Dwelling architecture and flexible land-use strategies in the Prehispanic Sierras de Córdoba, Argentina

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ABSTRACT - The article examines the evidence of architecture recovered from the Late Prehispanic Period of the Sierras de Córdoba (~1220–330 cal BP), Argentina. We explore the relationship between household architecture and the level of residential mobility, arguing that a flexible subsistence and mobility pattern followed the adoption of plant cultivation and not entirely sedentary farming. The architectural evidence presented structures made using low-energy construction techniques that were not intended for an anticipated long-term occupation. This architecture meets the expectation of a settlement pattern left by groups that were occasional food producers and used specific locations as seasonal campsites, indicating a flexible landscape-use organization.

KEY WORDS – Late Prehispanic Period; house features; pithouses; flexible mixed economy; sedentism; residential mobility

Bivanska arhitektura in prilagoditvene strategije rabe zemljišč v predšpanskih Sierras de Córdoba, Argentina

IZVLEČEK - V članku analiziramo podatke o arhitekturi v poznam predšpanskem obdobju v Sierras de Córdoba (~ 1220–330 kalibrirano pr. n. št.), Argentina. Ukvarjamo se z odnosi med hišnimi gospodarstvi in stopnjo bivalne mobilnosti, pri čemer trdimo, da je fleksibilen način preživljanja in mobilnosti sledil preverzemu gojenju rastlin in ne posamezno sedentarnega kmelovanja. Arhitekturne dokaze predstavljajo strukture, narejene s pomočjo nizkoenergijskih gradbenih tehnik, ki sicer niso povezljive s predpostavljen dolgotrajno poselitvijo. Arhitektura je skladna s pričakovanim poselitvenim vzorcem skupin, ki so občasno pridelovale hrano in so izbrane prostore uporabljale kot sezonske tabore. To kaže na fleksibilno organizirano izrabo krajine.

KLJUČNE BESEDE – pozno predšpansko obdobje; hišne značilnosti; zemljanka; fleksibilna mešana gospodarstva; sedentizem; bivalna mobilnost

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Introduction

A significant issue in the archaeological study of the spread of food-producing economies is delineating the different forms and levels in which prehistoric foragers adjusted their mobility strategies to the labour demands of plant cultivation, mainly when mobility serves to position them for the acquisition of the resources needed to survive (Rafferty 1985; Hard, Merrill 1992; Kelly 1992; Silva, Frank 2013; Gibbs, Jordan 2016; Roth 2016; Ricci et al. 2018; Schmader 2023). Considering the relationships among the types of houses (everyday domestic residences) identified in deposits and mobility is essential in developing these archaeological interpretations, given that the durability and form of house construction are regular cross-cultural indicators of the frequency of residential moves (Binford 1990; Diehl 1992). All ethnographic and archaeological groups build some housing, with a wide range of mobility possibilities ranging from a full-fledged sedentary lifestyle to a high degree of group mobility. Thus, the style of a dwelling house, and especially the amount of energy spent on its construction, is a powerful tool for understanding a group’s residential mobility strategies (Binford 1990; Diehl 1992; Smith 2003). Therefore, the analysis of this relationship offers a distinct perspective on studying the food-production transition that was little explored in Argentina, where the few archaeological investigations of house design have generally focused on groups that were wholly sedentary or assumed to be sedentary (Raffino 1988; Nastri 2001; cf. Albeck et al. 2010; García 2010; Callegari et al. 2015; Ratto et al. 2019). Less attention has been given to the more mobile mixed foraging and cultivation groups that invested less energy in dwelling construction.

The excavation of habitation structures over the past 40 years in the Sierras de Córdoba (Fig. 1), a low-altitude mountain range (500–2800m) bounded by areas of early plant domestication in South America, provides an excellent opportunity to study the houses of groups that had a flexible mixed-economy adaptive strategy combining small-scale farming and broad-scale foraging (see Recalde 2008; Pastor, López 2010; Pastor et al. 2012; Medina et al. 2014; 2016; 2020; Recalde, López 2017). The house remains of the excavated sites allow examination of the relationship between the design and form of domestic architecture and mobility, increasing the understanding of the role of houses in societies with a mobile form of socioeconomic organization that incorporates plant cultivation within the economy. Most of these sites were recently defined as semi-sedentary campsites or villages occupied during the growing season (October–April) by people following a spectrum of farming and foraging strategies that challenge any unidirectional scheme of cultural evolution (see Medina et al. 2016; 2020). According to the model, the groups used pottery, maize, and other crops within a broad-spectrum foraging base that included high re-
sidential mobility, co-residential group fission-fusion mechanisms, and the temporary abandonment of cultivated fields to reduce their dependence on a single or few resources. In this context, the groups weighed the local resource abundance regarding the regional foraging potential (Recalde 2008; Pastor et al. 2012; Medina et al. 2016; 2020).

We think this seasonally sedentary model requires elaborating on details about the dynamic of base-camp occupations that have not yet been specified. This paper examines the evidence of the architecture remains recovered from the Late Prehispanic Period of the Sierras de Córdoba (~ 1220–330 cal BP, Argentina) to improve our understanding of local and regional mobility. Our objective is to explore what the presence of house remains in the archaeological record implies for the model of occupation persistency and landscape-use organization, assuming that group mobility strategies and the anticipated use-life are of significant importance to dwelling design and form (Gilman 1987; Kent, Viedrich 1989; Diehl 1992; 1997; Smith 2003). Thus, we explore the relationship between the architectural design of structures and the level of residential mobility. We focus on the assumption that a flexible subsistence and mobility pattern accompanied the adoption of domesticated plant cultivation and not entirely sedentary farming. We also analysed the kind of storage technology utilized at sites due to its influence on mobility strategies and the duration of occupations (Kent, Viedrich 1989; Diehl 1992; Smith 2003). We expect the results to help improve the current archaeological knowledge of the landscape-use organization in groups worldwide where the adoption of crop plants did not necessarily lead to a sedentary lifestyle. This pattern, commonly observed ethnographically, is challenging to identify from the archaeological record.

