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Hunter–gatherer provisioning strategies in a landscape with abundant lithic resources (La Primavera, Santa Cruz, Argentina)

Lucía A. Magnin

CONICET, División Arqueología del Museo de La Plata, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, Argentina

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ABSTRACT

The aim of this paper is to generate new data on raw material sourcing of multiple activities sites at La Primavera locality to describe some provisioning strategies adopted by mobile hunter–gatherer societies, and contribute to the study of the local settlement in the wider regional context. The local structure of lithic resources is characterized; the natural distribution of useful rocks is modeled and the raw materials of artifacts from multiple activities sites are sourced. The classification and sourcing technique applied is not a determinant method, but a preliminary approach adequate to deal with a very large lithic artifact sample. The rock distribution across the landscape was analyzed using a Geographical Information Systems (GIS) for compiling the available data and estimating the distances from the sites to the sources for each raw material found in them. Based on the circulation distances and different considerations regarding the characteristic of the lithic sources, three different provisioning strategies are delineated. They suggest that settlement at the locality involved a certain permanence time that surpasses a logistic use, while keeping trade and social networks with other localities in the regional context.

1. Introduction

The identification of the movement of materials by hunter–gatherers across the landscape has been applied in archaeological research to study their mobility, use of space, technological organization, territoriality and social interaction (see Jochim, 1976; Ericson, 1984; Torrence, 1984; Bamforth, 1986; Aschero, 1988; Meltzer, 1989; Nelson, 1991; Geneste, 1992; Gamble, 1993; Franco and Borrero, 1999; Duke, 2003; Méndez et al., 2004; Charlin and Cardillo, 2005; Berón, 2006; among others). The vast bibliography on this subject suggests that provisioning and exchange of raw material depends on many variables, including availability and accessibility of workable stone, the uses of the tools, the types of stone-working techniques employed in their manufacture, and the types of mobility strategies and settlement patterns which the knapper was engaged in (Holdaway and Stern, 2004). In this regard, the formulation of sound interpretations of sourcing choices is not a simple matter and raw material studies complement information coming from different lines of evidence.

In this article, lithic raw material circulation is studied for approaching provisioning strategies that were adopted by hunter gatherer mobile societies in La Primavera locality, a research area that extends 10 × 10 km around Cueva Maripe, the main archeological site. This information contributes to the understanding of the hunter–gatherers adaptations in the regional context, a subject that needs further in depth research for the Late Holocene after ca. 3000 BP.

2. Environmental setting and archaeology studies at La Primavera

The study area is situated in the center of the Deseado Massif plateau (Santa Cruz province, Argentina), covers an area of approximately 100 km^2 and extends between 47° 48 ′17.724″ and 47° 54′ 8.073″ S and 69° 1 ′17.2″ and 68° 53′ 14.538″ W (Fig. 1). The topography of this area is characterized by the presence of extensive plains with a gentle east regional slope and terrain elevations ranging between 400 and 900 m. From the geomorphologic point

E-mail addresses: lumagnin@yahoo.com.ar, lmagnin@fcnym.unlp.edu.ar.

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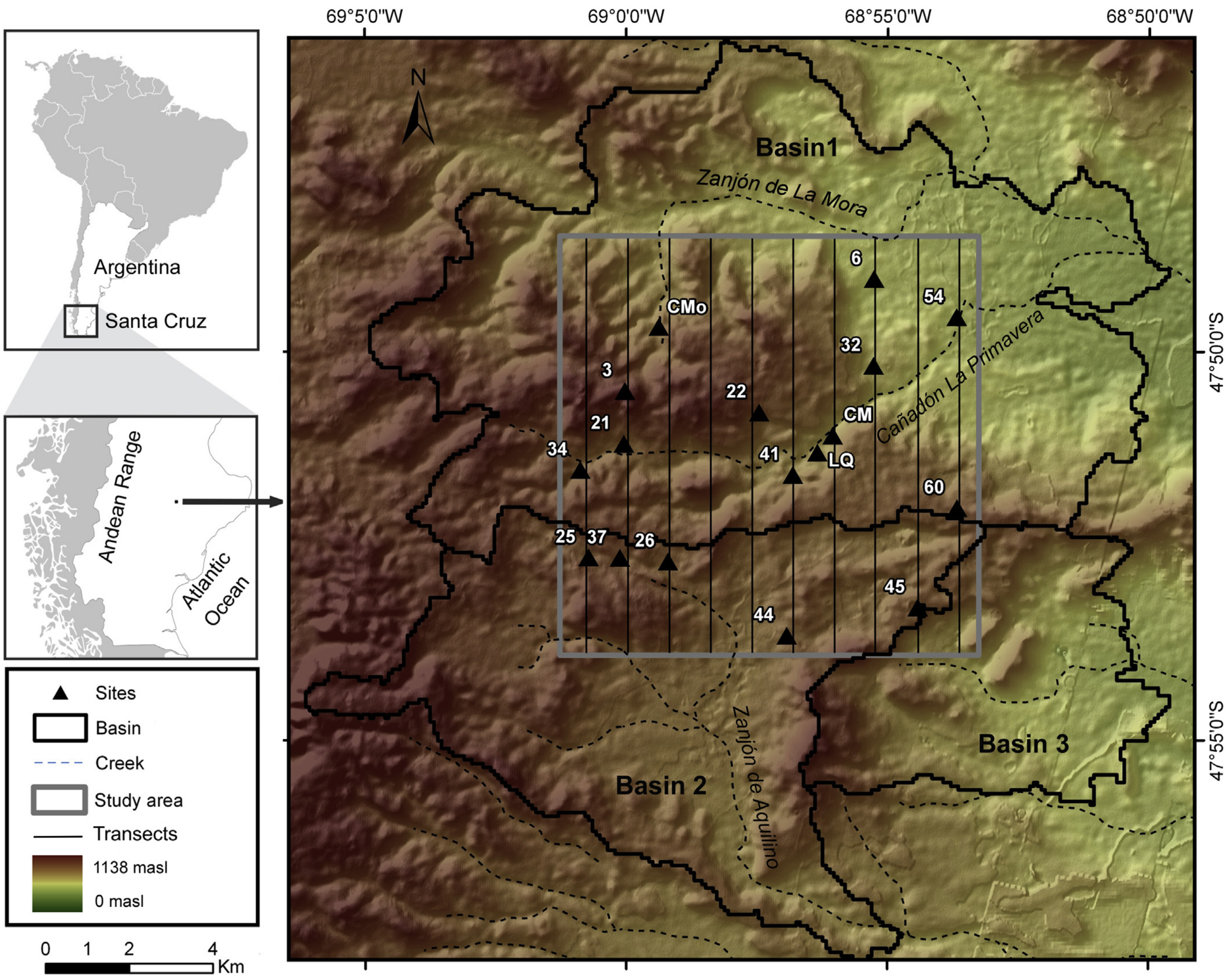


Fig. 1. Location of the study area and the archaeological sites analyzed for this research (for their references see Table 1). Sratigraphic sites with radiocarbon dating: CM: Cueva Maripe; CMo: Cueva Moreno; LQ: La Quinta. Elevation data derives from ASTER GDEMv2 (METI–NASA, 2009); hydrology data derived from SIG-IGN 250 (2013).

of view, fluvial action is the main landscape shaping agent. In addition, as it is a semi-desert region, wind, landslides, and volcanic action are other important factors affecting the local morphology (Panza, 2001).

The river structure is only partially integrated in a multiple endorheic system. This consists of transitory regime courses that carry water only during the rainy season (during the winter and early spring). The main tributaries at the locality are the ravine Cañadón La Primavera and the temporary creeks Zanjón de Aquilino and Zanjón De la Mora. They are distributed in two of the drainage basins delineated in the locality (Magnin, 2011) (Fig. 1). The permanent freshwater sources are springs associated with the basaltic and volcanic rock aquifers (Mazzoni and Rabassa, 2010).

The local geology is characterized by the presence of a variety of rock formations, mainly of volcanic origin and of Jurassic and Cretaceous age, which are locally covered by basaltic rocks that shield them from erosion. In a few cases, the basalts present an elongated arrangement, marking lava flows along waterways that existed in the past and indicating a process of inversion in the ancient landscape (Panza, 2001) (Fig. 2). The main geologic formations are Chön Aike (primarily conformed by rhyolitic ignimbrites, agglomerates and tuffs, rare tuffites and rhyolitic porphyries, and epithermal quartz veins); Bajo Grande (tuffs, tuffites, sandstones and conglomerates, rare laminated limestones); Baqueró (tuffs, shales, coarse sandstone, and conglomerates); Las Mercedes basalt; materials of landslides; deposits that cover pediment levels; and deposits that cover alluvial fans and plains (cobbles of varied lithology, gravels, sand and lime) (Panza, 2001).

All of the bedrock outcrops and secondary deposits were important geological resources for hunter–gatherers, not only as rock sources for manufacturing stone artifacts (i.e. silicified ignimbrites and tuffs, rhyolitic ignimbrites, basalts, chalcedony), but also as sources of minerals for rock art paint and building blocks used in hunting blinds and burials. In addition, caves and rock shelters formed mainly in the Chon Aike Fm. were valued for protection from strong winds during the summer and low winter temperatures.

