THE INTRODUCTION OF WHEAT IN MENDOZA, ARGENTINA DURING THE SIXTEENTH CENTURY A.D.: ARCHAEOBOTANICAL EVIDENCE

Carina Llano and Victor Durán

During the colonial era, southern Mendoza, Argentina, functioned as a frontier where indigenous and Spanish-speaking people interacted. Contact caused major transformations to indigenous economic, social, and political organization. Archaeological analysis is fundamental to understanding the characteristics of local indigenous populations that rapidly incorporated European products into their diets. Analysis of archaeological remains from the region, therefore, can cast light on important aspects of Spanish-indigenous interactions. The aim of this work is to describe the archaeobotanical record of Cueva de Luna—located in the Río Grande Valley and containing occupations dated between ca. 3800 B.P. and European contact—and to understand how plants were exploited by the inhabitants of southern Mendoza. Preliminary analysis of the archaeobotanical record, consisting primarily of seeds and woody endocarps in a dry state of preservation, indicates the use of native wild taxa, among which algarrobo *(*Prosopis *sp.),* molle *(*Schinus polygamus*),* solupe *(*Ephedra*), and* jarilla *(*Larrea nitida*) abound. American cultivars including beans (*Phaseolus vulgaris*) are also present. Significantly, the record includes Eurasian taxa, including wheat (*Triticum *sp.) and walnut tree (*Juglans *sp.). The Cueva de Luna record is important in this regard for it may correspond to the nineteenth century, when the area was inhabited by what may have been the last indigenous Pehuenche group preceding the current ranchers. Our results provide a basis for future work related to change and continuity in the prehistoric use of plants.*

*El sur de Mendoza funcionó como un área de frontera entre indígenas y españoles/hispano-criollos. Como consecuencia del contacto entre ellos, se generaron profundas transformaciones en sus formas de organización económica, social y política. En este sentido, la excavación del sitio arqueológico Cueva de Luna podría arrojar luz sobre algunas consideraciones acerca del contacto hispano-indígena, donde el análisis arqueobotánico es fundamental para dilucidar aspectos de las poblaciones indígenas locales, las cuales incorporaron rápidamente en sus dietas productos europeos. El objetivo de este trabajo es describir el registro arqueobotánico y comprender el uso de las plantas por parte de las poblaciones que habitaron el sur de la provincia. El sitio arqueológico Cueva de Luna, ubicado en el Valle del río Grande, presenta ocupaciones desde ca. 3800 años a.P. En términos generales, el registro arqueobotánico evidencia taxa silvestres autóctonos, entre los que abundan el algarrobo (*Prosopis *sp.), el molle (*Schinus polygamus*), el solupe (*Ephedra*) y la jarilla (*Larrea nitida*). Los restos arqueológicos recuperados son principalmente semillas y endocarpos de consistencia leñosa y en estado de preservación seco. Se registró también la presencia de especies domesticadas de origen americano, tales como el poroto (*Phaseolus vulgaris*). Además, se reconocieron taxa de origen euroasiáticos siendo éstas el trigo (*Triticum *sp.) y la nuez (*Juglans *sp.). El registro de Cueva de Luna es interesante al respecto porque podría corresponder al siglo diecinueve, siendo una ocupación de pehuenches, probablemente los últimos, a quienes les sucedieron los puesteros actuales. Estos resultados podrán ser útiles como base para futuros trabajos en relación a los cambios y continuidades en el uso de los recursos vegetales.*

It is well known that the adoption of cultivated plants results in economic, social, and political changes in human societies. In parts of southern South America, for example, indigenous lifeways shifted from hunting and gathering toward agriculture, and the focus of production changed from local crops to Old World varieties (Capparelli et al. 2005). According to early historical chronicles, relatively peaceful contact between Spanish-speaking people from Chile and the indigenous Huarpes from Mendoza may have transpired before exploratory and conquering advances from the west were made towards Cuyo. Thus, as suggested by Báez (1948), European

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Table 1. Chronology of Discrete Components of Cueva de Luna (Durán 2004).

Layer	Component	Chronology	Archaeological Evidence
I	1	20th century	Groups of pastoralists who used the cave sporadically
II	2	18th–19th centuries	Pehuenche occupation; the record indicates significant inter-ethnic trade (trans-Andean painted pottery, bones of European cattle, wheat seeds)
II	3	?	Hunter-gatherer occupations close to Spanish contact
II	4	1490 BP (PL-321 LATYR)	Hunter-gatherer occupations, including lithics, ceramics, and plant remains
II	5	3830 BP (LP-341 LATYR)	Occasional hunter-gatherer occupations, including formal lithic artifacts, retouched flakes, and plant remains

species would have been available to indigenous Mendozans since the founding of Santiago in 1541 by means of the trips made by the Huarpes between river basins on either side of the Andes.

Recent archaeological studies carried out in southern Mendoza, Argentina, show that wild plants, particularly *algarrobo* (mesquite) and *molle* (peppertree), were important for the survival of hunting and gathering populations (Llano 2011). Nonetheless, contact between indigenous groups and Spanish colonizers resulted in the exchange of cultivated plant species (Capparelli et al. 2005). The most credible archaeological evidence confirming the concurrent use of wild native species and Eurasian cultivars is provided by the archaeological site of Cueva de Luna, located in the middle Río Grande basin, Mendoza, Argentina (Durán 1999; Llano 2011).