A series of innovative hypotheses drive our article. We propose that Late Prehispanic construction techniques vary according to the socio-environmental conditions dictated, and the identification of temporary structures has been biased towards more recognizable pit-houses (semi-subterranean, single-room structures), with pithouse construction being episodic rather than continuous. We also suggest that the prevalence of less visible temporary structures in the record aligns more with the dwellings of people who did not reside at a single location for an entire year, reflecting a flexible settlement pattern. Furthermore, we argue that implementing low-investment extensive cultivation, which did not restrict group mobility, likely prevented the opportunity for extensive long-term storage. Therefore, we anticipate that short-term storage was used for food surpluses.

Architecture, storage, and mobility from a dynamic perspective

Archaeologists have long recognized that sedentary groups or people who anticipate a lengthy occupation of sites usually construct structures that require the investment of considerable time and energy (McGuire, Schiffer 1983; Rafferty 1985; Gilman 1987; Kent, Viedrich 1989; Binford 1990; Kelly 1992; 1998; Rock 1995; Diehl 1997; Panja 2003; Kelly et al. 2005; Schmader, Graham 2015; Roth 2016; Schmader 2023). In contrast, mobile people minimize the time and effort spent on domestic architecture due to its generally short use, resulting in ephemeral structures built using easily transportable or locally available materials requiring little preparation time (Binford 1990; Diehl 1992). Cross-cultural ethnographic studies strongly support this assertion. For example, different case studies showed that more residentially mobile groups typically create low-cost habitation structures with a circular or semicircular plan that usually requires a limited amount of transportable or readily available perishable materials (McGuire, Schiffer 1983; Kent, Viedrich 1989; Binford 1990; Diehl 1992; Kelly et al. 2005). Conversely, more sedentary groups generally build houses with rectangular plans, more durable materials (wood, mud brick, or stone), and higher initial construction costs. These houses can be easily maintained and subdivided for the differentiation of activities. However, cases in the middle would represent residential mobile people constructing substantial structures at specific locations for anticipated revisits over the years (Kelly 1992), a typical behaviour among Andean pastoralists (Kuznar 1995; Vacobaccio et al. 1998). In these examples, the expectation of reuse over several years justifies the cost of the construction (Smith 2003; Morgan et al. 2017).

Storage can extend the use of a seasonally abundant resource beyond its availability period. Thus, the presence or absence of storage facilities plays a vital role in the length of time groups occupy a location (Kent, Viedrich 1989; Schmader 2023). According to Carol Goland (1991), storage among food collectors and producers may range from the intensive large-scale accumulation of surpluses to a short delay in the use of
resources. Specifically, the first strategy involves storing large quantities of a resource, usually in immovable, permanent facilities such as storage pits or granaries, to feed the group through food scarcity or until the next harvest (O. c.). Robust evidence for long-term storage has generally been linked to permanent, sedentary occupations (Kelly 1992). Mobile people also rely on immovable facilities for storage when they anticipate returning to locations (Kent, Viedrich 1989; Graham 1994; Rocek 1995; Binford 2001). However, the cost and risk of failure increase because stored food would be exposed to theft or destruction during site abandonment (Howey, Frederick 2016; Roth 2016). In contrast, short-term storage involves saving limited resources for more immediate needs and planting in subsequent years, often in portable containers such as pottery vessels or basketry. Short-term storage frequently occurs when resources are insufficient and predictable enough to sustain a group over a season of scarcity. During this time, the group needs to rely on other subsistence activities. To allow farming to persist as a viable economic strategy, small-scale farmers had to store a minimal supply of crop seeds.

Therefore, we need to consider the substantial amount of energy spent on the construction of habitation structures and the characteristics of storage facilities to provide archaeological clues concerning the duration of Late Prehispanic Period site occupation and the level of group mobility. According to the landscape-use model, it is expected that most of the Late Prehispanic house structures would indicate that little time was invested in their preparation. They would exhibit irregular or overlapping outlines, only identified by discretely packed floors and a few post-molds. Moreover, any information about the layout of house features would suggest using ephemeral organic construction materials, providing indications of the short-term duration of site occupation consistent with seasonal use. Something similar should occur with storage. Farming plots and wild fruit patches occasionally provide a minimal surplus that can be stored in portable containers such as pottery vessels or basketry. However, they do not produce enough stores consistently to feed the group from year to year. Thus, even with horticulture and storage technology, Late Prehispanic people were still tied to seasonal movements to forage wild resources and reinforce inter-group obligations, carrying stored seeds in portable containers for food and future planting. Long-term storage facilities would not be expected. Moreover, patches with seasonally predictable resources may remain repeatedly occupied, even when the resource does not furnish the surplus necessary for long-term storage and occupation.

Materials and methods

The database reviewed here consists of house features and presumed storage facilities at ten sites excavated within the region (Fig. 1). It contains entirely or almost wholly excavated remains interpreted as house features or presumed storage facilities for which descriptive reports are available in publications (Berberián et al. 1983; Berberián 1984; Laguens 1999; Pastor 2007; Laguens, Bonnin 2009; Medina 2015; Recalde, López 2017; Medina et al. 2020). The study also considers the unpublished excavation notes of Potrero de Garay obtained by Eduardo Berberián.