The archaeological investigations at La Primavera locality have yielded valuable information on hunter–gatherer societies that inhabited this landscape in the past. Radiocarbon data at two of the rock shelter sites (Cueva Maripe, Cueva Mora) and an open air site

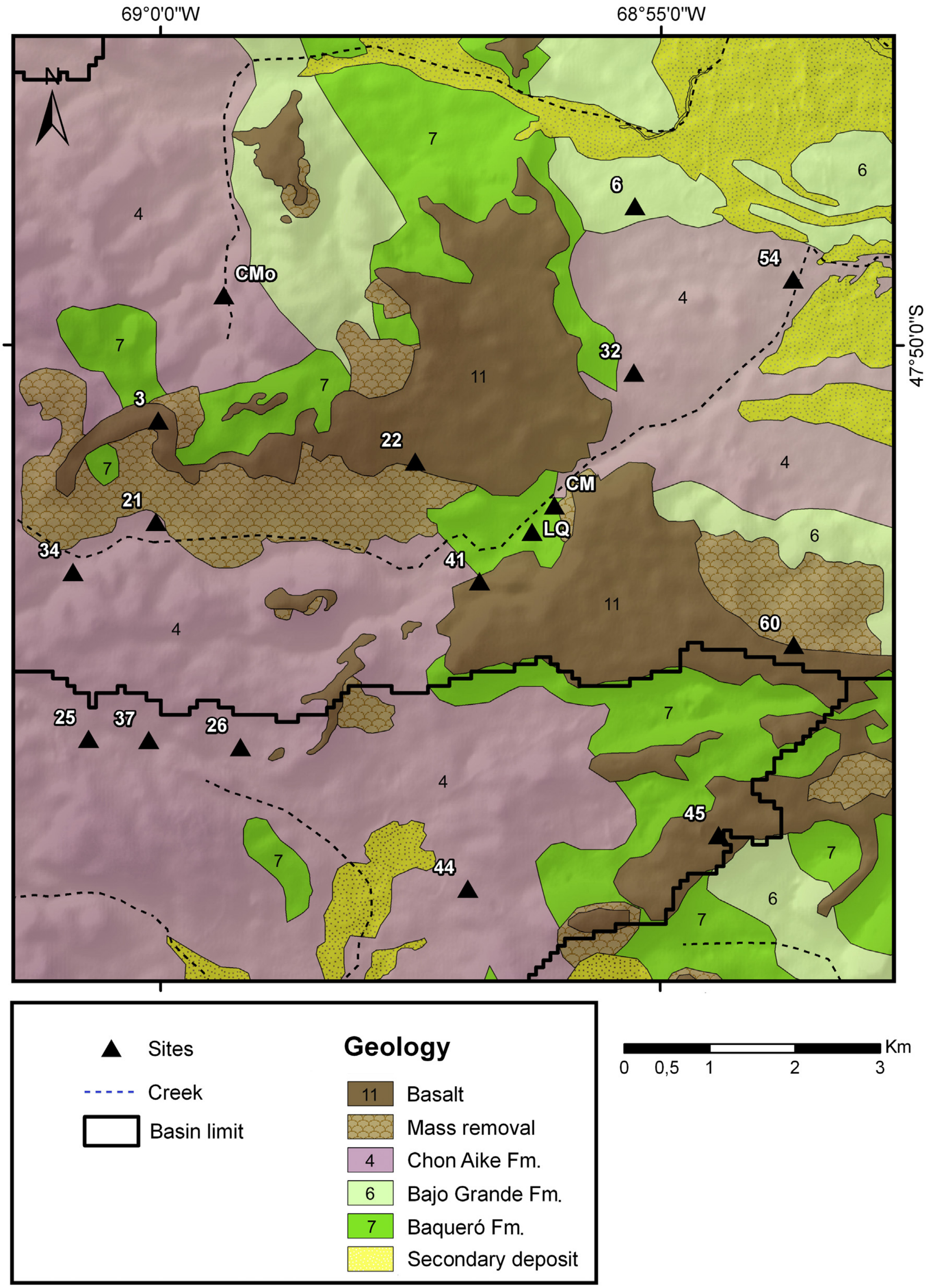


Fig. 2. Geological formations in the study area (Panza, 2001) (see Table 1 for site references) digitized from the geological cartography 4769–IV, Monumento Natural Bosque Petrificado; at a 1:250.000 scale; Secretaría de Minería, Instituto de Minería y Recursos Minerales (SEGEMAR). Its original projection is Gauss Krüger Faja2; Datum: Campo Inchauspe.

(La Quinta) (Fig. 1) show that they occupied this area for a period of approximately 8000 years. The earliest dates in the locality corresponds to a hearth charcoal sample taken from the lower deposits at the Cueva Maripe site, which was dated to 9518 ± 64 BP (AA65175) (Miotti et al., 2007); and the latest dates corresponds to a *Lama guanicoe* cuneiform recovered in archaeological context at the open air site La Quinta, dated to 939 ± 59 BP (AA85460) (Magnin, 2010); two hearth charcoal samples dated to 3.210 ± 60 BP (LP1497) and 1.078 ± 40 BP (AA65176) from deposits at Cueva Maripe site (Miotti et al., 2007); and a flake of *L. guanicoe* metacarpal bone from Cueva Mora site, dated to 3.678 ± 65 BP (AA85461).

Cueva Maripe is the most intensively investigated site in the locality. Situated in the middle course of Cañadón La Primavera, 4 m above the valley course (Fig. 1) and with an inner space measuring 24 m long, 26 m wide, and 1–5 m in height, this cave is the largest rock shelter in the area. The site has a high density of artifacts recovered from its long sedimentary sequence (49.44 and 100.73 lithic artifacts/m^3 in the north and south chamber, respectively) and an abundance of rock art painted on its walls. The archaeological context has been interpreted as a sequence of multiple activity events where mainly domestic tasks took place (Miotti et al., 2007). Ritual activities were also performed, as shown by the presence of parietal art in the same habitation space (Carden, 2008).

In the last years, a systematic surface survey was carried out in the locality using parallel transects that were 10 km long and spaced at 1-km intervals (Fig. 1). Four surveyors separated 10 m apart from each other described and sampled both natural resources and archaeological evidence. Some of the resources registered included springs, lithic raw materials and rock shelters; and the archaeological evidence registered included, not only dense sites, but also isolated finds and lower density scatters dispersed across the landscape. This data was used to generate a GIS geodatabase that permitted modeling the way hunter–gatherer societies used the local space (Magnin, 2010). The lithic assemblages were classified as multiple activities sites when they presented high artifact densities (0.22 > 2.33 artifacts/m^2) and a diversity of tool types and raw materials, indicating places where prolonged residential occupations or successive reoccupations occurred (Binford, 1982). Lithic assemblages with intermediate artifact density values (0.02 > 0.22 artifacts/m^2) were classified as multiple activities sites when high artifact diversities along with conditions of low archeological visibility were detected (Magnin, 2010). These criteria allowed identification of a total of 14 multiple activities sites with a mean extension of 1823 m^2 (Fig. 1).

The location analysis revealed that open air multiple activities sites were localized close to freshwater sources, in sectors exposed to the wind and close to quarried bedrocks (Magnin, 2010). The last tendency was unexpected, as the vast abundance and wide distribution of raw materials suggest that the location of quarries should not constitute an important factor for the setting of sites.

This motivated some further questions; namely, in addition to quarried outcrops, what other potential sources of raw materials exist? What is their local distribution? Which of them were used in multiple activities sites? What raw materials have no local sources? What distances are involved in the sourcing and discard of artifacts? What sourcing strategies can be inferred? The current research on raw material availability and their discard in multiple activities sites aims to approach some of these questions aiming to contribute useful information for modeling the latest period of occupation in the locality in its regional context.

3. Regional archaeological studies

The Deseado Region is located at the interior of the Deseado Massiff plateau, north of the province of Santa Cruz between the Andean cordillera, to the west and the Atlantic coast, to the east (Fig. 1) and was inhabited by hunter–gatherer societies from the Pleistocene–Holocene transition (ca. 13,000–9500 BP) (Miotti, 1989; Miotti and Salemme, 2003, 2004). The zooarchaeological evidence shows that the main subsistence strategy was sustained by hunting guanacos (*L. guanicoe*) and complemented by ñandú (*Rhea americana*) (Miotti and Salemme, 1999; Salemme and Frontini, 2011; Miotti, 2012). According to available population models (Borrero, 1989–1990; Miotti, 1989; Kelly and Todd, 1998; Miotti and Salemme, 2004) and supported by palaeo-climatic studies and archaeological evidence (Miotti and Salemme, 2003, 2004), a high residential mobility was key to the successful initial colonization of the region.

Current studies suggest that the high mobility probably continued during the Mid-Holocene and included residential or logistic moves to the cordillera and the coast (Miotti, 1989; Miotti and Salemme, 1999, 2004; Salemme and Miotti, 2008). The presence of allochthonous materials indicates contacts between those regions pointing to the existence of extensive social networks that facilitated the movement of goods and information between people inhabiting different environments (Miotti, 2006; Carden et al., 2009; Hermo and Miotti, 2011; Hermo and Magnin, 2012).

By the Late Holocene, some of the regional spaces, as the marine littoral, were effectively occupied. Populations moved along the coast and settled for periods of time and performed logistical movements to the interior plateau mainly for hunting and provisioning of lithic raw materials (Castro et al., 2003; Zubimendi et al., 2004). While the extension and timing of the residential moves along the coast is still unknown, the sourcing forays to the continental interior may have followed cañadones and, as is suggested by the archaeological information available (Castro et al., 2003; Zubimendi et al., 2004; Zubimendi, 2010), could have involved distances of about 10–25 km.

