review the regional structure of lithic resources and the major technological traits in the southern Humid Pampas sub-region. Subsequently, I describe the characteristics of prehistoric settlement associated with hunting/scavenging sites of megamammals (e.g., location, chronology, environmental setting, and faunal evidence) and the techno-morphological analysis of the lithic assemblages found in this type of site (i.e., raw material, stages of the manufacturing process, and tool production, maintenance, and discard). Lastly, the information obtained in sites situated in different environments is used to discuss the strategies applied in lithic-resource utilization and human mobility in the Pampa grasslands during the late Pleistocene and early Holocene.

For this purpose, temporal and spatial intervals have been defined. The late Pleistocene and early Holocene periods range from the earliest accepted dates for the human peopling in the region (ca. 12,240 ^{14}C yr BP, 14,254 cal yr BP (Prates et al. 2013; Steele and Politis 2009)) until the early-middle Holocene boundary (ca. 7500 ^{14}C yr BP, 8200 cal yr BP (Walker et al. 2012)) when the Pampean climate became warmer and wetter. In the early Holocene, the last appearance of extinct megafauna is registered in the archaeological record associated with cold climatic conditions in a semiarid to arid environment (Cione et al. 2009; Politis and Messineo 2008; Tonni et al. 1999). In terms of spatial scale, this work is restricted to the southern Humid Pampas sub-region, because sites associated with the hunting/scavenging and butchering of megamammals have been found only in this part of the region (Figure 1).

2. Physiography, climate, and paleoclimate in the Pampas

The Pampean region is located in the eastern part of Argentina between 30° and 39° S, Uruguay, and southern Brazil (Morrone 2001). The Pampa grassland, an extensive flat to gently undulating landscape, is the most extensive area covered by grass in Argentina. This vast plain includes two sub-regions divided by the 700–800 mm isohyet: the Dry Pampas in the west characterized by an arid steppe of moderate continental climate and the Humid Pampas in the east distinguished by a mesic temperate prairie (Prieto 2000). The latter sub-region is interrupted by the Tandilia and Ventania mountain ranges, and its southern portion is connected with the coastal plain (Figure 1).

The climate of the Pampa grasslands is temperate. This region is characterized by an east-west moisture gradient and increasing continentality toward the northwest. Average temperatures in the northeast range from 24 °C in summer (January–February) to 10 °C in winter (July–August), whereas in the southwest, for the same months, the average is between 20 and 7 °C (Burgos 1968). Precipitation is highly seasonal with two well-defined rainy seasons, spring and fall. The annual total rainfall increases toward the east from ca. 400 mm in the southwest to 1000 mm or more in the northeast (Burgos 1968; Prieto 2000).

The early human colonization of the Pampa grasslands, and its subsequent development has been discussed in the context of regional environmental evolution mostly in the Humid Pampas sub-region (e.g., Martínez 2006; Mazzanti et al. 2013; Politis 2008; Politis and Madrid 2001; Tonni et al. 1999), from where most of the biostratigraphic information comes. Because the sites discussed in this work are located chronologically in the late Pleistocene and early Holocene, only the information from these periods is summarized.

The paleoclimatic evidence in the southern Pampas suggests that by the end of the Pleistocene (12,500–10,000 ^{14}C yr BP, 14,500–11,700 cal yr BP), the human migration took place under cold climatic conditions in a semiarid to arid environment (Grill et al. 2007; Prieto 2000; Tonni et al. 1999). The faunal association found in the top of the Guerrero Member (Luján Formation) of the regional stratigraphic sequence suggests a temperate to semiarid climate. During this period, the eastern portion of the Pampa grasslands greatly expanded due to a sea level drop of about 60 m. The coastline would have been located ca. 150 km to the southeast of its present location (Figure 1; e.g., Tonni et al. 1999), and the de la Plata River, which today is a formidable barrier, was an ancient delta shaped by larger and more developed alluvial plains, lagoons, and aquatic landscapes (Cavallotto et al. 2002).

During the formation of the Puesto Callejón Viejo paleosol in the top of the Guerrero Member, around 10,000 ^{14}C yr BP (11,500 cal yr BP), the climate became more humid. The pollen assemblage suggests vegetation characteristic of ponds, swamps, floodplains, and/or environments with locally more effective moisture, developed under a subhumid–humid climate (Prieto 2000). In the early Holocene, from 9000 to 7500 ^{14}C yr BP (10,000–8200 cal yr BP), the faunal record of the area reveals a return to a dry episode and probably colder conditions than the present. Tonni et al. (1999) and Cione et al. (2009) observed that extinct species adapted to arid–semiarid conditions were still present in the early Holocene records (see discussion in Politis and Messineo 2008). However, the development of humid grasslands associated with hydrophytic vegetation communities indicates flooding and a subhumid–humid climate (Prieto 2000). In the last part of the early Holocene, the continental Pampas climate was wet and subtropical to tropical associated with the Hypsithermal period (Iriondo and García 1993).

3. Regional structure of lithic resources

Lithic resources in the Humid Pampas sub-region have a heterogeneous distribution and are highly circumscribed to bounded sectors of the landscape, such as the Tandilia and Ventania range system, the Interserrana area, and the Atlantic coast (Figure 1). Extensive primary outcrops and secondary deposits are located in the Tandilia (fine-grained orthoquartzite from the Sierras Bayas Group, chert, quartz, silicified dolomite, medium-grained orthoquartzite from the Balcarce Formation, among others) and Ventania range systems (rhyolite and metaquartzite from the La Mascota Formation, quartz, orthoquartzite, chert, etc.). Between the Ventania and Tandilia mountain ranges extends the Interserrana plain, where scantily exposed bedrocks and quarries have been identified (silicified tuff, quartzitic sandstone, and coarse-grained metaquartzite). Secondary pebble deposits of metaquartzite and quartz are available in some fluvial valleys, while along the Atlantic coast there are coastal pebbles (basalt, rhyolite, quartzite, granite, andesite, dacite, chert, tuff, and others) discontinuously distributed (e.g., Barros and Messineo 2006; Bayón and Flegenheimer 2004; Bayón et al. 2006; Bonomo 2005; Catella et al. 2013; Colombo 2011; Flegenheimer et al. 1996; Messineo and Barros 2015; Oliva et al. 2006). Therefore, hunter-gatherers necessarily had to transport stones within this region for hundreds of kilometers, employing different strategies to access raw materials (Bayón et al. 2006; Bonomo 2005; Martínez 2006; Messineo 2011).

Orthoquartzites from the Tandilia range were the main rocks transported and utilized by the earliest human groups that occupied the Humid Pampas sub-region, while other secondary rocks (chert, silicified dolomite, quartz, and others) have been transported from this range, Ventania, the coast, or unidentified sources (Armentano et al. 2007; Bayón and Flegenheimer 2003; Bayón et al. 2006; Messineo 2012; Valverde 2004). The places of provenance of these rocks have been identified through macroscopic similarities. Furthermore, in some sites (e.g., El Sombrero, La China, Cueva Zoro, Paso Otero 5, and Abrigo La Grieta), a few artifacts and debitage of exotic raw materials have been micro- and macroscopically identified as silicified limestone of the Queguay Formation from Uruguay (Flegenheimer et al. 2003; Martínez 2001; Mazzanti et al. 2013; Mazzia 2013). Flegenheimer et al. (2003) interpreted this presence as resulting from long-distance transport and exchange through regular social interactions between groups of hunter-gatherers who inhabited both sides of the de la Plata River.