The investment in dwelling construction was measured at the coarse-grain resolution following the logical framework for evaluating the effort invested in construction proposed by Michael W. Diehl (1997), which applies to any region where archeologically known architecture remains are available for study. As such, this study considered the size of a structure, the number of post-molds, the kind of material used in construction, the formality of hearth construction, the depth of floors, the evidence of reoccupations, and so on to make inferences about the amount of time a structure was occupied based on the assumption that mobile people minimize the time and effort spent on construction (McGuire, Schiffer 1983; Rafferty 1985; Gilman 1987; Kent, Viedrich 1989; Binford 1990; Kelly 1992; 1998; Rocek 1995; Diehl 1997; Panja 2003; Kelly et al. 2005; Schmader, Graham 2015; Roth 2016; Schmidt 2023). The term ‘post-mold’ refers to the archaeological trace of a wooden post, regardless of whether it had decayed in situ or been intentionally extracted. It was crucial for our research because more extended interannual occupation increased the number of posts used to support the roof, and vice versa. Something similar occurred with the other indicator analysed here, where ephemeral features or raw materials were assumed to be used only for a few weeks and constitute evidence of high residential mobility. We also conducted a morpho-functional analysis of pottery vessels based on Philip J. Arnold (1999), Margaret E. Beck (2009), and Katherine M. Grillo (2014), taking the data about vessel morphologies from publications (Dantas, Figueroa 2008; Medina 2010; Heredia 2015). Radiocarbon age estimates also came from the literature and were used to assess evidence of site re-
use (Berberián 1984; Laguens 1999; Pastor 2007; Laguens, Bonnin 2009; Medina 2015; Recalde, López 2017; Medina et al. 2020; Tavarone et al. 2020). We implemented radiocarbon models in OxCal 4.3 (Bronk Ramsey 2009a), using the calibration curve SHCal20 (Hogg et al. 2020). Modelled dates and boundaries are presented in italics. We present only the medians and 95% probability ranges of the dates, rounded by ten years (Marsh et al. 2019).

**Sites and structures**

Sites containing structures were found sparsely throughout the Sierras de Córdoba (Fig. 1). Unambiguous examples of house structures are uncommon at Late Prehispanic Period sites, and well-delineated house patterns are rarely found in excavations. Moreover, there was some debate or doubt concerning recognizing certain features as actual houses. Several examples, for example, have been reported with evidence of post-molds suggesting the presence of dwelling structures, but these do not often occur in an easily interpretable pattern (Medina et al. 2016). Surprisingly, stones were not used for dwelling construction in the region, even when abundant in the landscape. Instead, they were used in historic times to build puestos, ranchos, and estancias (Aparicio 1931; López 2021). Thus, the relative invisibility of Prehispanic house architecture may relate to the high degree of mobility of the small-scale groups that resided in the region, a possibility that is explored further.

Potrero de Garay, an open-air site near Lake Los Molinos, stands out as one of the most archaeologically and extensively investigated sites in the Late Prehispanic Period (Fig. 1). It is particularly notable for its well-documented houses (Berberián et al. 1983; Berberián 1984). During the large-scale open-area excavations, Eduardo E. Berberián identified four semi-subterranean pithouses (Fig. 2). The houses were constructed on soft, easily deformed soil. Of the four houses completely exposed, three were rectangular pit-houses. They had a mean length of 6.1m and a mean width of 4.7m, with straight or slightly rounded corners. The morphology of Unit 4 was fuzzy and failed to yield rectangular pristine outlines (Fig. 2). The pit walls formed the lower portion of the structures without any evidence of a stone wall foundation or columns that would suggest long-term use life. The 1.5m wide sloping entrance and walls were 0–40cm below the prehistoric ground surface. Post-molds averaging 15cm in diameter were placed around their perimeter to support the upper portion of the walls and the roof. However, the number of post-molds was not high, despite the relatively large size of the structures. Moreover, sometimes the post-molds were nearly 2m from each other (Fig. 2). There was no evidence of secondary posts reinforcing the corners, showing little effort invested in the construction and maintenance of the houses as observed in long-term occupied sites (see Diehl 1997; Ellis et al. 2015; Schmader 2023). Central support posts were rare and only recorded in Unit 4. Such a layout suggested that the superstructure of dwellings was not particularly heavy or elaborated, a position consistent with the lack of collapsed roof deposits. The habitation floors were plain, consolidated, and a few centimetres thick, formed by daily domestic trampling (Fig. 3.a-b). Floors presented some de facto refuse and site furniture (for example, immovable or heavy ground stones and large vessels) for future re-use. The relative absence of small or expensive items might result from the depletion of abandoned assemblages. There were no storage pits indoors or outdoors and no evidence of formal interior hearth features. However, there were shallow charcoal-stained and oval-shaped (30–40cm) pits with fire-scorched earth and scattered-wood charcoal consistent with on-floor hearths (Fig. 3.a) (Berberián 1984). Berberián (O.c.) detected burials under the living floors, sometimes covered with a small structure made of stones and grinding artefacts or evidenced by the different coloration of the sediments, indicative of earth removal (Fig. 3.b-c). Aside from pithouses, Berberian also identified four small oval and basin-shaped habitation structures (~2.50m diameter), flimsy in roof construction and without indication of post-molds (Berberián et al. 1983, 77). However, information about the location of these informal constructions is not available in reports. The descriptions of the structures were consistent with ephemeral, easily constructed domed brush huts, showing multiple forms of residential structures and flexibility of house construction techniques utilized during the site occupation, with various levels of energy investment and probable length of stay. Pit structures appeared to represent a more substantial labour investment than smaller structures, which indicates greater mobility for the residents. Wood charcoals obtained from the living floor of Unit 2 were dated by Berberián (1984) at ~330 cal BP (500–...AD, 95%) (Tab. 1). However, radiocarbon dates recently obtained from human skeletal remains by Aldana Tavarone et al. (2020) shed light on the fact that the site represents several centuries of reoccupation. In line with other evidence described here, we think
Dwelling architecture and flexible land-use strategies in the Prehispanic Sierras de Córdoba, Argentina