In the Andean pre-cordilleran sector, palaeo-environmental studies at Lake Cardiel (Stine and Stine, 1990; Stine, 1994) show a decrease in humidity around 1000 BP during the Medieval Climatic Anomaly, and archaeological evidence suggests that these climatic changes led to a reduction in residential mobility, concentrating populations in the basins of Lake Pueyrredón, Salitroso-Posadas, Strobel and Cardiel, while performing logistic forays to the plateaus and high basins for provisioning of diverse resources (Goñi, 2000–2002; Cassiodoro et al., 2004; Goñi et al., 2004; Aschero et al., 2005; Cassiodoro, 2008). This means that forays from the lake basins to the nearby plateaus could have involved mean roundtrip distances of 45 km.

It is within this regional scenario that it is important to assess which was the mode of occupation of La Primavera, in the Late Holocene. Was it a space occasionally visited by hunter–gatherers with logistic purposes or was it characterized by a residential use, as has been proposed for the Andean pre-cordillera and the Atlantic coast?

The lithic sourcing study performed here is one possible line of analysis to address this subject. According to Rockman (2003: 12), lithic sourcing involves a “landscape learning process”, which implies that time is needed to locate and test different types of raw materials before selecting the appropriate rock or mineral for use. The longer the time a group stays in a place or the more often it revisits that place, it acquires a deeper familiarization with resources distribution. In comparison with other resources, lithic raw materials are particularly adequate for this because their fixed locations preclude the use of standard strategies to exploit them at different localities (Ford, 2011).

Given the abundance of lithic sources in La Primavera, short sourcing distances are expected, but significant information can be drawn from a detailed examination of the raw material most frequently used in a determined site and the relative sourcing distances of the different raw materials present in them. If the source of the most frequently used raw material in a site is not the closest to it but a more distant one, this could be indicative of detailed knowledge of resource distribution, implying a learning time involved that could not be proposed if the directly available raw materials were mainly used. These different situations are referred to as non-immediate sourcing and immediate sourcing, respectively.

4. Materials and methods

4.1. Surface archaeological evidence, source distribution, and inferences

The chronological framework defined for the hunter–gatherer occupation at La Primavera in this work implies that a low temporal resolution will be reached, but because the analyzed data comes from surface assemblages, the evidence will probably reflect the latest periods of occupation more intensely and it is possible to assume that the observed trends are assignable to the Late Holocene occupation period.

Concerning the use of present data on raw materials distribution, geologic studies assert that the central Deseado Massif plateau is highly stable compared to the Andean range or the Atlantic coast, where the landscape has undergone significant changes from the last glacial period (Isla and Bujalesky, 2008; Rabassa, 2008). In general terms the landscape known by the early populations that arrived to the area was very similar to the present (Zárate et al., 2000), so the distribution of rock sources analyzed here should be a valid source of information for past sourcing behaviors.

On the other hand, the action of natural processes in semi-desert conditions on archaeological distributions cannot be disregarded. The registered assemblages are part of "remaining settlement patterns" (Dewar and McBride, 1992: 227), implying that the tendencies in the circulation of raw materials obtained in the present analysis can be interpreted in the long term.

4.2. Lithic raw material sourcing method

Following Summerhayes (2008), it is not possible to unequivocally source an object; instead, the archaeological evidence and the equivalent available source materials can be characterized using different analytical methods to search for similarities and to generate attributes. Sourcing materials by characterization studies depends significantly on the knowledge of the natural raw material distribution, so it requires an intensive survey within the study area looking for possible geological sources and working with local geologists. Once the geology is known, and the raw materials are identified, any lithic evidence in an archaeological context could be traced back to its origin, and the distance that the material has traveled can be estimated.

Diverse analytical methods can be applied to identify raw materials used for knapping stone tools. These differ in cost, destructiveness, and sensitivity. Based on high-quality geological mapping, the visual examination represents an adequate starting point, but methods such as trace-element analysis, microscopic examination of thin sections (METS), and isotopic analysis are more reliable procedures (Renfrew and Bahn, 1993; Summerhayes, 2008).

In the Deseado Massiff area, energy-dispersive X-ray fluorescence (XRF) and trace element by instrumental neutron activation analysis (INAA) have been successfully applied to obsidian (a volcanic rock which does not have known local sources). These studies determined that the source of the black obsidian analyzed from sites Piedra Museo, La Martita and Cerro Tres Tetas come from the areas Pampa del Asador, Pampa de La Chispa, and the alluvial fan of Cerro Bayo, located 120–195 km west of these sites (Espinosa and Goñi, 1999; Stern, 1999, 2004; Belardi et al., 2006).

At La Primavera locality, METS analysis was applied to artifact samples from Cueva Maripe, and rock samples from three local quarried bedrock outcrops: Cantera Rocky (CR), Cantera del Verde (CDV), Cantera del Rojo (CDR), and the secondary deposit Pedimento 1 (LP-P1) (Hermo, 2008). A total of five samples from Cueva Maripe and nine samples from the mentioned quarries were analyzed. The study, performed by Pilar Moreira (Instituto de Recursos Minerales, INREMI), permitted assigning the samples to five groups based on their mineral characterization. Data showed that all the studied sources were involved in the manufacture of artifacts discarded at Cueva Maripe. This information allowed Hermo (2008) to establish that the distances implied in the circulation of lithic artifacts from Cueva Maripe are 199 m (Silicified Ignimbrite Group 2 from the quarry CR), 6.23 km (Siliceous rock Group 3 from quarry CDV), and 11.59 km (Silicified Ignimbrite Group 1 from quarry CDR). Other rocks used were Siliceous rock Group 1, Opals Group 1, and Chalcedony Group 1, with results similar to samples from the secondary deposit LP-P, located 4 km from the site.

In order to study general tendencies in the circulation of artifacts in residential contexts at La Primavera, in this article the study of raw materials circulation is extended to the total number of multiple activity sites known and all up to date available information on potential sources (Bailey and Davidson, 1983). This implies that a large sample of artifacts and raw materials needs to be characterized, which in turn jeopardizes the application of expensive and destructive techniques. Therefore, it is proposed here to make a preliminary characterization applying a non-destructive method that allows the inclusion of a very large sample of artifacts and raw material sources at low costs. Based on these considerations, visual and 10× magnifying glass examination is applied. The first step is to classify the raw materials on the basis of observable characteristics in the hand specimen, and then to estimate its possible sources.

A characterization problem inherent of the study area is that many raw materials are abundant and available at different locations. This is not a problem of precision of the characterization technique, but it is related to the local geography since rocks and minerals of good knapping quality are available not only in outcrops but also in secondary deposits like pediments and alluvial fans (Hermo, 2008; Magnin, 2011). The solution proposed here is to include all the possible sources for raw materials present at the sites and defining ranges of distances involved in their circulation. Although this is not a method that permits a specific determination of the raw material provenience, it is a preliminary starting point.

4.2.1. Artifact raw materials

Following the general characteristics defined in Tarbuck and Lutgens (2007), the raw materials from artifacts at sites and the samples of raw materials from quarries were grouped in one of the following classes: andesite, basalt, chalcedony (homogeneous translucent silica), obsidian, opalized petrified wood, rhyolite, siliceous rocks (including opals) and indeterminate.

The class “siliceous rocks” includes a number of volcanic rocks, such as tuffs, high silicification ignimbrites, and breccias. These have conchoidal fractures and are characterized as flintknapping material with qualities that range from regular to good (Aragón and Franco, 1997). This group may also include rhyolite, except those in which the porphyritic texture where quartz or alkaline feldspar crystals can be observed. In those cases, the sample is classified as “rhyolite”. With respect to the category “chalcedony”, the term is used here for descriptive purposes and refers to a variety of extremely homogeneous silica with conchoidal fractures, translucent and with vitreous luster. Therefore, the class chalcedony has no correlation with the mineral, as it is not possible to determine it in a hand specimen.

4.2.2. Lithic sources

The information on the distribution of workable rocks in the landscape come from three different data sources: field data gathered from a detailed terrain survey (Magnin, 2010), the geologic map at a 1:250.000 scale (Panza, 2001) and the geomorphology map available for this area at a 1:50,000 scale (Gómez

Fig. 3. a) and b) Siliceous outcrop used as a raw material quarry (Cantera Platense, Chön Aike Fm.); c) and d) a secondary deposit in basin 1; e) and f) nodules of siliceous rock in Chön Aike Fm, close to Cueva Mora.

and Magnin, 2008). Fieldwork observations and interdisciplinary work with geologists (Pilar Moreira and Santiago Medel) were very important to make that information functional to the archaeological purposes. During the surveys, useful rocks were found in three different conditions: as outcrops with evidence of quarrying, as concentrations in secondary deposits and as rock nodules dispersed in extensive geologic formations (Fig. 3). The field observations and geologic information available allowed assigning these rocks a local or extra-regional origin. Most of the used rocks present local sources: Las Mercedes Fm. is a source for basalt; Baqueró Fm. and Bajo Grande Fm., which are very abundant in vegetal fossils, are sources for petrified wood; Chön Aike Fm., characterized by rhyolitic ignimbrites, agglomerates, tuffs and porphyry is the source for rhyolite (Panza, 2001). Concerning siliceous rocks, they have their sources in formations which are mainly composed by volcanic rocks presenting high silicification. For instance, Chön Aike Fm., presenting sectors of bedrock with high silicification and epithermal quartz veins. Also, younger formations as Baqueró Fm. with scarce conglomerates that bear quartz and highly volcanic silicified rocks could also be sources for these raw materials (Panza, 2001). Finally, andesite may come from Bajo Pobre Fm., nine km away from this locality, or may be included as cobbles present in agglomerates that belong to Chön Aike Fm (Panza, 2001).