4. Technological traits in the southern Humid Pampas sub-region

By the end of the Pleistocene and early Holocene, the archaeological sites in the Tandilia mountain range and Interserrana area were characterized by significant intersite variability, evidenced by technological diversity, sequences and techniques of tool production, the presence of bifacial technology in some contexts, and the frequency of lithic raw materials identified and their provenance. These characteristics indicate differences in the activities carried out, as well as different social actors taking part in them (Flegenheimer et al. 2003; Martínez 2006; Politis and Madrid 2001; Politis et al. 2004).

In the Tandilia hills, a cluster of sites is mostly represented by rockshelters (Figure 1) occupied at the end of the Pleistocene and early Holocene, between 11,000 and 8000 ^{14}C yr BP (12,900–8765 cal yr BP) (e.g., Bonnat and Mazzanti in press; Flegenheimer and Mazzia 2013; Flegenheimer et al. 2003; Mazzanti 1999, 2003; Mazzanti and Bonnat 2013; Mazzanti et al. 2013; Mazzia 2011a, 2013). According to Politis (2008), these sites would have been generated by small groups of people (a band or even segments of bands) during a time of fissioning while visiting the hills to perform individual tasks such as gathering raw material or hunting small mammals (see also Politis and Madrid 2001; Politis et al. 2004). In this area, the functionality of the sites was associated with: (1) multiple-activity base camps (Cerro La China 3, Cueva Tixi, and Cueva El Abra); (2) ephemeral or short-term occupations (Los Helechos, El Ajarafe, Cueva Zoro, Alero El Mirador, Abrigo La Grieta, and Lobería 1), some of them related to hunting (Cerro La China 2); (3) hunting blinds equipped with Fishtail projectile points (El Sombrero Cima); (4) specific activities associated with the final steps of the lithic-reduction sequence (Cueva Burucuyá, Cueva La Brava, and Amalia site 2); and (5) workshop of multiple activities and reoccupation (Los Pinos) (Bayón et al. 2006; Bonnat and Mazzanti in press; Flegenheimer 1986–1987; Flegenheimer and Bayón 2000; Flegenheimer et al. 2003; Mazzanti 1999, 2003; Mazzanti and Bonnat 2013; Mazzanti et al. 2010, 2013; Mazzia 2011a, 2013).

The more frequently used rock in these early assemblages is the fine-grained orthoquartzite macroscopically identified as the Sierras Bayas Group (between ca. 45 and 90 per cent), found between 50 and 150 km from the archaeological sites considered to date to this temporal period (Figure 1). This stone was chosen firstly for its high quality for knapping and secondly for its other qualities such as color (Bayón et al. 2006; Colombo 2011; Colombo and Flegenheimer 2013, 133). The orthoquartzite was employed, together with other non-local and extra-regional rocks such as chert, silex, basalt, and silicified limestone, as part of a curated technological strategy, whereas those rocks immediately available and with poor qualities, such as orthoquartzite of the Balcarce Formation and quartz, were used as part of an expedient technology (Flegenheimer 1986–1987; Mazzanti 1999; Mazzia 2011a, 2013). Although both technological strategies do not constitute mutually exclusive types, within a continuum, they respond to different ways of exploiting the environment.

In the Interserrana area (Figure 1), the earliest well-dated site is Arroyo Seco 2 (Politis 2008; Steele and Politis 2009). This represents a large, geologically stratified, multicomponent, and open-air site. Numerous occupation episodes representing camping activities dated to the late Pleistocene and early-middle Holocene have been uncovered (Politis et al. 2014). The main lithic raw material corresponds to a non-local orthoquartzite macroscopically identified as the Sierras Bayas Group (ca. 93 per cent), followed by other non-local rocks in lower frequencies (e.g., chalcedony, silicified tuff, chert, basalt, and silicified dolomite). The debitage is characterized by small sizes (<4 sq. cm), interior flakes, and a low frequency of cortex (1.5 per cent). Peretti and Escola (2014) concluded that this assemblage mainly resulted from the final steps of the lithic-reduction sequence (e.g., tool manufacture and resharpening).

Other archaeological sites in the plain are El Guanaco Locality (Bayón et al. 2004; Mazzia 2011b) and Paso Otero 4 (Barros et al. 2014). The first one is located close to the Atlantic coast, and the chronology of the lower component of El Guanaco 1 is from the beginning of the Holocene (ca. 9250 ^{14}C yr BP, 10,496–10,250 cal yr BP), while El Guanaco 2 is in the early Holocene (between ca. 9140 and 8100 ^{14}C yr BP, 10,264–8958 cal yr BP). Paso Otero 4 is located in the middle basin of the Quequén Grande River (Figure 1), and its lowest level is chronologically placed between ca. 8900 and 7700 ^{14}C yr BP (9900–8400 cal yr BP). These sites show the variability of the early Holocene archaeological record in the southern Pampas. The main rock represented in these assemblages is the non-local fine-grained orthoquartzite macroscopically identified as the Sierras Bayas Group, followed in low frequencies by other non-local lithic raw materials such as silicified dolomite, chert, metaquartzite, granite, and orthoquartzite of the Balcarce Formation (Barros et al. 2014; Mazzia 2011b). Basalt is a non-local rock in Paso Otero 4 and immediately available in the El Guanaco Locality. Bayón et al. (2004) highlight the use of bifacial technology at El Guanaco 1.

5. Synthesis of the archaeological record

Early traces of humans in the Pampa grasslands date back to ca. 12,240 ^{14}C yr BP (14,254 cal yr BP) and indicate that at the end of the Pleistocene, foragers were living at least in the southeastern plains. Between 11,000 and 7500 ^{14}C yr BP (12,900–8200 cal yr BP), archaeological evidence increases and there are ca. 25 archaeological sites from the Tandilia range system, its neighboring plains, the coast, and the central northern area (Figure 1; Prates et al. 2013 and references therein). The high frequency of sites identified in the hills reflects a bias toward researched caves and rockshelters. However, only three single-component sites were associated with the hunting/scavenging and butchering of megamammal species. These sites were selected to understand the technological strategies used by hunter-gatherer groups during the late Pleistocene and early Holocene. One of them is located in the Interserrana area (i.e., Paso Otero 5), while the other two occur along the boundary between the Tandilia mountain range and the Interserrana area (i.e., La Moderna and Campo Laborde), although in plains environments. All the archaeological sites considered in this paper were placed in close proximity to water sources such as floodplains or swamps.

5.1 *Paso Otero 5*

Paso Otero 5 is a single-component open-air site located on the bank of the Quequén River (38° 12′ 08″ S, 59° 06′ 58″ W). An area of 98 m^2 was excavated yielding bones of 10 extinct megamammals species (*M. americanum*, *Equus* (*Amerhippus*) *neogeus*, *Macrauchenia patachonica*, *Lestodon armatus*, *Toxodon* sp., *Glossotherium* sp., *Scelidotherium* sp., *Mylodon* sp., *Hemiauchenia* sp., and *Glyptodon* sp.) as well as extant mammals (*Lama guanicoe* and *Lycalopex gymnocercus*). The archeological remains are placed within the Puesto Callejón Viejo paleosol, associated with an ancient floodplain, and chronologically situated at the Pleistocene–Holocene transition (Martínez 2001, 2006; Martínez and Gutiérrez 2011; Martínez et al. 2013). Three radiocarbon samples obtained on megamammal burnt bones yielded dates of 10,440 ± 100 ^{14}C yr BP (12,561–11,839 cal yr BP), 10,190 ± 120 ^{14}C yr BP (12,380–11,268 cal yr BP), and 9560 ± 50 ^{14}C yr BP (11,089–10,655 cal yr BP). Moreover, one sample of soil organic matter obtained from the archaeological component was dated to 9399 ± 116 ^{14}C yr BP (10,828–10,247 cal yr BP) (see synthesis in Martínez and Gutiérrez 2011).