Boyo Paso 2 is an open-air site in Eastern Salsacate Valley excavated by Matías E. Medina (Fig. 1). Although soil strata were fairly uniform, the horizontal excavation revealed two overlying archaeological floors formed by unprepared-packed sediments that appeared fire-altered by multiple on-floor hearths (Figs. 3 d-e, 4 and 5). The upper floor was a thin level of compacted sediments less than 2cm thick spread over the 55m² excavated (Medina et al. 2020). Medina did not detect storage pits during excavations. However, he documented a roughly semi-subterranean structure in the southern portion of the excavated area, in close association with more than 20 post-molds and undefined basin-shaped depressions, which contained evidence of multiple functions in connection with the abandonment process, including storage, caching tools, and trash disposal (Fig. 4; Medina et al. 2016; 2020). A few centimetres below the upper floor, the change in the consistency of sediments led to the lower archaeological floor (Fig. 5), which presented a feature of unknown use made of 14 cobble-sized stones, basin-shaped depressions, and two post-molds. One of the post-molds had a fire-altered (burned) post inside (Fig. 3.e; Medina et al. 2020). Medina et al. (O.c.) also noticed a pit feature of unknown function filled with uncompacted, fine-grey sediments in the northwestern corner of the excavation. The upper and lower floors were rich in scattered ash, ash by-products, charcoal, and some reddened earth rather than well-defined hearths, indicating multiple occupational and reoccupation events across decades (O.c.). Living floors also had abundant domestic refuse, including a high diversity of pottery, metal, stone, and bone tools, biological debris, and residues of time-consuming activities such as pottery making. The excavator also found functional artefacts on the living floors, suggesting that people planned to return to this location (Medina et al. 2016; 2020). By detecting post-molds, we inferred the presence of habitation structures like pithouses, brush huts, or windbreaks over the living floor (Figs. 2 and 3). Post-molds were closely spaced on the upper floor (Fig. 4). They range from 22–27cm in diameter and 17–31cm deep. Two overlap, representing a time sequence or minimally multiple occupation events. It is unclear what this pattern represents, especially when well-defined outlines are not evident enough to identify the shape or size of the structures. The random distribution of artefacts and features on living floors had more in common with overlapping brush houses (see Wheaton 2014) than the pit structures overemphasized by the study of ethnohistoric sixteenth-century documents (see González 1943; Serrano 1945; Berberián 1984). The absence of well-defined hearth features made identifying houses even more complicated, reinforcing the hypothesis that there were multiple superimposed houses and no durable habitation residences for long-term occupation (Medina et al. 2020). The fact that Medina et al. (O.c.) reported pottery sherds from the fill of at least one posthole also supports this assertion (Fig. 3.d) because they showed that debris accumulated during late occupations slid down on the posthole of the earliest occupation. A context with this characteristic challenged any interpretation of the finely reticulated strati-

Fig. 2. Plan view of the pithouses and key features of Potrero de Garay. Key: U1 Unit 1; U2 Unit 2; U3 Unit 3; U4 Unit 4.
The lower floor had medians of 760, 780 cal years BP; and the upper floor’s three dates had medians of 720, 730, 740 cal years BP (Tab. 1). The random distribution of post-molds combined with the radiocarbon dates suggested a palimpsest of free-standing dwellings without direct continuity from one construction episode to the next, consistent with a repeated seasonal occupation over at least a century. Unfortunately, knowing how many occupation episodes were represented on an ethnographical observation scale is challenging. Based on the evidence, we interpreted Boyo Paso 2 as a seasonal encampment where small groups sporadically coalesced during the growing season to do various activities. The presence of fau-

<table>
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<th>Site</th>
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<th>Context</th>
<th>Lab code</th>
<th>(^{14})C age</th>
<th>±</th>
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<th>95% probability</th>
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<td>Upper floor (37-40cm)</td>
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<td>Quebrada Norte 7</td>
<td>Zea mays (seed)</td>
<td>35-4cm</td>
<td>AA107245</td>
<td>405</td>
<td>21</td>
<td>450</td>
<td>500–320 AD</td>
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Tab. 1. Radiocarbon dates from the archaeological sites. The three points of the 95% probability column imply that the date may extend out of the range of the calibration curve.
nal and botanical remains that indicated the site was occupied with a strong signal during the warm season (October–April), in combination with temporary organic structures and residues of activities that imply staying in a place for several weeks, supported this argument (see O.c.).

The presence of habitation structures in other open-air sites such as C.Pun.39, Puesto La Esquina 1, Quebrada Norte 7, Arroyo Tala Cañada 1, Cementerio, Huaycondo, El Ranchito and Arroyo Las Chacras 3 (Fig. 1) was noticed by the detection of packed surfaces with horizontally dispersed archaeological remains, ambiguous hearth features or firepits, soil stains, and post-molds. However, the reported features did not conform to expectations for substantial housing.

C.Pun.39 is located at Northen Punilla Valley (Fig. 1) and was excavated by Medina. House architecture was difficult to recognize on the modern ground surface.