In reference to the extra-regional raw materials, obsidian, a fragile rock presents no local sources. Until geochemical analyses are performed on obsidian samples from La Primavera, its geological origins can be assigned to the previously mentioned area of Pampa del Asador, Pampa de La Chispa and Cerro Bayo, which is the closest obsidian source for other sites in the Deseado Massiff (Espinosa and Goñi, 1999; Stern 1999, 2004; Belardi et al., 2006). Because obsidian is too brittle to resist its natural transport from distant areas, transport by humans is inferred (Hermo and Miotti, 2011).

4.3. Spatial analysis

Several approaches have been used to evaluate lithic resource availability and their distribution in archaeological assemblages. Some have been applied with the aim of tackling issues related to long distance mobility and processes of trade and exchange of lithic raw materials or manufactured lithic goods at a regional scale (Renfrew, 1969; Hodder and Orton, 1990; Renfrew and Bahn, 1993; for in-depth revision of these methods see; Conolly and Lake, 2006).

More adequate to study the circulation of raw materials focusing on the local scale, the analytical procedure applied here is a Site Catchment Analysis, a classic approach to human–environment interaction based on the study of resources found in a site and the determination of origin and provenience, which defines an area of influence for each site (Roper, 1979; Bailey and Davidson, 1983; Davidson and Bailey, 1984).

The present research estimates Euclidean distances to the sources in an area equivalent to a daily foraging trip. The distances are measured in a straight line and expressed in metric units of length that presents the advantage of being readily comparable with that generated by other studies. Other measures of proximity may be applied, such as travel time and energetic cost of traversing terrain (Vita Finzi and Higgs, 1970; Foley, 1977) using GIS accumulated cost-surface techniques to define accessible regions from sites. These techniques involve certain analytical simplicity and are practical tools for defining the site exploitation territory or performing an analysis of influence areas applied in settlement and land use studies, but require in-depth discussion of technical matters that are beyond the scope of this work and suggest a number of possibilities for further research (Bevan, 2002; van Leusen, 2002; Conolly and Lake, 2006; Wilson, 2007; Kantner, 2008; Whitley and Burns, 2008).

4.3.1. Geographic information system

All geospatial data used was compiled in a GIS environment ArcMap 10.1 (ESRI, 2010) and projected to the national grid system (POSGAR 2007 Argentina zone 2, reference system WGS 1984).

At this point it is pertinent to make some comments on the quality of the data sources employed. Quarries localized during fieldwork were registered with a GPS and then represented by point features in a GIS layer with a horizontal error of 4–7 m. Geology (Panza, 2001) and geomorphology information (Gómez and Magnin, 2008), on the other hand, were overlapped and combined in the maps represented by polygon feature GIS layers. The resulting map presents an enhanced graphic accuracy obtained from the geomorphology map (40–45 m). As is common in archaeological research, several sources of data are available, each one presenting strengths and weaknesses. It is evident that the geology and geomorphology data present a lower spatial accuracy than the quarries located by GPS on the ground. This inexactness is inherent to the kind of entities represented: in those maps, each polygon is a unit subjectively interpreted mainly from air photos and satellite images (Veregin, 1997). Provided it is recognized that the data present a higher level of generalization related to the real-world phenomena that it is representing, its low spatial and thematic resolution is acceptable for the application proposed in this work. It is not necessary to discard any of the data sources in advance, bearing their limitations in mind; all can be used and involved in a GIS aided exploratory data analysis.

A different issue to evaluate is if the available data are representative of the landscape in the past (Kvamme, 2006). It is assumed here that no important changes concerning the geology and geomorphology have occurred over the human occupation period in relation to the location of lithic raw materials (Zárate et al., 2000).

4.3.2. Patterns in raw materials used and estimation of minimum distances to sources

The analytic strategy is to detect general tendencies in the raw materials which are present in all the analyzed sites. Complementarily, the analysis is focused on each particular site and on possible sources to determine whether the most abundant raw materials which were used come from a source located at its immediate surroundings (and can thus be characterized as immediate sourcing), or if the closest source is not the most represented in the site, but rather other sources located farther away within the locality (non-immediate sourcing).

Ideally, the sourcing analysis proposed here would require measuring the distance from every site to the source for every kind of stone present in them. Since it is not possible to discern the actual source for each one, three different values were estimated: 1) the distance to the nearest quarried outcrop located during fieldwork; 2) the distance to the geologic formation that bears the particular raw material under analysis; and 3) the distance to the nearest secondary deposit containing cobbles of the alluded raw material (Fig. 4).

The secondary deposits represent a particular problem for source analysis (Luedtke, 1992; Duke, 2003). In this locality, they are deposits that cover levels of pediment and deposits associated to creeks. Field work observations show that useful cobbles of raw materials with varied qualities for flaking exist along the entire extension of those deposits, along with almost homogeneously distributed cortex removing evidences (Hermo, 2008;

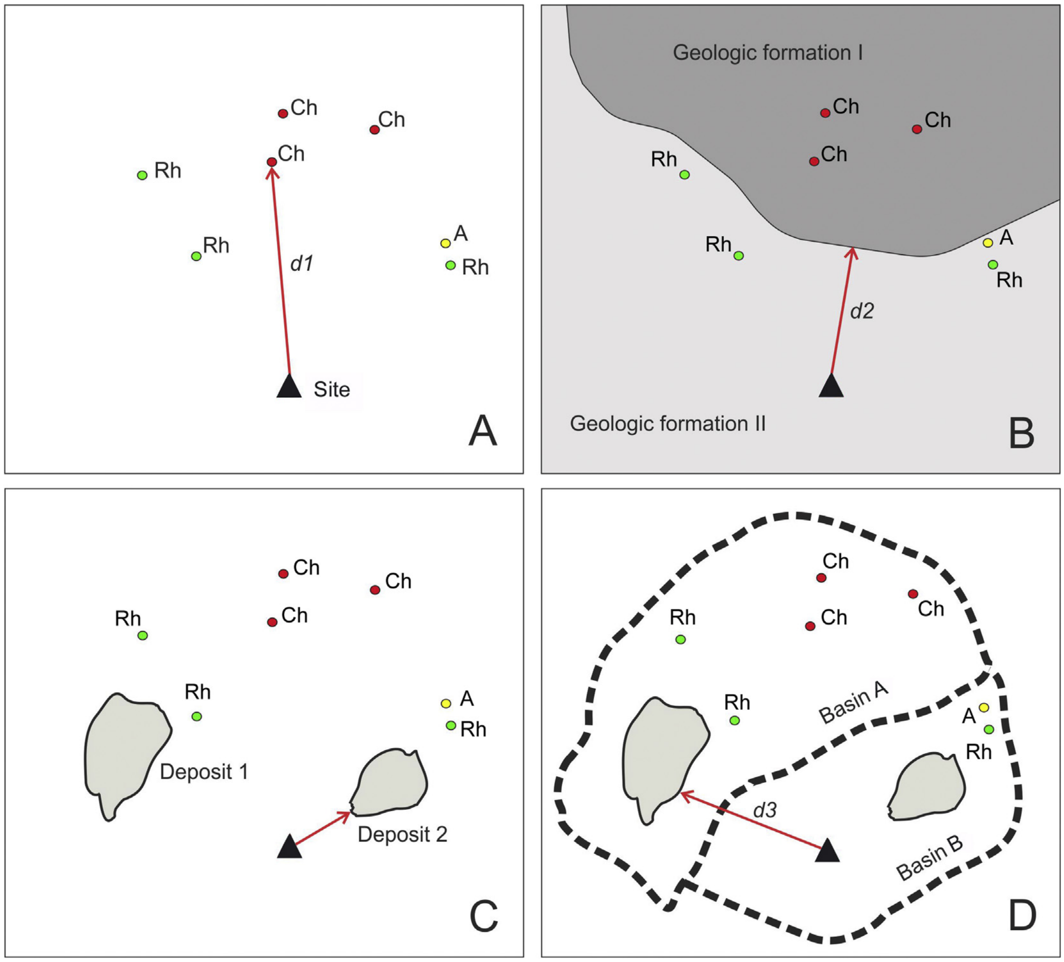


Fig. 4. Procedure for measuring the minimum distance between the multiple activity site and the closest source of chalcedony. Chart A shows the solution of the distance (*d1*) between the multiple activities site and the closest chalcedony quarry (Ch: chalcedony; Rh: rhyolite; and A: andesite). Chart B shows the distance (*d2*) to the closest geologic formation that could contain chalcedony. Chart C shows the distance to the nearest secondary deposit, but as can be seen in chart D, analyzing the boundaries of the drainage basins and the available information on quarries and geologic formations that are contained in each one, recognizes the closest secondary deposit that may be chalcedony-bearing, and calculate the distance (*d3*).

Magnin, 2010). A great variety of raw materials have been registered in these deposits, but it cannot be assumed that all the types of rocks existent in the locality are present in every particular deposit. An approach to this problem is the estimation of the classes of rocks in each deposit by analyzing the hydrologic basins as rock catchments (Carballido, 2000–2002; Magnin, 2010, 2011). It is assumed that rocks present at the different geologic formations inside the boundaries of the three drainage basins delineated (Fig. 1) were naturally transported and deposited to their bottom. The measuring of distances between sites and sources is illustrated in Fig. 4. The triangle represents a multiple activity site and the objective is to measure the Euclidean distance between this site and the possible sources of chalcedony, a raw material used to manufacture some of the artifacts found in that site. In Fig. 4A, quarried outcrops of different rocks (andesite, chalcedony and rhyolite) are represented by circles. The shortest distance to the source of chalcedony, using the available information on quarries, is distance *d1.* Fig. 4B shows data on the geology and the minimum distance to the chalcedony bearing Geologic formation I, plotted as *d2*. In Fig. 4C, data on secondary deposits is presented. In this case it would not be correct to plot the shortest distance to Deposit 2 as the chalcedony source, because the geological formations and known quarries that are located inside the basin and from where different materials are transported to the secondary deposit do not present chalcedony. Instead, the distance to Deposit 1 (*d3*) shown in Fig. 4D is the shortest distance to the sedimentary unit where the nodules of chalcedony are more likely deposited, since Basin “A” covers an area where it is present.