Paso Otero 5 is interpreted as a secondary processing locus of extinct megafauna, being the result of occupations linked to hunting or scavenging. The assemblage comprises a large amount of burnt/calcined megamammal bones that have been identified as raw material for combustion. The bones seem to be the result of the consumption of these animals and by the use of their bones as fuel (Joly et al. 2005; Martínez 2001, 2006). Two fragments of Fishtail projectile points, a small number of tools, and several flakes were found in association with these extinct species.

5.2 *Campo Laborde*

The Campo Laborde site is located along a tributary stream in the upper basin of the Tapalqué Creek (37° 00′ 36″ S and 60° 23′ 05″ W). An area of 28 m^2 was excavated and abundant bones from a giant ground sloth (*M. americanum*) were recovered in association with two stone tools and flakes from various types of raw materials. An examination of the horizontal spatial distribution of the archaeological material shows a non-homogeneous spatial distribution. Most lithic artifacts were placed within a concentration of *Megatherium* bone remains, suggesting that hunters knapped directly around the bones (Messineo 2012).

Geologic studies show that the archaeological component was recovered from a paleoswamp and a paleosol located in the lower section of the Río Salado Member (Luján Formation), a fluvial deposit representing an aggrading floodplain. Multiple dates were obtained from *M. americanum* bone samples. Taking into consideration the bones with better collagen preservation, the archaeological component is chronologically placed between 8080 ± 200 ^{14}C yr BP (9473–8537 cal yr BP) and 7750 ± 250 ^{14}C yr BP (9145–8039 cal yr BP). Moreover, two samples of organic matter obtained from the paleosol and paleoswamp gave dates of 7960 ± 100 ^{14}C yr BP (9033–8548 cal yr BP) and 8090 ± 190 ^{14}C yr BP (9466–8548 cal yr BP), respectively (Messineo and Politis 2009; Politis and Messineo 2008).

Campo Laborde is a single-component site related to the hunting and butchering of a giant ground sloth along the edge of a swamp during the early Holocene (Politis and Messineo 2008). The anatomical parts recovered included axial and appendicular elements (e.g., ribs, vertebrae, tibias, metapodials, carpals, tarsals, and phalanges). Additionally, a humerus and a femur from two extinct glyptodonts (*Neosclerocalyptus* sp. and *Doedicurus* sp.) and a few bones from extant species (*Dolichotis patagonum*, *Lagostomus maximus*, *Tayassu* sp., *Lycalopex* sp., *Zaedyus pichiy*, and small vertebrate bones) were also identified. Linked to butchering tasks, Messineo (2008) pointed out the presence of cut marks on a rib of *M. americanum* and a tibia of *D. patagonum*, and some helical fracture debris on megafauna bones. Moreover, two bone tools were made from giant ground sloth ribs, and they were used in butchering tasks (Messineo 2012; Messineo and Pal 2011).

5.3 La Moderna

La Moderna is a multicomponent open-air site located on the bank of Azul Creek (37° 07′ S and 60° 05′ W). An area of 45 m^2 was excavated yielding bones and scutes of extinct species (*Doedicurus clavicaudatus*, *Glyptodon* sp., and *Sclerocalyptus* sp.) and extant mammals (*L. guanicoe*, *Rhea americana*, and *Myocastor coipus*) associated with a lithic assemblage formed mainly by crystalline quartz debitage and tools (Palanca et al. 1972, 1973; Politis 1984; Politis and Gutiérrez 1998).

Multiple dates were obtained from *Doedicurus* bones (collagen fraction) and organic sediment samples. According to these dates, the lower component of La Moderna was chronologically situated between 7010 ± 100 ^{14}C yr BP (7969–7616 cal yr BP) and 7510 ± 370 ^{14}C yr BP (9233–7579 cal yr BP). These data support the survival of Pleistocene megamammals into the early Holocene (Politis and Gutiérrez 1998; Politis et al. 2003).

The lower component is interpreted as a procurement site (hunting or scavenging), where a giant armadillo (*D. clavicaudatus*) was butchered along the edge of a swamp situated at the transition between the Guerrero and Río Salado Members of the early Holocene (Politis 1984; Politis and Gutiérrez 1998). Cut marks were not reported in previous publications, and taphonomic studies were not carried out on the *D. clavicaudatus* bones because when these methodological approaches began to be used in Argentina in the 1990s, the bone collection was not available (Politis and Gutiérrez 1998). To carry out this activity, expedient tools of quartz (a raw material that is located less than 1 km away from the site) and some curated tools of quartzite and silicified dolomite were used (Politis and Gutiérrez 1998; Politis and Olmo 1986).

6. Characterization of the lithic assemblages

Published information on the lithic assemblages is scanty, with only a few cases of quantitative data (Armentano et al. 2007; Martínez 2001; Messineo 2012; Palanca et al. 1972, 1973; Politis 1984; Politis and Olmo 1986). Below I briefly describe the available data obtained for two archaeological sites (Paso Otero 5 and Campo Laborde) associated with the hunting/scavenging and butchering of megamammals. Also, I present new techno-morphological analyses of the lithic material from La Moderna site (Figure 2; Table 1). For the analysis of debitage and tools, I considered morphological and technological attributes, as proposed by several authors (Andrefsky 1994; Aschero 1983; Aschero and Hocsman 2004). It is necessary to clarify that in Paso Otero 5 and Campo Laborde, the sediments were water-screened with fine mesh (2 mm), whereas in La Moderna during the 1982–1984 field seasons the same system was also used but on this occasion the size of the mesh was larger (5 mm). There is no information about the method of recovery in early 1970s.

6.1 Paso Otero 5

The lithic assemblage from Paso Otero 5 site comprises 86 artifacts (0.87 items/m^2), including 45 flakes, 35 debris, and 6 tools (Table 1; Armentano et al. 2007). The assemblage contains a high percentage of flake fragments such as distal (57.78%) and proximal (37.78%), and a relatively low proportion of complete flakes (4.44%). Macroscopic analysis established that the main lithic raw material was the non-local fine-grained orthoquartzite from the Sierras Bayas Group (55.81%), resources located 50–70 km from the site. Other non-local lithic raw materials such as basalt (4.65%), siliceous rocks, volcanic rock (outcrops not identified in the region), and extra-regional silicified limestone were recorded in lower percentages (1.16% each; Figure 2). Finally, quartz (4.65%), chalcedony (3.48%), silicified dolomite (1.16%), and undetermined rock (26.74%) are represented only by distal flake fragments and angular debris (Armentano et al. 2007, Table 1), possibly suggesting an over-representation of some of these raw materials.