Fig. 3. Examples of house architecture and features from the sites Potrero de Garay, Boyo Paso 2, and C.Pun.39. a extensive charcoal staining on the floor of Unit 2 of Potrero de Garay; b Unit 1 from Potrero de Garay; c burial from the Unit 2 of Potrero de Garay; d pottery sherds filling a posthole at the upper floor of Boyo Paso 2 (the dashed line indicates the outline of the posthole); e post-molds with a fire-altered (burned) post inside recorded at the lower floor of Boyo Paso 2 (the dashed line indicates the outline of the posthole); f possible archaeological floor from Sector 3 of C.Pun.39.
As such, the excavations were developed in three sectors where the surface lithic scatter and ceramics exceeded five items per m² (see Medina 2015). In Sector 1, a packed surface was recorded at 27–40 cm over the 4 m² excavated (O.c.). The floor deposit contained a few small, highly fragmented archaeological remains. It is suspected that a slightly built house structure existed, but there was no direct archaeological evidence for this despite the packed surface (O.c.). Something similar occurred with the 4 m² excavation of Sector 3, where Medina detected a slightly packed surface containing a few significant horizontally dispersed artefacts 20 cm from the surface (Fig. 3.f; O.c.). No house features were discovered on the hypothetical floor, making any habitational structure hard to detect. Medina excavated 8 m² in Sector 2 until reaching sterile sediments at 90 cm (O.c.). The deposit was homogeneous, with undistinguished stratigraphic layers. A high tool richness was documented along the stratigraphical sequence, including clay nodules with fingerprints interpreted as pottery-making by-products (Medina 2010; Medina et al. 2016). Medina (2015) dated three charcoal samples from overlapping layers at ~520 cal BP (550–490 AD, 95%), ~620 cal BP (680–550 AD, 95%), and ~720 cal BP (800–670 AD, 95%), showing different occupation events across the Late Prehispanic Period (Tab. 1).

Puesto La Esquina 1 is located in a well-protected gorge of the Pampa of Olaen (Fig. 1). Five test pits over 5 m² (Sectors 1 to 5) were created by Medina (O.c.), which revealed that not all the site was intensively occupied. He concentrated excavations on the deposit of Sector 5, which showed high archaeological potential, unco-

![Fig. 4. Plan view of the upper archaeological floor of Boyo Paso 2 with the excavation units, post-molds, and critical features (from Medina et al. 2020).](image-url)
Dwelling architecture and flexible land-use strategies in the Prehispanic Sierras de Córdoba, Argentina

Medina (et al. 2016) dated two charcoal samples from overlapping layers at ~390 cal BP (490–300 AD, 95%) and ~390 cal BP (400–300 AD, 95%), indicating that most of the elements accumulated over a short period, probably as a seasonal-type occupation (Tab. 1).

Sebastián Pastor (2007) led the excavation of Arroyo Tala Cañada 1 in Eastern Salsacate Valley and detected a slightly packed surface with primary refuse in situ and two post-molds around 30cm wide (Fig. 7). Based on these findings, he inferred the presence of a temporary habitation structure dated by wood charcoal with a median of 770 cal BP (920–670, 95%) (Tab. 1). He also recorded a plough soil feature with cultivated plant remains at 12m of the presumable house structure, including phytoliths of Zea mays leaves (Fig. 7). This type of feature had never been detected in the Sierras de Córdoba until Arroyo Tala Cañada 1, even when the planting of domesticated species was considered a significant landmark in recent prehistory. He dated a charred seed of Phaseolus vulgaris aff. var. vulgaris from the agricultural feature at ~870 cal BP (960–790 AD, 95%) (Tab. 1). The archaeological record of Arroyo Tala Cañada 1 supports the development of low-investment cultivation during the Late Prehispanic Period, with residential units dispersed across farming plots.

Fig. 5. Plan view of the lower archaeological floor of Boyo Paso 2 with the excavation units, post-molds, and critical features (from Medina et al. 2020).
Matías E. Medina, Gisela Sario, Andrea Recalde, Sebastián Pastor, and Eduardo E. Berberián

morphologies (12–14cm wide at the mouth), which are optimal for transport, storage, and cooking a broad spectrum of resources (Heredia 2015). This pattern is reiterative in the other Late Prehispanic sites (Fig. 9; Danzas, Figueroa 2008; Medina 2010).

The stratigraphic excavations by Andres Laguens in the site Cementerio (Fig. 1) detected two hearths, a hearth-like feature made of rocks, two post-molds, and a burial (Appendix, Figure 1; Laguens 1999). Based on this evidence, the archaeologist hypothesized the presence of a not well-defined domestic residence (see La-
Wood charcoals recovered in this stratum were dated at ~320 cal BP (500–... AD, 95%).

El Ranchito is an unusual site in size and composition (see Laguens 1999; Marcellino 2001; Laguens, Bonnin 2009; Sario et al. 2017). It was surveyed and excavated by A. Laguens, who characterized the immense surface artefact assemblage of El Ranchito as a large open-air sedentary village. However, the excavation allowed the recovery of few archaeological residues and no house features, making it impossible to conclude year-round sedentism behaviour (see Laguens 1999). Most importantly, in the southwestern portion of the site Laguens discovered 112 clumped underground pit structures (Appendix, Figure 2), one of them dated at ~390 cal BP (490–310 AD, 95%) (Tab. 1). They were bell-shaped underground facilities approximately 90cm deep, 30–40cm in diameter at the top, and 80cm in diameter at the bottom (Laguens 1999). Such facilities are universally seen as storage pits (Roczek 1995), suggesting the collection of a wild or domesticated resource in sufficient quantities and stored for delayed consumption by sedentary groups (see Laguens, Bonnin 2009.288). Nevertheless, the pits were described as storage facilities without many supporting arguments despite the finding of charcoals, indeterminate charred seeds, rodent bones, or stained sediment (see Laguens 1999). There was no evidence to support the storage function. The interpretations as storage facilities are thus open to discussion, with roasting pits (which imply food processing, not an anticipated lengthy occupation) or cisterns for water collection, conservation, and decontamination seem to be better alternative explanations (see Heider 2020).

According to the published evidence (see Marcellino 2001; Sario et al. 2017), we interpreted El Ranchito as the result of multiple small short-term visits over 3000 years or more, which produced an extensive archaeological site deposit that resembles a multi-household nucleated settlement of entirely sedentary farmers (see Medina 2015). However, the hypothesis requires detailed open-area excavations of buried deposits to move forward and evaluate previous research models empirically.