5. Results

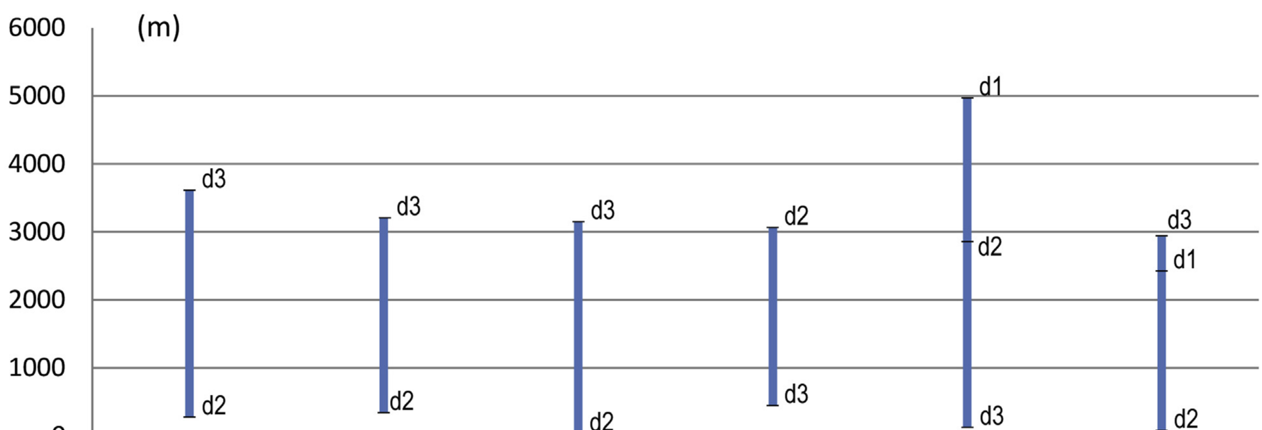
All the artifacts collected in the surface sites ($N = 1886$), and raw material samples from quarries: Cantera D9 (CD9); Cantera del Gris (CDG); Cantera Platense (CP); Cantera Rocky (CR); Cantera F4 (CF4), and Filón Negro (FN) were analyzed to examine the lithic raw materials used and their possible provenience. In addition, a sample of artifacts from the stratigraphic site Cueva Maripe ($N = 2742$) (Hermo, 2008) was included for a comparative perspective. All the analyzed artifacts are presented in Table 1.

In Table 2 the three measures of distance (*d1*, *d2* and *d3*) from the 15 sites analyzed to the 7 different raw materials are presented. With the exception of obsidian, all the raw materials used can be found at minimum distances that range from 0 to 1156 m from each site. Fig. 5 shows the range of mean distance values registered for the same raw materials, not exceeding 5000 m in any case.

Table 1
Artifacts lithic raw materials sampled at multiple activities sites.

Sites	Site ID	Andesite	Basalt	Chalcedony	Obsidian	Petrified wood	Rhyolite	Siliceous rock	Indeterminate	*N*	Local (%)	Extra-regional (%)
Alta Primavera	**3**	0	2	3	7	7	130	106	1	**256**	97	2.7
Camino Clandestino	**6**	0	0	7	0	1	4	140	1	**153**	100	0
El Denticulado	**21**	0	3	4	10	4	20	64	1	**106**	91	9.4
El Descanso	**22**	0	0	0	0	1	6	89	1	**97**	100	0
El Pájaro Muerto	**25**	0	0	1	0	0	120	5	8	**134**	100	0
El Piche Lento	**26**	0	1	1	0	1	52	7	0	**62**	100	0
Frente	**32**	0	0	0	0	20	1	21	0	**42**	100	0
Gran B.	**34**	0	0	1	3	1	36	14	0	**55**	95	5.5
La Herradura	**37**	0	0	1	1	2	33	43	0	**80**	99	1.3
Loma Blanca Bajo	**41**	0	13	1	9	2	13	78	1	**117**	92	7.7
Mirador	**44**	0	0	0	0	0	40	1	1	**42**	100	0
Oasis	**45**	1	3	21	25	9	28	364	1	**452**	94	5.5
Pico Blanco	**54**	0	3	11	9	6	1	159	1	**190**	95	4.7
Sitio del Paso	**60**	0	1	16	0	5	0	73	6	**100**	101	0
Cueva Maripe[a]	**CM**	0	137	308	297	87	1137	776	0	**2742**	89	11
Total		1	163	375	361	146	508	3053	22	4628		

[a] The artifact assemblage from all stratigraphic levels of Cueva Maripe (Hermo, 2008) were included in this chart for comparison purposes. The last columns show the proportion of extra-regional (obsidian) vs. local (all other) raw materials present in each site.



	andesite	basalt	chalcedony	petrified wood	rhyolite	siliceous rock
d1					4906	2501
d2	334	407	91	517	193	114
d3	3560	3148	3092	3004	2899	2868

Fig. 5. Range of mean distances (m) registered for different raw materials (excluding obsidian).

The distance estimations from each multiple activity site to the closest known quarry (*d1*) are plotted in Fig. 6; the distance to the geological formation which bears the raw material (*d2*) in Fig. 7; and the distance to the closest secondary deposit containing the raw material (*d3*) in Fig. 8. These figures show that at least one possible source for each raw material used is located inside the boundaries of the same basin where the site is placed. All the obtained values are presented in Table 2.

Fig. 9 presents the range of distance values registered using the three data sources: known quarries (*d1*); geologic outcrops (*d2*) and secondary deposits (*d3*).

The estimation of distances from sites to quarries show that the longest circulation distances correspond to CD9, the only rhyolite quarry known in the study area; while intermediate and shorter distances were plotted for quarries of siliceous rocks that are widely dispersed in the area (Fig. 6). As shown in Table 2 and Fig. 5, rhyolite presents the larger mean circulation distance (4906 m), while the mean distance for siliceous rocks is 2501 m. This suggests that rhyolite sources are rarer and thus better suited for raw material circulation analysis in the locality (Table 2).

According to geological data (Fig. 7), the circulation of raw materials could have involved shorter circulation movements than the previous information suggests. This information, coming from a geologic map, is more generalized; however, it permits discussion of sourcing of raw material for which quarries have not been localized in the field (i.e. andesite, basalt, chalcedony and petrified wood). These raw materials could have come from mean distances of 91–517 m (Fig. 5, Table 2). The map in Fig. 8 shows that distances to secondary deposits are long, although somewhat shorter than the distances to quarries; with mean values ranging between 2868 and 3560 m (Fig. 9, Table 2).

Finally, the analyses of the most frequent raw materials by site show that in 64% ($N = 9$) of the cases the most frequently used raw materials were those immediately available from the site (immediate sourcing), and in 36% ($N = 5$) of the cases other more distant raw materials were the most frequently used (non-immediate sourcing). The non-immediate raw materials would have circulated

Table 2
Distance from each site (se references in Table 1) to *d1*: the closest quarry; *d2*: the closest geologic outcrop and *d3*: the closest secondary deposit potentially bearing the rock. The reference between brackets in column d1 corresponds to quarries CD9 (Cantera D9); CDG (Cantera del Gris); CP (Cantera Platente); CR (Cantera Rocky); CF4 (Cantera F4); FN (Filón Negro). The identification number between brackets in column *d2* refers to the formation as in the geological map (Panza, 2001): 4 (Chön Aike Fm); 6 (Bajo Grande Fm); 7 (Baqueró Fm); 27 (Deposits that cover pediment level I); 33 (Deposits that cover pediment levels II and III); 37 (deposits of alluvial cones) (Panza, 2001). "–" indicates that the raw material is absent in the analyzed site; "x" indicates that no local quarries are known.