A high percentage (91.1%) of the debitage is represented by a very small size range (no longer than 10 mm), whereas the remaining 6.7% is small (from 10 to 20 mm), and only an orthoquartzite flake has a size ca. 27 mm (medium size). Different kinds of flakes were recognized in the assemblage, mainly interior flakes. Among all the raw materials, there

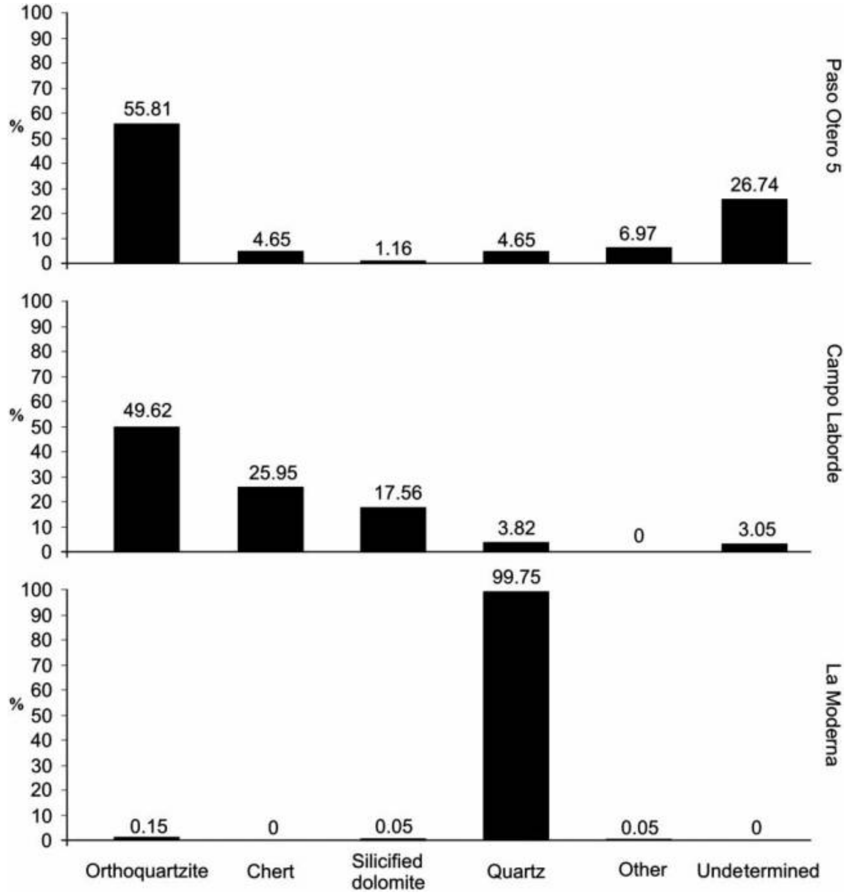

Figure 2 Percentages of lithic raw materials in the assemblages.

exists a predominance of plain (47.37%), followed by ridged and angular flakes (31.57 and 21.05%, respectively). These flakes exhibit mainly single and linear platforms (68.42 and 21.05%, respectively) (Armentano et al. 2007).

The tools are represented by two Fishtail projectile points (Figure 3), one of them made on a white orthoquartzite from the Sierras Bayas Group (ca. 50–70 km from the site) and the other on a reddish silicified limestone from the Queguay Formation, located in the

Table 1
Raw-material provenance and artifact categories

Site	Provenience*	Raw material	Tool	Debitage/debris	Core	Cortex
Paso Otero 5	Immediately available (less than 5 km)	–	–	–	–	–
	Local (5–40 km)	–	–	–	–	–
	Non-local (more than 40 km)	Orthoquartzite	5	43	–	No
		Chert	–	1	–	No
		Chalcedony	–	3	–	Yes
		Silicified dolomite	–	1	–	No
		Quartz	–	4	–	No
		Volcanic rock	–	1	–	No
		Basalt	–	4	–	No
	Extra-regional (more than 500 km)	Silicified limestone	1	–	–	No
	Unspecified	Undetermined	–	23	–	No
La Moderna	Immediately available (less than 5 km)	Quartz	15	>1983	–	Yes
	Local (5–40 km)	Silicified dolomite	1	–	–	Yes
	Non-local (more than 40 km)	Orthoquartzite	2	1	–	Yes
	Extra-regional (more than 500 km)	–	–	–	–	–
Campo Laborde	Immediately available (less than 5 km)	–	–	–	–	–
	Local (5–40 km)	Chert	–	34	–	Yes
		Silicified dolomite	–	23	–	Yes
		Quartz	–	2	–	No
	Non-local (more than 40 km)	Orthoquartzite	2	63	–	No
	Extra-regional (more than 500 km)	–	–	–	–	–
	Unspecified	Undetermined	–	4	–	Yes

*Following the criteria used by Civalero and Franco (2003).

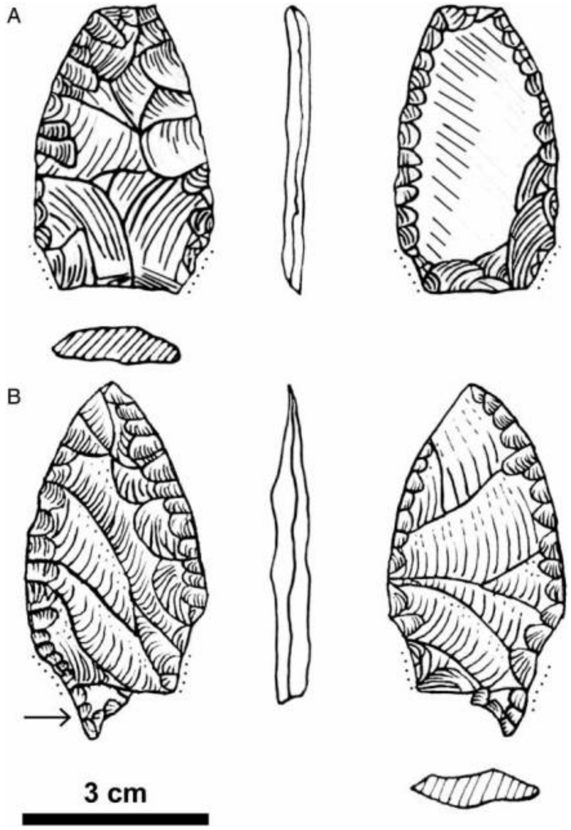

Figure 3 Fishtail projectile points from Paso Otero 5: (A) reddish silicified limestone from the Queguay Formation; (B–C) point and edge/basal stem fragment made of white orthoquartzite from the Sierras Bayas Group (drawing courtesy of Gustavo Martínez).

south of Uruguay (ca. 400–500 km away). Also an edge/basal stem fragment of a Fishtail projectile point made on orthoquartzite was found. Additionally, a bifacial tool, a multipurpose tool on a thick flake (burin, notch, and edge with marginal retouch), and a tool with scarce retouch were made on orthoquartzite (Figure 4). All of these tools were broken (Armentano et al. 2007; Martínez 2006).

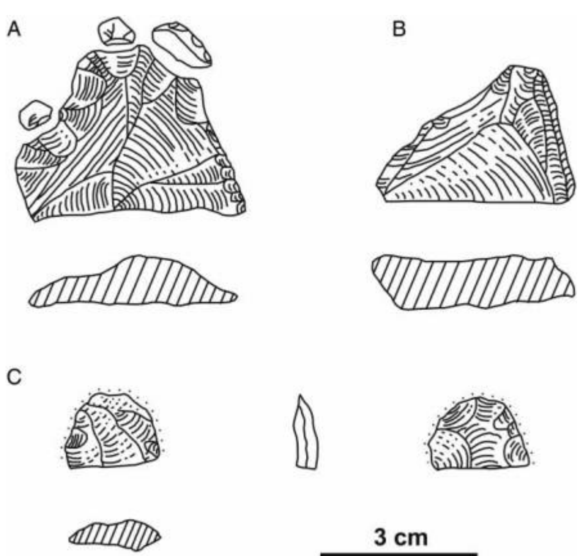

Figure 4 Lithic tools from Paso Otero 5: (A) multipurpose tool showing three refittings; (B) tool with scarce retouch; (C) bifacial tool fragment (drawing courtesy Gustavo Martínez).