Huaycondo is an open-air site in southern Punilla Valley (Fig. 1). During the open-area excavation (>30m²) by Gisela Sario, the homogenous and organic-rich soil stratigraphy of the upper levels led at 30–40cm to packed reddened sediments that formed an archaeological floor (Figs. 10 and 11.a). The living floor reveal-
ed fourteen post-molds and irregular shallow pit features. The diameter of the post-mold varied between 11 to 20cm. Seven post-molds aligned fairly regularly and formed a slightly rounded corner. This layout seemed to reveal the remains of a surface-dwelling structure with straight-walled and right-angled alignments (Fig. 10). Whether the other post-molds are associated with the structure or represented other structures (not necessarily contemporary) requires further research. Moreover, these post-molds were sometimes in pairs or filled with tiny pieces of pottery, as in Boyo Paso 2, supporting the claim that multiple occupational events and site formation processes formed the site. Stripping large areas around the post-molds did not reveal any associated hearths, a typical pattern of open-air sites. Nevertheless, the packed surface was rich in scattered charcoals, amorphous ash stains, and reddened sediments, suggesting that multiple burning events affected the deposit. The floor also contained abundant archaeological remains in situ. Most findings, including bones and pottery sherds, lie horizontally or subhorizontally. No radiocarbon dates have yet been obtained from the floor. However, the small-stemmed

triangular arrow points and numerous pottery fragments collected on the packed surface support logical association with the Late Prehispanic Period (Fig. 11.b-c).

Finally, Quebrada Norte 7 is an open-air site at Sierras del Norte (Fig. 1). Excavations by Andrea Recalde covered 15m² with a maximum depth of 70cm (Recalde, López 2017). She recorded a dense concentration of pottery fragments, cultivated plants, wood charcoals, faunal remains, and bone, lithic, and grinding tools across the strata. The high tool richness and plant macro-remains suggested that domestic activities occurred on-site, including the short-term storage of wild fruits for delayed consumption (O.c.). Most importantly, the archaeologist noticed an archaeological floor at 45cm, but only restricted to a small area near the northwestern edge of the excavation (Fig. 12). Darkly compacted sediments formed the floor. No well-defined house features were noted. The only possible evidence to support the existence of a house structure was ambiguous and consisted mainly of on-floor hearth by-products (charcoals, ash, and oxidized sediments) and pottery sherds horizontally dispersed on the floor. Unfortunately, the floor was not discerned in the rest of the excavated surface, which was heavily affected by the root system of the trees that had grown over or near the excavated area (Fig. 12). Moreover, no direct radiocarbon date was obtained from the floor. However, wood charcoals recovered at the same floor depth were dated at ~1120 cal BP (1280–960 AD, 95%) (Tab. 2). In addition, a charred seed tentatively assigned to cf. Zea mays recovered at 35–45cm was

Fig. 8. Plan view of the excavation of Arroyo Las Chacras 3.
We observe that houses were not substantial, and their construction involved relatively little investment. In this regard, the house features at Sierras de Córdoba generally consist of compacted archaeological floors, ambiguous hearth lenses, and post-molds. Evidence of pithouses was limited to Potrero de Garay, and the other sites show only one or a few post-molds. The scarcity of post-molds suggests that the superstructure constructed lacked an elaborate and formal design. The labour invested in such constructions and their flimsy characteristics indicate they were for short-use periods. They may have been simple huts, ramadas (sun shades), or windbreaks made from stacked brushes, grasses, and furs, such as those observed in ethnographic studies of mobile people from the early 20th century in central Argentina or even in modern times (Fig. 11; see Aparicio 1931; 1932; 1937; Zamorano 1956; Katzer et al. 2017). Such low-cost domestic architecture implies seasonal occupation and high residential mobility. Sedentism has thus been somewhat overstated in the archaeological narratives, and sites were not continuously used as was assumed for decades.

Table 2 synthesizes the archaeological record in open-air sites interpreted as seasonal base camps described above.

Discussion

The preceding review demonstrates that despite the small inventory of habitation structures, clear patterns emerge regarding the relationship between everyday domestic residences and the level of residential mobility. We observe that houses were not substantial, and their construction involved relatively little investment. In this regard, the house features at Sierras de Córdoba generally consist of compacted archaeological floors, ambiguous hearth lenses, and post-molds. Evidence of pithouses was limited to Potrero de Garay, and the other sites show only one or a few post-molds. The scarcity of post-molds suggests that the superstructure constructed lacked an elaborate and formal design. The labour invested in such constructions and their flimsy characteristics indicate they were for short-use periods. They may have been simple huts, ramadas (sun shades), or windbreaks made from stacked brushes, grasses, and furs, such as those observed in ethnographic studies of mobile people from the early 20th century in central Argentina or even in modern times (Fig. 11; see Aparicio 1931; 1932; 1937; Zamorano 1956; Katzer et al. 2017). Such low-cost domestic architecture implies seasonal occupation and high residential mobility. Sedentism has thus been somewhat overstated in the archaeological narratives, and sites were not continuously used as was assumed for decades.

Domestic structures have rarely been directly dated via in situ post-mold radiocarbon dating as occurred on Boyo Paso 2. The available stratigraphic details and sequences of radiocarbon age estimates do not allow for the isolation of individual, periodic revisits at an ethnographic scale. Still, they do provide evidence of reuse over broader periods. For example, the excavations at Boyo Paso 2 delineated two archaeological floors or periods of use that suggest a punctuated pattern of reuse at a broad temporal scale. The radiocarbon dates of floors lacked the precision to isolate the age of the different periods of occupation. Moreover, overlapping post-molds on the upper floor and the record of a post-mold filled with sherds indicate the
had similar medians in the 410–440 cal years BP range. Assuming the estimates roughly represent when the site was occupied, the dates suggest a hiatus of nearly four centuries, indicating that the site was probably abandoned. We thus consider that Potrero de Garay also represents a palimpsest of a semi-isolated farmstead reoccupied over several centuries and not a year-round village of many clustered and integrated contemporary households, as was initially proposed by Berberián (1984) and claimed by Andres Laguens and Mirta Bonnin (2009). The lack of interior features, such as hearths may indicate warm-weather use of pit-houses, an interpretation supported by the shallowness of pithouses and the faunal remains of prey with warm seasonal behaviour (see Berberián 1984).