Site	Andesite			Basalt			Chalcedony			Obsidian			Petrified wood			Rhyolite			Siliceous rocks		
	d1	*d2*	*d3*	*d1*	*d2*	*d3*	*d1*	*d2*	*d3*	*d1*	*d2*	*d3*	*d1*	*d2*	*d3*	*d1*	*d2*	*d3*	*d1*	*d2*	*d3*
3	–	–	–	×	0 m (11)	4867 m (37)	×	279 m (7)	4867 m (37)	×	×	×	×	279 m (7)	4867 m (37)	5319 m (D9)	344 m (4)	4837 m (37)	3050 m (CF4)	279 m (7)	4837 m (37)
6	–	–	–	–	–	–	×	0 m (6)	616 m (37)	–	–	–	×	0 m (6)	616 m (37)	9328 m (D9)	161 m (4)	616 m (37)	3175 m (FN)	0 m (6)	616 m (37)
21	–	–	–	×	89 m (11)	6061 m (37)	×	0 m (4)	6061 m (37)	×	×	×	×	742 m (7)	6061 m (37)	4091 m (D9)	0 m (4)	6061 m (37)	3194 m (CF4)	0 m (4)	6061 m (37)
22	–	–	–	–	–	–	–	–	–	–	–	–	×	601 m (7)	4074 m (27)	5210 m (D9)	898 m (4)	4074 m (27)	244 m (CF4)	601 m (7)	4074 m (27)
25	–	–	–	–	–	–	×	0 m (4)	3501 m (37)	–	–	–	–	–	–	2240 m (D9)	0 m (4)	3501 m (37)	5017 m (CP)	0 m (4)	3501 m (37)
26	–	–	–	×	374 m (11)	1942 m (37)	×	0 m (4)	1942 m (37)	–	–	–	×	896 m (7)	1942 m (37)	1157 m (D9)	0 m (4)	1942 m (37)	3197 m (CP)	0 m (4)	1942 m (37)
32	–	–	–	–	–	–	–	–	–	–	–	–	×	219 m (7)	1374 m (27)	7644 m (D9)	0 m (4)	1374 m (27)	1372 m (FN)	0 m (4)	1374 m (27)
34	–	–	–	–	–	–	×	0 m (4)	4958 m (37)	×	×	×	×	1156 m (7)	4958 m (37)	3916 m (D9)	0 m (4)	4958 m (37)	4377 m (CF4)	0 m (4)	4958 m (37)
37	–	–	–	–	–	–	×	0 m (4)	2849 m (37)	×	×	×	×	1566 m (7)	2849 m (37)	1662 m (D9)	0 m (4)	2849 m (37)	4297 m (CP)	0 m (4)	2849 m (37)
41	–	–	–	×	0 m (11)	3098 m (37)	×	74 m (4)	3098 m (37)	×	×	×	×	77 m (7)	3098 m (37)	4417 m (D9)	74 m (4)	3098 m (37)	1262 m (CR)	74 m (4)	3098 m (37)
44	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2942 m (D9)	0 m (4)	496 m (37)	482 m (CP)	0 m (4)	496 m (37)
45	×	334 m (7)	3560 m (36)	×	0 m (11)	3560 m (37)	×	334 m (7)	3560 m (37)	×	×	×	×	302 m (6)	3560 m (37)	6005 m (D9)	1036 m (4)	3560 m (37)	2680 m (CDG)	334 m (7)	3560 m (37)
54	–	–	–	×	2737 m (11)	323 m (27)	×	0 m (4)	323 m (37)	×	×	×	×	474 m (6)	323 m (27)	9843 m (D9)	0 m (4)	323 m (27)	2325 m (FN)	0 m (4)	323 m (27)
60	–	–	–	×	0 m (11)	2766 m (27)	×	408 m (7)	2766 m (37)	–	–	–	×	408 m (7)	2766 m (27)	–	–	–	2646 m (FN)	408 m (7)	2766 m (27)
CM	–	–	–	×	53 m (11)	2566 m (27)	×	0 m (7)	2566 m (37)	×	×	×	×	0 m (7)	2566 m (27)	5747 m (D9)	95 m (4)	2566 m (27)	199 m (CR)	0 m (7)	2566 m (27)
Mean		**334 m**	**3560 m**		**407 m**	**3148 m**		**91 m**	**3092 m**					**517 m**	**3004 m**	**4906 m**	**193 m**	**2899 m**	**2501 m**	**114 m**	**2868 m**

in minimum ranges of 74–898 m from the sites. The stratigraphic site Cueva Maripe also shows a similar pattern of non-immediate sourcing of the most frequently used raw materials (Tables 1 and 2).

6. Discussion

6.1. Raw materials use and distance from the analyzed sites

As it is evident in Fig. 9, the use of alternative data on potential sources retrieves different distance values. For instance, using solely the data on the location of known quarries (*d1*) would lead to interpreting longer distances for the circulation of raw materials; while the use of the geologic map (*d2*) would return shorter distances and the use of the secondary deposits information (*d3*) would show intermediate distances. Therefore, the information obtained was considered in terms of a range of possible values for provenance distances.

Results show that most of the raw materials which were used are local, with the exception of obsidian. Within local raw materials, in the majority of the analyzed cases ($N = 9$; 64%), the most used rock coincides with the closest source (immediate sourcing); while in the remaining surface sites ($N = 5$; 36%) as well as in Cueva Maripe, the most frequent raw materials are not the ones most closely available but other ones sourced further away in the locality (non-immediate sourcing). Therefore, an accent on the use of the closest raw materials at hand is evident, but some of the sites show a preferred use of rocks located further away.

The obsidian has an extra regional source and was introduced by anthropic action. Despite this fact, it is present in 50% ($N = 7$) of the analyzed surface sites representing 1.3–9.4 % of the total artifacts, and 11% of the total artifacts from Cueva Maripe (Table 1). The presence of obsidian in half of the studied sites is remarkable, considering the long distances involved. Obsidian is a rock which fractures easily and predictably, so it is simple to work with and produces very sharp edges, but can also be fragile for certain uses. Moreover, many of the local raw materials present excellent quality and because they are more durable, their edges are less easily damaged. Therefore, a purely functional explanation for direct provisioning, trading or exchanging this rock so distantly sourced is not suitable. As discussed elsewhere (Hermo and Miotti, 2011), symbolic and social matters would have affected human decisions on the long distance circulation of this rock. These observed tendencies in the material record can be interpreted in terms of a variety of provisioning strategies that are listed below.

6.2. Raw materials provisioning strategies at La Primavera

The information on raw materials could be evaluated to provide some clues to understand choices that hunter–gatherers made in their interactions with the environment (Mithen, 2009). Quarries, geological formations, and secondary deposits present different levels of find certainty. On the one hand, the largest rock outcrops with evidence of quarrying could have been precisely located in space and their location easily kept in the memory of hunter gatherers. On the other hand, the extensive geological formations and the secondary deposits represented a higher degree of uncertainty, because they are wide areas where raw materials are not evenly distributed. So, it may be assumed that the possibility of finding certain raw material is high if it is decided to procure it from a quarry which provides it abundantly and which is precisely located. In contrast, the possibility of finding raw material is low if it is decided to traverse the wide areas of geologic formations or secondary deposits where the needed rocks are found. Some differences in the spatial distribution should be taken into consideration: secondary deposits are areas where nodules of raw

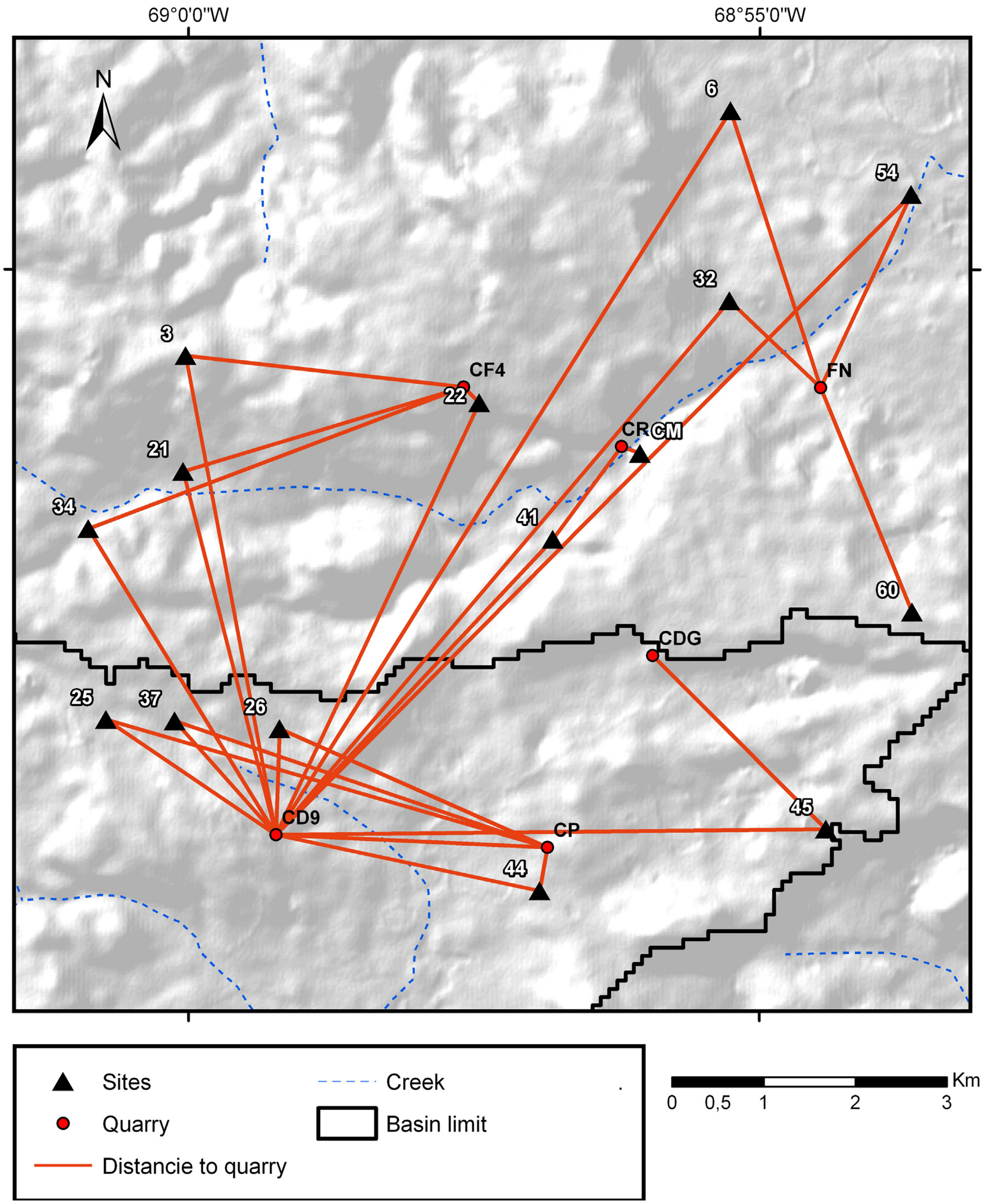


Fig. 6. Map of distances (*d1*) from multiple activities sites (see sites names in Table 1) to quarries CD9: Cantera D9; CDG: Cantera del Gris; CP: Cantera Platente; CR: Cantera Rocky; CF4: Cantera F4; FN: Filón Negro.

materials presenting varied qualities are concentrated, while geologic formations are wider areas where they are dispersedly distributed. Therefore, geologic formations could be assigned to a low level of certainty and secondary deposits to an intermediate level. These observations suggest some possible strategies that could have been adopted in relation to sourcing.