6.2 Campo Laborde

The lithic assemblage from the Campo Laborde site comprises 131 artifacts (4.68 items/m^2), including 105 flakes, 24 angular debris, and 2 tools (Table 1). Macroscopic analysis established that the main lithic raw material represented is the fine-grained orthoquartzite from the Sierras Bayas Group (49.62%), followed by chert (25.95%) and silicified dolomite (17.56%). Other lithic raw materials were present in lower percentages, such as undetermined rock and quartz (Figure 2), the last stone only recognized as angular debris and distal flake fragments. The assemblage has an intermediate percentage of complete flakes (37.14%), with relatively more flake fragments, including proximal (40.95%) and distal (21.91%).

With the exception of an orthoquartzite flake that has a size ca. 23 mm (medium size), the rest of the complete flakes are represented by very small sizes (no longer than 9 mm). Different kinds of flakes were recognized in the assemblage, suggesting the existence of diverse reduction sequences and chipping techniques conducted at the site. In orthoquartzite, there are only interior flakes with a predominance of ridged, plain, and angular flakes (these exhibit mainly single, pointed, linear, and dihedral platforms). In the same way, chert has the highest percentage in the similar kind of interior flakes (ridged and plain) and platforms (single and linear), but low frequencies of exterior flakes and platforms with cortex were identified. In silicified dolomite, ridged and angular flakes prevail; also there are unifacial and bifacial resharpening flakes (Messineo 2012).

The two stone tools recorded at the site were manufactured on orthoquartzite (Figure 5). One of them is interpreted as the stem of a broken lanceolate bifacial projectile point. The base of this piece is convex, with a transverse fracture, and the edges are not abraded. One face has laminar pressure-flaked scars along the base, and the opposite face has a single tiny fluting scar. The use-wear analysis indicates that this projectile point was probably hafted (Messineo and Pal 2011, Figure 1). The second tool is a side scraper made from a large and thick flake without cortex. It has two working edges with unifacial and marginal retouch.

6.3 La Moderna

La Moderna's lithic assemblage comprises crude quartz flakes, some of them with retouch. During the 1972 and 1973 field seasons 11 tools, 258 flakes, 690 chips, and more than 1000 small pieces of waste debitage were recovered (Palanca et al. 1972, 1973). However, the information obtained from the analysis of the debitage was never published and almost all

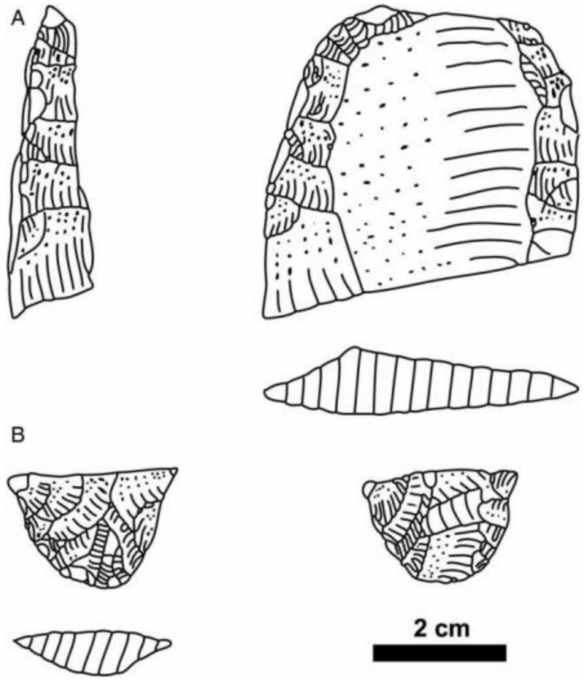

Figure 5 Lithic tools from Campo Laborde: (A) side scraper and (B) lanceolate bifacial projectile point.

the material recovered during this early fieldwork was lost (see Politis and Gutiérrez 1998). During 1982–1984, new fieldwork was conducted and 35 quartz flakes and debris, 4 quartz flakes with marginal retouch, 2 orthoquartzite tools, and 1 silicified dolomite tool were found (Table 1; Politis 1984; Politis and Olmo 1986). Taking both assemblages as one, the density in this site is ca. 42.2 items/m^2. The main lithic raw material is quartz (ca. 99.75%), followed by fine-grained orthoquartzite (ca. 0.15%), silicified dolomite (ca. 0.05%), and others (0.05%) (Figure 2).

The quartz lithic assemblage recovered during the second phase of fieldwork is represented by a high percentage of flake fragments, primarily distal (56.25%) and proximal (18.75%), with a relatively low proportion of complete flakes (9.38%). The remaining lithic materials correspond to angular debris (15.63%). The large number of fractured flakes and debris suggests an over-representation of this raw material. The debitage is represented by flakes with different size ranges. The highest frequency corresponds to the small size range (from 10 to 20 mm), followed by the very small size range (no longer than 10 mm), and medium size range (from 20 to 40 mm). Mainly interior flakes are represented in quartz (angular, ridged, and unidentified flakes), but a small percentage of exterior flakes (11.8%) was found. These flakes exhibit mainly single (53.3%), dihedral (20%), cortex (13.3%), and pointed platforms (6.7%).

The quartz tools are principally unifacial retouched edges, knives, and utilized flakes, whereas in orthoquartzite and silicified dolomite, the tools are represented by flakes with marginal and discontinuous retouch (Figure 6). Moreover, Palanca et al. (1972)

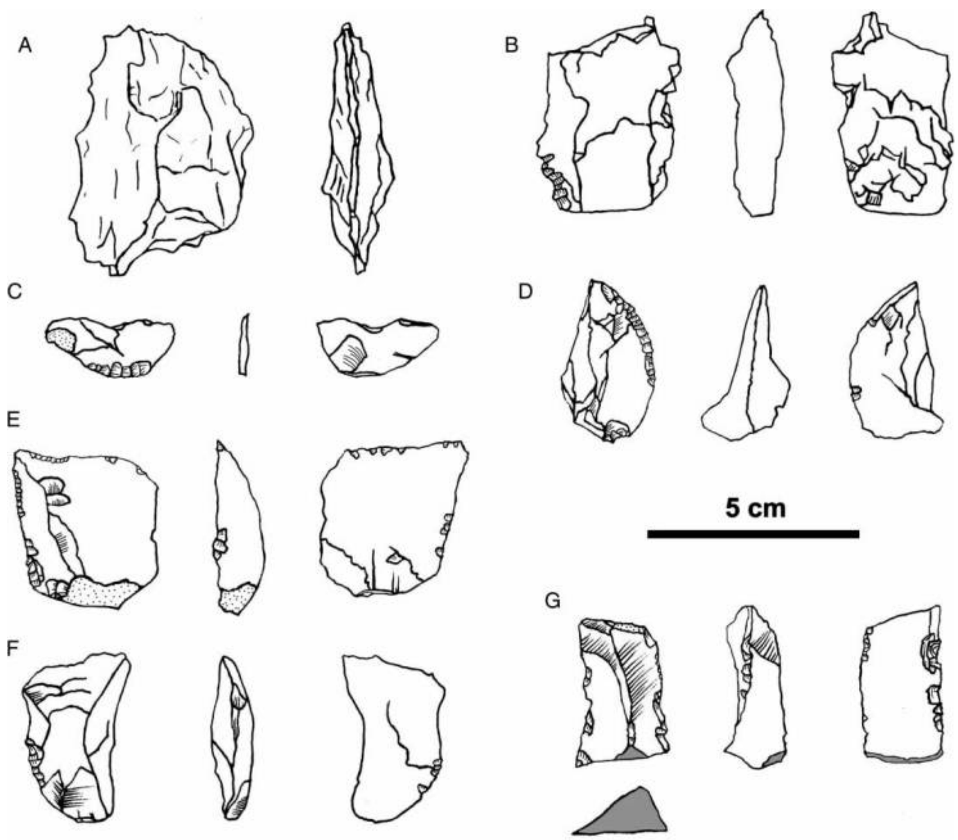

Figure 6 Lithic tools from La Moderna: (A) quartz bifacial tool (from Palanca et al. 1972); (B–D) quartz tool flakes with marginal retouch; (E–F) orthoquartzite tools with marginal retouch; (G) silicified dolomite tool (shown in gray is thermal alteration).