In sum, the archaeological information suggests that sites encompassed a sequence of reoccupations (albeit during the same season) and post-depositional proces-

**Fig. 11. The site Huaycondo and a photograph of a modern ramada (sun shade).**

a excavation at Huaycondo viewed from the East; b pottery sherds lying horizontally on the archaeological floor of Huaycondo; c Late Prehispanic Period chipped-stone arrow point lying horizontally on the archaeological floor of Huaycondo; d Ramada temporarily used by modern farmers from the Departamento Juan Facundo Quiroga (La Rioja, Argentina, photo by S. Pastor in May 2021).
Dwelling architecture and flexible land-use strategies in the Prehispanic Sierras de Córdoba, Argentina

The superstructures appear to have been of local perishable materials, contrasting with the more elaborated and formal contemporary habitation structures of the Andean region, where groups were entirely sedentary farmers, and the use of rocks or other durable materials for house construction predominated (e.g., Raffino 1988).

The lack of clear evidence for storage pits or other storage facilities suggests that the occupants did not practice long-term food storage. Because long-term storage would have been required for a year-round occupation, the sites were probably used for a few months before the residentially mobile groups had to move to a new patch. Perhaps more plausible is the idea that storage was largely aboveground and transportable, carrying a minimal surplus in pottery and basketry containers during the frequent changes in the location of the co-residential groups. The presence of large-sized vessels on-site challenges this suggestion, but they were always few in number compared to the medium-sized rounded morphologies that dominated the pottery assemblages (Medina 2010). Although crop plant cultivation played an ancillary role, some storage would have been necessary to allow farming continuity. Storage was not at the extensive level that permitted a reduction of residential mobility or an increase in the duration of site occupation. Conversely, the Late Prehispanic people stored only for the short term, using portable containers as globular-shaped pottery vessels, one of the most numerous artefact types represented in the archaeological record after lithic tools. Baskets and net bags were also used, even in combination with pottery vessels, though evidence of these perishable technologies is often elusive and was only identified by pottery sherds bearing impressions of basket containers (Dantas, Figueroa 2010; Medina 2010; Cossani 2015; Abalos Luna 2020).

The identification of Rhea spp. eggshells, small-vertebrate bones from prey that suggest warm seasonal behaviour, crops, and wild plant remains support that Late Prehispanic villages were occupied with a
more robust signature in middle spring through early autumn (October–April), where planting, harvesting, and wild food were available around the sites (Berberián 1984; Pastor 2007; Medina, Pastor 2012; Medina et al. 2016; 2020; Recalde, López 2017). Occupations during other seasons were also possible, and sites were probably used intermittently or occasionally visited for raw material provisioning on a broad temporal scale. Still, clear evidence of this is lacking (Medina et al. 2020). If the houses had not been used in the winter, the evidence supports that late Prehispanic people were not following a wintering-over strategy where the entire winter was spent at a single location, which would have only been possible if long-term stores had been available. Conversely, overall data and settlement pattern survey data suggest that when harvest activities finished in early autumn, most core-sidential groups dispersed for four or five months to forage resources elsewhere, collect information about their socio-environment, and maintain the sociopolitical fluidity upon which they depended to cope with environmental fluctuations. During the cold months food consumption relied on foraging wild resources, mainly the large game that inhabited the upper mountain grassland range, and on stored food partially transported from summer hamlets in portable containers (Medina et al. 2016).

**Conclusion**

The recognition of habitation and pit features in Late Prehispanic sites has sparked diverse opinions concerning the duration of site occupation and whether long-term storage was practised. However, some hypotheses, such as those proposed by Laguens and Bonnin (2009), lack empirical discussion or detailed data analyses. In a recent regional synthesis, they argue that base camp occupation was sedentary, with groups living on food from storage pits and pottery. Arguments for longer-term occupations were generally supported, with a brief discussion, by the presence of

<table>
<thead>
<tr>
<th>Site</th>
<th>Excavated surface</th>
<th>Pithouses</th>
<th>Oval-shaped structures</th>
<th>Living floors</th>
<th>Post-molds</th>
<th>Post-mold alignments</th>
<th>Basin-shaped depressions</th>
<th>Refuse horizontally dispersed</th>
<th>Stone features (not walls)</th>
<th>Burials</th>
<th>Formal hearths</th>
<th>On-floor hearths by-products</th>
<th>Pit structures (unknown function)</th>
<th>Pottery making evidence</th>
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presumable storage pits restricted to El Ranchito. The function of these pit features was attributed to storage by Laguens and Bonnin (O.c.), although without explaining why. In addition, the presence of any evidence of housing, even a post-mold or a packed floor that indicated a dwelling or other ephemeral architecture, was taken by many researchers as evidence of year-round sedentism, leading to an erroneous reconstruction of Late Prehispanic residential mobility (González 1943; Berberián 1984; Laguens, Bonnin 2009). The problem with these interpretations is that the data do not prove the existence of sedentarization, since such claims are based exclusively on negative evidence.