6.2.1. Long provisioning distance, high reliability

In a mobility strategy for provisioning camp sites with raw materials, the distances traversed to access far away quarries would be compensated by the certainty in finding specific raw materials. This could be the case of the rhyolite and siliceous rock quarries known in this locality. These quarries may have been included in the foraging

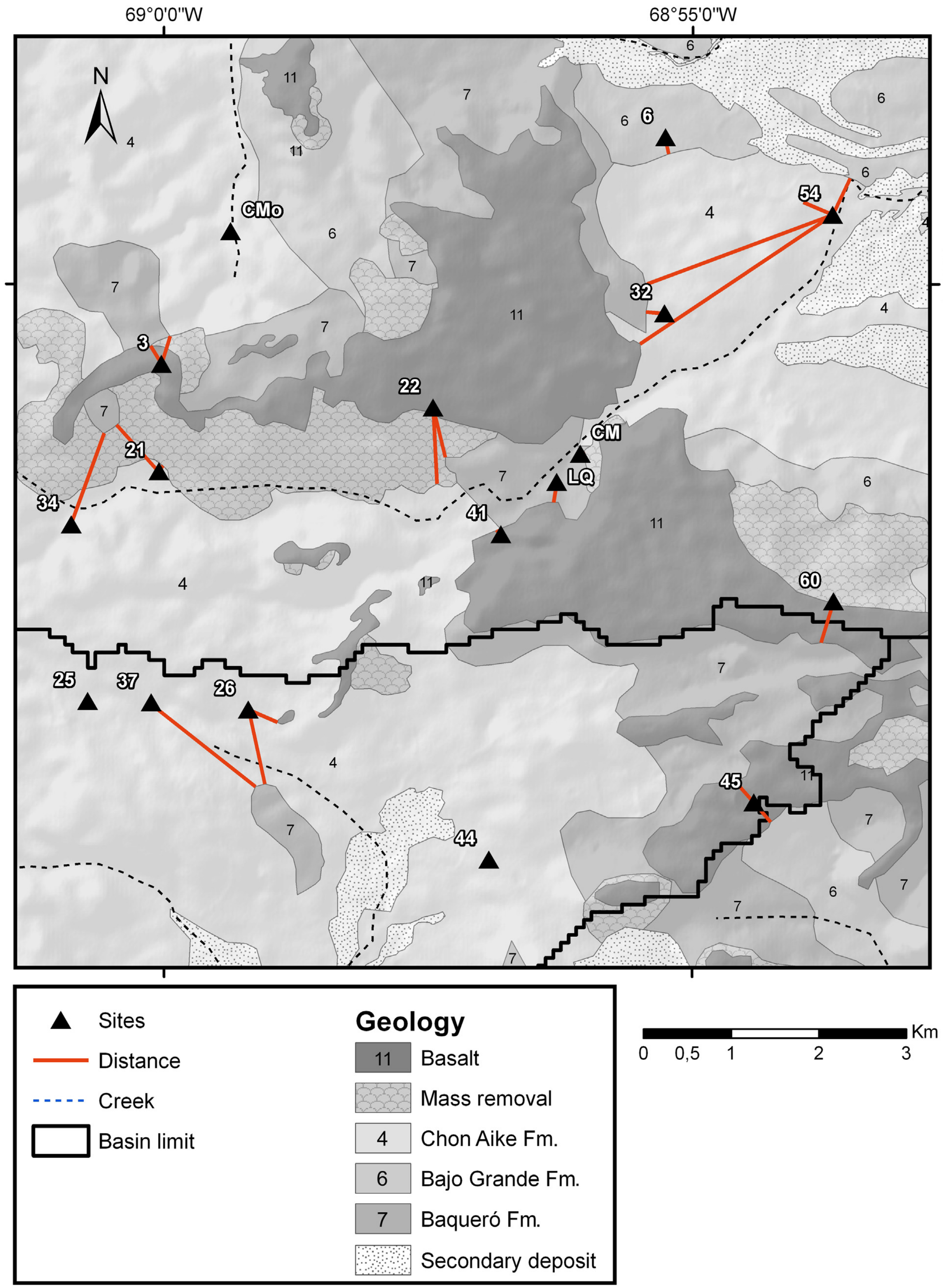


Fig. 7. Map of distances (*d2*) from multiple activities sites (see sites names in Table 1) to the closest geological formation bearing the rocks of interest. The identification numbers on the outcrops correspond to those in the geological map (Panza, 2001): 4 (Chön Aike Fm.); 6 (Bajo Grande Fm.); 7 (Baqueró Fm.); 11 (Las Mercedes Basalt).

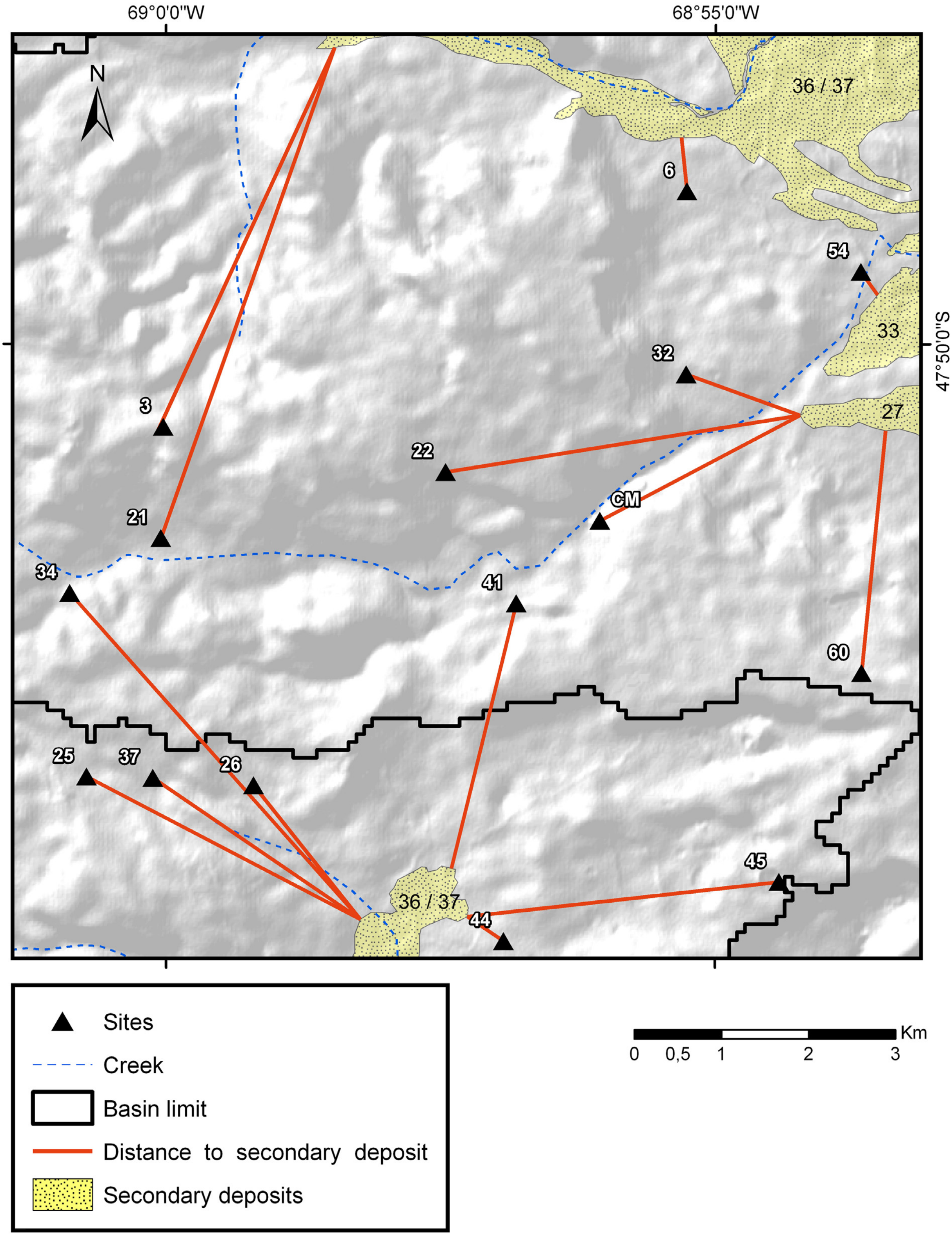


Fig. 8. Map of distances (*d3*) from multiple activities sites (see sites names in Table 1) to the closest secondary deposit bearing rock nodules of the kind analyzed. The identification numbers correspond to those in the geological map (Panza, 2001): 27 (Deposits that cover pediment level I); 33 (Deposits that cover pediment levels II and III); 36 and 37 (deposits of alluvial cones and plains).

circuits when the provisioning of rocks was the main concern, or may have occurred after the provisioning of other main subsistence resources were met. Other advantages of extracting raw materials from quarries may be related to technical concerns, since quarried blanks (and not cobbles or slabs) may be favorable to attain some morphology and utility of artifacts (Holdaway and Stern, 2004).