described the presence of a bifacial tool made of quartz. The silicified dolomite tool was altered by thermal modification (e.g., this piece presents a color shift and heat spall on the fracture section (Figure 6G)), suggesting that the tool was located near a heat source. Politis and Olmo (1986) performed microscopic edge-wear analysis on the 42 lithic materials recovered during the 1982–1984 fieldwork. They concluded that eight quartz tools, two orthoquartzite tools, and one silicified dolomite tool showed clear evidence of use, meat cutting being the main activity identified and the scraping of hard material (wood) occurring less frequently (Politis and Olmo 1986).

7. Discussion

7.1 *Technological organization strategies*

The three sites associated with the hunting/scavenging and butchering of megamammal species are located in the Pampa grasslands. Paso Otero 5 was located in an ancient floodplain during the Pleistocene/Holocene transition, whereas Campo Laborde and La Moderna were placed in swamps of the early Holocene. They shared several traits suggesting a common pattern in the strategies for exploiting megamammals. No evidence of on-site consumption was recorded, which logically corresponds with the setting of the sites (edge of a floodplain or swamp), places not typically used for more permanent human settlements or multiple-activity camps (Gutiérrez and Martínez 2008; Martínez 2006; Politis and Gutiérrez 1998; Politis and Messineo 2008).

There are similarities and differences in the utilization of lithic raw materials and in the activities performed in these sites. First, artifacts are represented mainly by a high frequency of debitage and a small number of tools. The low presence of cortex indicates that initial decortication stages did not occur at the sites. The utilization of bifacial technology was registered at Campo Laborde (i.e., the fragment of a lanceolate projectile point) and Paso Otero 5 (a bifacial tool) (Armentano et al. 2007; Martínez and Gutiérrez 2011; Messineo 2012). Similar artifacts and technologies in other early sites in the Tandilia mountain range were classified as bifacial products (Flegenheimer et al. 2003, Figure 5D). Among the differences, I should mention the higher rate of artifacts discarded in La Moderna and lower rates in the remaining sites (Table 1). Following Hofman (1994), there is no standard equation between the numbers of artifacts discarded, the number of participants in the hunting party, and the number of animals killed. Diverse causes such as the type of prey, duration of stay, access to carcasses, lithic raw-material availability, and fragmentation patterns of different rocks (e.g., quartz breaks into more fragments than other rocks do) would probably all contribute to explain the discard rate.

The techno-morphological analysis of Paso Otero 5 and Campo Laborde assemblages indicates that the flakes represent the final stages of tool production and the resharpening of different types of cutting tools, whereas in La Moderna on-site quartz manufacture is also recognized, as indicated by the presence of debitage (e.g., large number of flakes, different size ranges, and cortex). These stages of the lithic-reduction sequence were recognized both on non-local and local raw materials that were used in the processing of different megamammal species (e.g., giant ground sloth and armadillo). At Paso Otero 5 and Campo Laborde, some formal artifacts could have been transported to other sites (e.g., camp sites) and only broken tools (i.e., the side scraper, multipurpose tool, and projectile points) were discarded where the hunting/scavenging and butchering of megamammal species took place (Armentano et al. 2007; Martínez 2001; Messineo 2012; Politis and Messineo 2008).

Different scenarios can be postulated in relationship with the technological strategies applied on the lithic raw material found in these sites. To describe them, I apply the model proposed by Knell (2004, 2012), but with some modifications due to the fact that I use the type of raw material instead of Knell's generalized nodule analysis approach. Knell (2004, 161) notes that five scenarios differ depending on whether lithic raw-material acquisition, tool manufacture or maintenance, and discard, occurred on or away from a site. In scenario 1, the entire sequence of manufacturing, use, and discard occurs on-site, whereas in scenario 2, the behavior sequence includes on-site manufacturing for off-site transport and discard. In scenario 3, a previously manufactured tool or perform is introduced, modified (e.g., maintenance), and discarded on-site (complete tools may be transported off-site). In scenario 4, a finished tool is introduced to and then modified or maintained on-site, after which the tool is transported and discarded off-site. In scenario 5, a finished tool is transported to and on-site discarded (Knell 2012, 331–332, Figure 5).

At Paso Otero 5 and La Moderna, three scenarios have been recognized, whereas at Campo Laborde there are only two (Figure 7). At Paso Otero 5, scenario 3, associated with the non-local orthoquartzite from the Sierras Bayas Group, depicts the transport to the site of a previously manufactured tool that was possibly maintained or underwent additional on-site manufacture (final stages of tool production) before being discarded (Figure 7A). These inferences are supported by the refitting of the multipurpose orthoquartzite tool and two small flakes associated with the resharpening of its edge (Figure 3A; see Armentano et al. 2007). Scenario 4 is represented by