This paper takes a second, more empirically based interpretation, suggesting that open-air sites were campsites wherein small-scale groups with a mixed foraging and cultivation economy sporadically coalesced to carry out a wide range of activities. Nevertheless, we expect some fluctuation or variability in the length of stay at sites among the same social groups over time. For example, Potrero de Garay may have served as an episodic location for long-term occupations (for at least six to 12 months) because it appears to contain the remains of more substantial and formal structures than most in the Sierras de Córdoba sample. While extended periods without pithouse construction could result from many factors, the construction of different low-cost types of dwellings during the Late Prehispanic Period indicates a flexible landscape-use organization based on intermittent sedentism and a greater tethering or redundancy in the structure of mobility (see also Kelly 1992; Rocek 1995; Schmader, Graham 2015). Moreover, the fact that the construction techniques use for the habitations varied, including at the same site, questions any identification of a ‘pithouse’ based on a few architectural remains and highlights the possibility that ‘pithouses’ may have been an episodic house type that has been overemphasized by ethnohistoric and normative approaches rather than a common Prehispanic category. In addition, implementing low-investment extensive cultivation that did not constrain group mobility probably precluded the opportunity for extensive long-term storage. Short-term storage in medium-sized pottery vessels and basketry was thus essential to withstand the stress of a semi-sedentary lifestyle.

Archaeologists often assume that settlement and subsistence patterns followed an immutable patterned seasonal round. Less attention has been given to the tendency of many small-scale societies to show inter-annual behavioural changes (Jochim 1991). Indeed, ethnohistoric examples indicate that such a rigid view is oversimplified across the world, showing that occupation strategies can change significantly over time and that temporary shifts from farming to foraging, and vice versa, were common (Jochim 1991; Layton et al. 1991; Kelly 1992; Graham 1994; Chilton 1999; Smith 2001; Panja 2003; Hill et al. 2008; Wheaton 2014; Ellis et al. 2015; Schmader, Graham 2015; Roth 2016; Scancarello et al. 2021). However, the preference for normative rigid views blinded archaeologists in their understanding of the past flexibility of human groups to adjust settlement location and group size to local changing circumstances. In contrast, we interpret a mosaic of foraging and farming patterns among the broad temporal scale of the Late Prehispanic Period that did not involve all the region’s people in the same ways. This view does not necessarily match paradigms that equate foraging with non-sedentary people and farming with sedentary people. The ethnohistoric record shows that occupational strategies were highly variable and occurred in different combinations, mainly at an evolutionary scale resolution. So, while most Late Prehispanic people occupied farmsteads during the growing and planting season, other small groups may sometimes have continued to be mobile to forage or occasionally settled in semi-permanent villages up to an entire year (six to 12 months) when conditions were suitable for farming, as probably occurred in Potrero de Garay. Farming activities were limited to field preparation using stone axes, planting, harvesting, and processing, so they did not interfere with foraging (Medina et al. 2016; 2020). If a crop failed or high-return wild resources became available, the settlement technology could fall back on higher mobility or dispersion as a description of Late Prehispanic adaptability to changing conditions. These settlement patterns led to arguments for greater residential mobility for the Late Prehispanic groups residing in the Sierras de Córdoba. Seasonal settlement rather than year-round sedentism might thus account for the archaeological record of the open-air residential sites, with clear signs of a flexible settlement strategy, especially as regards the domestic architecture, which was temporary, required a low investment of time and effort, and was not intended for long-term occupation.

We concluded that the material culture, particularly architecture, follows the expectation of a settlement pattern left by groups organized as seasonal or occasional food producers that used specific locations as campsites for a few months. Pottery vessels reflect not
only storage, but instead were multipurpose containers whose design constitutes a compromise in response to several performance requirements, something that would come under intense pressure within a residentially mobile setting (Medina 2010; Heredia 2015; Carosio et al. 2021). Based on such evidence, the Late Prehispanic villages were formed by a few extended family reoccupations during the growing and planting season. The repeated overlapping outlines of ephemeral houses occasionally create the illusion of large, deep, and extensive archaeological site deposits that resemble the multi-household nucleated settlements of entirely sedentary agriculturalists. However, these represent semi-isolated habitational structures discontinuously reoccupied over several centuries by a small-to-medium-sized group that practiced flexible land use and a mixed subsistence strategy. As such, the settlements were small, dispersed, and provisioned, contrasting with the classic view supported even by Laguens and Bonnin (2009) of permanently settled agricultural villages. According to this view, the Late Prehispanic Period record reveals a messy settlement and subsistence pattern in time and space, where flexibility was one of its defining straits. It is now time to dispense with rigid cultural classifications that ignore the fact that evolutionary change is not unidirectional, and to replace them with the recognition that the ability to move between subsistence and mobility strategies was an expected behaviour in the past. Archaeologists must rely on a flexible approach that seeks to balance suites of evidence and ethnographically derived models, addressing how to increase our understanding of where a mixed foraging and cultivation economy should be expected and what the archaeological consequences of such flexibility might be. Once we accept this perspective, then the Late Prehispanic cultural process’s with regard to settlement variability and high dynamism will be more clearly understood.


Berberián E., Martín V., and Martín de Zurita J. 1983. Contribuciones Arqueológicas a la Arquitectura Aborigen en la Región Serrana de la Provincia de Córdoba (República Argentina) durante el Periodo Hispano-Indígena. In E. S. Morresi, R. Gutierrez (eds.), Presencia Hispánica en la Arqueología Argentina. Tomo I. Museo Regional de Antropología “Juan A. Martinet”. Instituto de historia, Facultad...
Dwelling architecture and flexible land-use strategies in the Prehispanic Sierras de Córdoba, Argentina


Heredia C. 2015. La Cerámica como Indicador de Estrategias de Movilidad y Subsistencia en el Periodo Prehispánico Tardío de las Sierras de Córdoba (Argentina). Primeros


Dwelling architecture and flexible land-use strategies in the Prehispanic Sierras de Córdoba, Argentina


Appendix

Appendix Fig. 1. Plan view of Cementerio with the excavation units, post-molds, and critical features (taken from Laguens, Bonnin 2009).

Appendix Fig. 2. Plan view of the pit structures from El Ranchito (taken from Laguens 1999.99).