From another point of view, the long distance movements to exploit quarries or the procurement of very distant raw materials

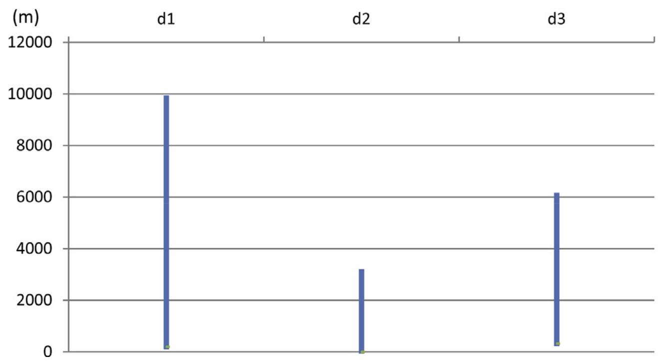


Fig. 9. Range of values (m) for distances registered using the field data on quarries (*d1*); the geologic map (*d2*) and the closest secondary deposit (*d3*) (excluding obsidian).

by exchange would be expected if the use of those raw materials was not only determined by its function, but also involved social and symbolic factors. A clear example of this is obsidian, the only raw material of extra-regional provenance. One possible explanation for this would be the need to maintain extensive trade and exchange networks in a high-risk environment. As Hermo and Miotti (2011) propose, obsidian present at the Deseado Region probably had a special socio-symbolic value as a prestige good.

6.2.2. Intermediate provisioning distance, intermediate reliability

The distance traversed to access secondary deposits is relatively intermediate, and was probably compensated by the certainty in finding a variety of rocks useful for diverse purposes. The diversity of available raw materials positions this source as the most suitable when intending to find raw materials for several different purposes (i.e. for flaking, for making bolas or cobbles to be used as hammers). This suggests that provisioning trips could have been directed to these areas when a diversity of rocks applicable to different tasks were needed; or when no specific raw material was searched for, when longer searching time was available, or it was of primary importance to find cobbles to be used as hammers.

6.2.3. Short provisioning distance, low reliability

According to the widespread distribution of geological formations, abundant raw materials (siliceous rocks, chalcedony and rhyolite), as well as less abundant ones (andesite, basalt and petrified wood) could have been obtained at short distances, but they were dispersed and heterogeneously localized, so their finding was less reliable. This suggests that the provisioning of raw materials that occur as infillings of cavities and small cracks in rocky outcrops, as well as cobbles in streambeds dispersed across the wide areas that these formations cover, was not a planned activity, but was probably a task carried out in an opportunistic fashion, most likely embedded in other planned actions (Binford, 1979; Duke, 2003).

6.3. Regional scale

The information presented contributes to the characterization of the mode of occupation at La Primavera and the mobility patterns considering the regional context and the information on possible changes through time provided by the stratigraphic studies at Cueva Maripe.

The evidences of non-immediate sourcing at the surface sites analyzed suggest a familiarity with lithic resources distribution and knowledge of their characteristics that necessarily involves some time elapsed in the process of landscape learning (Rockman, 2003; Ford, 2011). This idea is consistent with results generated from other lines of evidence. For example, previous inter-visibility GIS analysis revealed a patterned spatial disposition of rock structures across La Primavera locality (Magnin, 2010, 2013), suggesting a symbolic continuity involving certain temporal depth in the enculturation of space (Zvelebil, 2003). Also, the location of a stone structure built on three cores interpreted as a lithic raw material cache registered in a sector with relative scarcity in useful rocks, could indicate a strategy of provisioning of places (Kuhn, 1995, 2004) and points to a very detailed knowledge of resource distribution (Magnin, 2010).

In sum, a sustained use of the locality seems to be pointed at during the Late Holocene. This idea is complemented by the findings of Hermo and Lynch (in this volume) about temporal tendencies sustained by morpho-technologic analysis of cores from the excavations at Cueva Maripe. The authors observe a change from the discard of a few cores manufactured on raw materials available near the site in the earlier period (Early Holocene), to a higher frequency of cores manufactured on a more varied local and extra-regional provenance raw materials and discarded with relative high weight in deposits assigned to the Mid- and Late Holocene. This suggests the consolidation of a strategy of provisioning of places towards the later periods that, according to Kuhn (1995, 2004) implies a regular, planned use of the landscape, where known activities will be carried out in known locations.

Regarding mobility ranges and their possible variations, they are still unknown, but the presence of obsidian in La Primavera shows that some contact, either direct sourcing or exchange with other groups, existed between this locality and the pre-cordilleran sector 120 km west, where the sources of obsidian for the entire region have been established (Espinosa and Goñi, 1999; Stern, 1999, 2004; Belardi et al., 2006). Despite the long distance involved, obsidian artifacts are present not only in 50% of the multiple activity sites analyzed here, but also in 8% of the total archaeological surface evidence registered (including sites, assemblages and isolated finds) (Magnin, 2010). A possible explanation is that the circulation of obsidian could have been established for a long period. In accordance with this, the presence of obsidian in stratigraphic levels at Cueva Maripe suggests that the contact with the Andean cordillera region existed from the Mid-Holocene (Hermo, 2008).

Similar contacts are proposed for other localities of the Deseado Massif (sites Piedra Museo, Los Toldos and Cerro Tres Tetas), where obsidian and other allochthonous materials as marine bivalves and snails were found in stratigraphic contexts corresponding to the Mid-Holocene (Miotti, 1989, 1995; Cardich and Paunero, 1991–1992; Miotti and Salemme, 2004; Miotti, 2006; Salemme and Miotti, 2008).

The long distance involved in the provisioning of the mentioned materials exceeds the 10–45 km proposed for the complementarity between environments in the occupation models for the Atlantic coast and the pre-cordillera lakes area. Assuming similar movement ranges at La Primavera, the distribution of obsidian can be explained by other mechanisms as exchange, not implying moves to distant areas. Nevertheless, long distance logistic moves cannot be disregarded. As was demonstrated by Lovis et al. (2005) with archaeological data from England and eastern North America and ethnographic data from this last region, long distance logistic moves were not uncommon among low-density hunter–gatherers in northern environments. They proposed that such long distance mobility was task specific, confined to hunting, trapping and collecting by one to four individuals. In the present case, the task performed could be obsidian sourcing among others as social interaction. Finally, the idea of long distance moves find support in studies of stable isotopes analysis performed on human remains from sites Palermo Aike and Fortaleza dated to the late Holocene and located in the steep area south of Deseado Region (Borrero and Barberena, 2006). The samples showed 20% of marine resources in the diet and were located at 45 and 90 km from the Atlantic coast and can be used as proxy for individual home-range sizes.

7. Conclusions

The spatial analysis of raw material circulation is a line of analysis that allowed outlying some of the varied factors that may have shaped past decisions on raw materials sourcing that, in turn, permits a new insight to the archaeology of La Primavera locality towards the last period of hunter–gatherer occupation. The evidence discussed suggests that: 1) The provisioning of sites would have involved longer distances to local known quarries or to other regions when the main concerns were the provision of specific raw materials (i.e. rhyolite) and base forms (blanks); and when its sourcing involved special symbolic and social importance (i.e. obsidian). 2) Intermediate distances would have been traversed to reach secondary deposits when enough time was available to search within the diversity of rocks applicable to different tasks that could be found in them. 3) Finally, the use of raw materials present in the extensive geological formations may have involved shorter provisioning distances, but the low find chance due to their dispersed distribution implies that they were probably exploited when found by chance while performing other planned activities.

In general terms, the exploitation of non-immediately available raw materials in a landscape with abundant rocks suggests certain temporality involved in the knowledge of the territory (Rockman, 2003). This finding, along with other evidence pointing to enculturation of the landscape (Zvelebil, 2003) and provisioning of places (Kuhn, 1995, 2004), stand against a transient use of the locality, only occasionally visited in the Late Holocene. Instead, mobile people could have obtained this knowledge by staying at the locality for relatively long time or by reoccupying it frequently, supporting its residential use.

As regards the wider regional scale, the presence of obsidian allows sustaining the idea of contacts with the Andean precordillera that, according to the stratigraphic evidences were already established since the Mid-Holocene (Hermo and Miotti, 2011). The wide dispersion of obsidian across the surface the locality could indicate that those contacts were solidly established. Accepting a residential use of the locality, obsidian sourcing could indicate exchange with other groups at any point between La Primavera and its sources in central-western Santa Cruz, although direct provisioning cannot be discarded.

Although some of the evidence presented here needs further discussion, they contribute to the understanding of the hunter–gatherers adaptations in La Primavera locality. The conclusions reached are consistent with a territorial consolidation and increase in the interaction with other mobile groups towards the Late Holocene proposed in the general models currently available for the region (Borrero, 1999; Miotti and Salemme, 2004). The existence of springs, permanent water sources associated to the basaltic plateaus; shelter provided by the geologic outcrops and the ravines eroded in them and the associated concentration of vegetation and fauna are the natural conditions that may have sustained such occupational intensity.

The research agenda includes a deepening on palaeo-climatic studies to evaluate possible fluctuations in the critical resources along the Late Holocene, especially during the Medieval Climatic Anomaly. That information and the development of a program of excavation at the open air multiple activities sites will produce archaeological evidence critical for complementing the picture of La Primavera.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.quaint.2014.11.064.

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