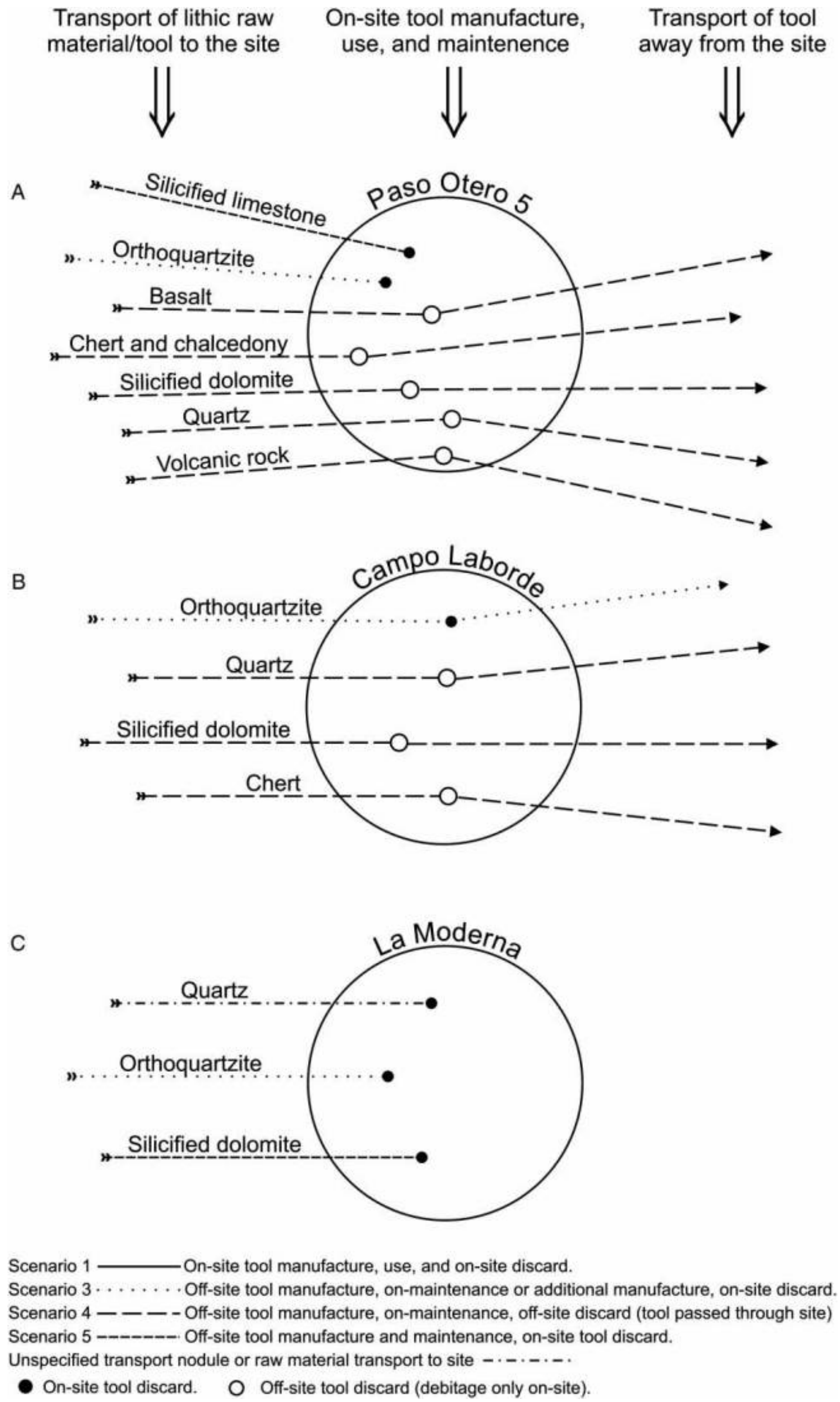

Figure 7 Movement of lithic raw material and tools through the sites (scenarios and references from Knell 2004, 2012).

a large amount of non-local raw material (quartz, silicified dolomite, basalt, chert, volcanic rock, chalcedony, and others). This scenario shows the transport of previously manufactured tools that were maintained or knapped at the site and then removed from the site and transported to other locations. In this scenario, only small flakes are present in the assemblage. Scenario 5, characterized exclusively by the extra-regional silicified limestone from the Queguay Formation in Uruguay, depicts the transport of a previously manufactured tool (Fishtail projectile point) that was discarded at Paso Otero 5 without modification or maintenance after fragmentation. In other sites in the Pampa grasslands, artifacts of silicified limestone from Uruguay (e.g., bifaces, a recycled Fishtail point, and bifacial thinning flakes) have been mentioned (Flegenheimer et al. 2003; Mazzanti 2003). The broken Fishtail point made on non-local orthoquartzite could also correspond to this scenario because evidence associated with its resharpening was not identified. Armentano et al. (2007) suggested that both projectile points could have been transported to the site within the animal carcass.

In Campo Laborde, scenario 3 is also associated with the non-local orthoquartzite from the Sierras Bayas Group (Figure 7B). This shows the transport to the site of a previously manufactured tool that was possibly maintained, or large flakes that were manufactured (final stages of tool production) on-site before being discarded (e.g., the side scraper). However, the large number of flakes found in the assemblage and the macroscopic characteristic of orthoquartzite would suggest that some tools were removed from the site and transported to other locations. On the other hand, scenario 4 is represented by three local lithic raw materials such as chert, quartz, and silicified dolomite (rocks found in low frequencies and represented by small-sized debitage). This scenario implies the transport of previously manufactured unifacial (chert and quartz) and bifacial tools (silicified dolomite) that were maintained on-site prior to being transported away.

In La Moderna, scenario 3 is also associated with the non-local orthoquartzite from the Sierras Bayas Group, whereas scenario 5 is represented exclusively by the local silicified dolomite (Figure 7C). The first one is characterized by one flake and two flake tools, and the second is formed solely by the silicified dolomite tool. This site is the only one where scenario 1 occurs, in this case in association with the immediately available quartz. In this rock, a high frequency of debitage (>1000), different flake-size ranges (small and large flakes), and diverse types of flakes from multidirectional cores were found (Politis 1984). These flakes were modified into a variety of tool types mainly associated with a wide range of unifacial retouched flake tools and utilized flakes (informal tools or expediently shaped artifacts). This scenario implies an expedient strategy of on-site manufacture, immediate use, and discard.

Following Andrefsky (1994), I suggest that the availability of lithic raw materials may have influenced the kinds of stone tools produced at the sites, and that such influence may have been only indirectly related to settlement configurations. According to this information, the scenarios in Paso Otero 5 and Campo Laborde are connected with the context of tool use through a curated technological strategy in the exploitation of the different lithic raw materials. Basically, the artifacts in these sites were curated items associated with individual toolkits (provisioning individuals, *sensu* Kuhn 1995) used by hunters during daily foraging trips where diverse megamammal species were hunted or scavenged and then butchered near water resources. From the technological point of view, this strategy reflects tool manufacture in anticipation of future events of hunting and butchering activities (see Armentano et al. 2007). The spatial incongruence between the outcrops and the place where the tools were used was an important variable influencing the choice of this strategy (Bamforth 1986; Binford 1979; Kelly 1988; Nelson 1991).

On the other hand, particular situations during the procurement and butchering of megamammals have been registered at La Moderna. For this site, Politis (1984) and Politis and Gutiérrez (1998) recognized for the less-abundant rocks (non-local orthoquartzite and local silicified dolomite) a curated strategy, whereas for the quartz assemblage they defined the use of an expedient strategy. Nevertheless, the high frequency of quartz debitage, the presence of large flakes and expedient tools manufactured, used, and discarded on-site, as well as the proximity to the quartz outcrops was interpreted by Messineo (2008, 494) as situational or opportunistic behavior (*sensu* Binford 1979; Nelson 1991) that was utilized by the hunters during the butchering of the giant armadillo (see similar ideas in Franco 2012, 85). This last strategy could have been produced in response to immediate and unanticipated conditions, and, therefore, the megamammal acquisition in the immediately surrounding area of the outcrop allowed these hunters to use a rock available nearby, despite it being of the worst quality. This situation also permitted hunters to conserve, through a curated technological strategy, those more distant and better-quality lithic raw materials (orthoquartzite and silicified dolomite).

7.2 Procurement of lithic raw material, human mobility, and prehistoric settlement

The identification of local, non-local, and extra-regional rocks in these sites allows us to recognize the different strategies applied in their acquisition. These strategies include three processes—embedded procurement, direct procurement, and indirect procurement or exchange (e.g., Binford 1979; Gould 1980; Gould and Saggers 1985; Whallon 2006)—which could have been used by hunter-gatherer groups during the late Pleistocene and early Holocene. In the Pampean region, since lithic resources are heterogeneously distributed in the landscape, it is proposed that lithic raw-material procurement would have been done mainly by specific trips and not as a secondary activity or embedded procurement (e.g., Colombo 2011; Flegenheimer et al. 1996; Messineo 2011).

The main difference among the three sites is the distance to sources. In Paso Otero 5, the presence of non-local rocks from Tandilia (orthoquartzite, chert, silicified dolomite, and quartz), the Atlantic coast (basalt), and outcrops not identified (volcanic rock) shows the exploitation of diverse environments through high mobility probably associated with direct procurement during the annual mobility range. Additionally, the presence of extra-regional rock (i.e., silicified limestone) from ca. 400–500 km away (Queguay Formation in Uruguay) depicts the long-distance movement of "exotic" raw materials across the de la Plata River as product of exchange and interaction between separate social groups. This last scenario has been proposed for other archaeological contexts located in the Tandilia range system during the Pleistocene–Holocene transition in which various small groups that inhabited different territories shared goods and information in the framework of a social-interaction network (e.g., Bayón et al. 2006; Flegenheimer et al. 2003, 2013; Mazzanti 1999; Mazzia 2011b, 2013).

On the other hand, the information obtained from Campo Laborde and La Moderna indicates that hunter-gatherers had a lower mobility during the early Holocene than in previous times (see a similar situation regarding Paso Otero 4 (Barros et al. 2014)). In these sites, all the lithic resources identified come from the Tandilia range system, which may suggest a reduction and change in the mobility ranges to access the resources. Likewise, a possible modification in the directionality of trade networks may be suggested for the Pampa grasslands because some rocks no longer appear in early Holocene sites such as the silicified limestone from Uruguay. This absence may be due to the de la Plata River becoming a biogeographic barrier for hunter-gatherers. The orthoquartzite is a non-local lithic resource and its outcrops are placed between 70 and 100 km from these sites (Colombo 2011; Flegenheimer et al. 1996). The distances involved strongly suggest that the circulation of this lithic raw material had little or nothing to do with daily subsistence activities, and its acquisition could be related to direct procurement during a logistical move and/or in the course of the hunter-gatherers' annual mobility. Finally, the less frequent resources (chert and silicified dolomite) are considered local due to the fact that the quarries identified in the Sierras Bayas and Cerro Negro hills (Messineo and Barros 2015) are placed less than 40 km from these sites, whereas the quartz found in La Moderna corresponds to a nearby available resource (less than 5 km (Politis 1984)). The acquisition of these local and immediately available rocks would suggest embedded procurement involved in subsistence activities of the groups.

During the Pleistocene–Holocene transition, the sites recorded in the Tandilia hills and the Interserrana plain shared some common features, for instance the Fishtail projectile-point technology, tool types (e.g., side scrapers, end scrapers, notches, and retouched flake tools), and some other technological traits such as lithic raw materials (mainly orthoquartzite from the Sierras Bayas Group), reduction sequences, and bifaciality (e.g., Bayón et al. 2004; Flegenheimer et al. 2003; Martínez 2006; Mazzanti and Bonnat 2013; Mazzia 2011a; Politis 2008). This suggests some kind of relationship or a common technological knowledge between the groups that inhabited these two areas. Nevertheless, the lithic assemblages in these sites also exhibit significant inter-site variability indicating diverse activities being carried out.

Politis and Madrid (2001) have postulated that the differences observed in the archaeological record of the Interserrana and Tandilia areas (settlement and land use) during the late Pleistocene would have been the result of occupations carried out by the same populations who were occupying different environments through two social strategies linked with the exploitation of resources. As has been postulated by Politis (2008, 237) "the sites in the Interserrana area would represent aggregation sites, produced by several bands during a period of fusion to perform cooperative activities such as the hunting of large megafauna."

Afterward, following the same reasoning, Politis et al. (2004) proposed that the distinction in faunal exploitation in the two areas was the result of several variables such as prey availability in the environment, site functionality (e.g., short-term versus multiple-activity campsites), and social strategies developed for the exploitation of resources (fusion and fission of bands). On the contrary, Gutiérrez and Martínez (2008, 62) recently criticized this last argument and postulated that there is no reason to believe that this process exclusively occurred in one area or another, as the zooarchaeological record does not indicate the presence of massive kill sites in the Pampas.

This process of fusion and fission of bands is recurrent among hunter-gatherer groups, and it constitutes a socio-economic strategy to exploit the environment and to use the land (e.g., Conkey 1980; Hofman 1994; Kelly 1995; Price and Brown 1985). Although aggregation sites are generally considered to be archaeologically well-evidenced and sometimes assumed to be highly correlated with communal kills or with large camp sites (Frison 1991), this process is not something we can assume for all places and times in the human past.

Driver (1995) made a distinction between cooperative and communal hunting strategies. In the first definition, the acquisition of a large prey could have been made by two or more hunters acting together during daily foraging trips, whereas the second term refers to the involvement of all members of a group or a community hunting together in a previously conceived plan (see discussions in Borrero 2013; Politis and Angrizani 2008). The evidence presented here suggests that the three sites associated with the hunting and butchering of megamammals do not confirm the aggregation or fusion of several groups to perform diverse activities; however, in these sites, cooperative hunting of large-sized prey (megamammals) could have been used to obtain these kinds of species.

The artifacts discarded in these sites could correspond to the individual toolkits carried by two or more hunters during their daily foraging trips. In Campo Laborde and La Moderna, the lithic raw materials come from the Tandilia range system and a reduced variety of rocks were transported and discarded. On the other hand, Paso Otero 5 has lithic raw materials representing sources from different and opposing directions (northwest, northeast, and southeast). Also, both Fishtail projectile points were made in different lithic raw materials, non-local orthoquartzite and extra-regional silicified limestone. Armentano et al. (2007, 538–539) demonstrated that these projectile points have different flaking patterns such as bifacial thinning on both sides (Figure 3B) and bifacial reduction (Figure 3A), suggesting a flexible technology to manufacture the Fishtail point (see Flegenheimer et al. 2003; Nami 2013). In this last situation, the cooperative hunting perhaps could have involved a larger number of hunters and potential consumers in the vicinity (the families of the hunters and the rest of the band).

8. Conclusion

The sites presented here, associated with the hunting/scavenging and butchering of megamammal species, offer an important record of subsistence activity, but the lithic assemblages only provide an incomplete view of overall technological organization. The information presented in this paper indicates that the acquisition of food and the distances that separated specific sites from quarries forced hunters to develop different technological strategies to exploit megamammal species. The frequency of lithic raw materials in each site suggests that the hunter-gatherer groups used diverse circuits of mobility and different action ranges in two chronological periods. During the Pleistocene–Holocene transition, the lithic assemblage shows the existence of wide ranges of human-circulation mobility and social-exchange networks that included groups that occupied distant territories of this extended region, as has also been suggested for the Tandilia hills by other authors (Flegenheimer et al. 2003, 2013), whereas during the early Holocene only resources from the Tandilia range system have been recognized. However, it must be taken into consideration that the data described here were generated with a limited number of archaeological sites, and, for this reason, future work in other sites should be made to adjust and/or modify these interpretations.

Acknowledgements

Thanks to Gustavo Politis for his comments and Agustina Massigoge and Florencia Santos Valero for their comments and review of the English version. I am grateful to Gustavo Martínez for providing me Figures 2, 3. Daniel Rafuse collaborated with the preparation of Figure 1. María José Colantonio made the illustration in Figure 6. Field work and analyses were financed by the Consejo Nacional de Investigaciones Científicas y Técnicas (PIP 5424), the Agencia Nacional de Promoción de Ciencia y Técnica (PICT 2010-1415 and PICT 2008-0430), and INCUAPA (FACSO-UNCPBA). This article is a product of the UE INCUAPA-CONICET, Facultad de Ciencias Sociales (UNICEN).

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