Prior to our excavations, limited information was available on human habitation in the area before the nineteenth century. The only systematic archaeological studies were Gambier's (1980, 1985, 1987) publications about the site of Gruta El Manzano, together with Schobinger's and Gradin's work on rock art (Schobinger 1978; Schobinger and Gradin 1985). Subsequently, Durán's (1991-1992, 1993-1994, 1999, 2004) historical and archaeological investigations demonstrated the existence in the Río Grande Valley of exchange networks between different indigenous groups and Spanish-speaking people. The temporal sequence at Cueva de Luna is presented in Table 1, which summarizes Durán's (2004) five-component sequence built on radiocarbon dates, changes in lithic technology, and other chronological indicators.

The aim of this work is to present the archaeological record of Cueva de Luna, with special emphasis on identifying changes or continuities in the use of plant species. We also assess the spread of wheat in the study region based on ethnohistorical information (Báez 1948, 1949) and the exhaustive analysis of plant macro-remains from Cueva de Luna carried out by Capparelli et al. (2005). We see the recovery of wheat and wild plant species from a single site, as documented here, as an important contribution for the following reasons: (1) it provides archaeological evidence of the spread of Old World plants in South America; (2) the context suggests that these remains date to the late Holocene; and (3) the plant macro-remains, together with other archaeological evidence, indicate exchange between Spanish-speaking and indigenous populations.

Brief Outline of the Culture History of Northwestern Argentina

Archaeological evidence from the Gruta del Indio site (García 2003; García and Lagiglia 1999; Neme and Gil 2008) indicates that the exploration and colonization of southern Mendoza began during the Late Pleistocene or at the beginning of the Early Holocene, ca. 11,000 B.P. Toward the beginning of the Middle Holocene (ca. 8000–7000 B.P.), the number of sites and density of associated materials increase (Gil et al. 2005). Regional occupation appears to change dramatically between approximately 7000 and 4000 B.P.: archaeological evidence decreases and, in some cases, disappears completely (Gil et al. 2005). This trend seems to be mirrored in a number of regions across the South American continent (Núñez and Grosjean 1994; Zárate et al. 2005). At the beginning of the Late Holocene, between 3800 and 3200 B.P., archaeological deposits reap-

Table 2. Summary of the Different Domains of the Microenvironment Adjacent to the Archaeological Site.

	Description
Morphology	The archaeological site is located on a basalt formation that, having eroded, has created a series of canyons with hollows and caves.
Soil	Soils are generally fine, stony or sandy, and poor in organic matter.
Vegetation Types	Psammophilous steppes, halophyte plants, and vegas.
Climate	Dominant arid climate. Air masses from the Pacific anticyclone unload heavy snowfall during winter in the mountains and weaker summer rains in the eastern highlands.
Land use	The native flora and fauna are currently depleted and under severe stress, given that the area has been farmed for more than 200 years and oil extraction has been carried out for over 50 years.

pear in almost all regions. In all these areas, growing human occupation of the land is signaled by an increase in the number and size of archaeological sites, especially toward the middle of the Late Holocene. Between 2000 and 1500 B.P. the colonization process spreads over the most marginal zones, including the desert of La Payunia and the mountainous zone above 2,700 m asl (Neme and Gil 2008). In some of these areas, cultivated plants such as corn and squash are introduced at this time (Llano 2011).

The analysis of ethnohistorical documents indicates that around the second half of the sixteenth century the region was inhabited by nomadic groups with a hunting-based economy. There is also evidence that these groups practiced exchange with the western side of the Andes, which resulted in access to Chilean agricultural products (Durán 2004). This trade relationship was so well established during the seventeenth century that hunter-gatherer groups inhabiting the area around Cueva de Luna exploited a wide variety of animal and plant species from both regional environments. By that time, the demand for exotic goods from Hispanicized *criollo* society had resulted in the formation of a large-scale exchange network connecting the different indigenous groups with each other and with the Spanish-speaking population (Durán 2004). This network grew even stronger during the eighteenth century. Although indigenous groups continued hunting and gathering traditionally foraged species, they also started producing food. By the end of the eighteenth century, populations were no longer organized into bands, but rather into tribal groups with greater political integration, incipient social hierarchy, and an economy based also on commerce and grazing (Durán 2004; Michieli 1978).

Environmental Context and Description of the Cueva de Luna Site

The study area is located west of the city of Malargüe, in the central Río Grande Valley. This region may be considered to be an extension of Argentinean Patagonia (Cabrera 1976; González and Fauqué 1993; Polanski 1954; Roig 1972). Because the Andean massif is lower in altitude here than in the rest of the province, the South Pacific anticyclone is the dominant weather pattern (Capitanelli 1972). The annual average rainfall of approximately 300 mm is evenly distributed across the seasons, which are mild to cool, with an average annual temperature of 12°C. Although winter precipitation (both snow and rain) predominates due to the presence of the anticyclone, summer rainfalls produced by humid air masses from the Atlantic also reach the area.

Phytogeographically, the area can be characterized as an ecotone between the Monte, Patagonia, and Payunia ecosystems (Roig et al. 2000). Vegetation is mostly similar to that encountered in Monte regions (represented by *Larrea*), but it includes Patagonian species such as *Grindelia chiloensis* and *Retanilla patagonica*, a species endemic to Payunia regions. In flood-prone areas close to the site, cattail (*Typha subulata*), common reed (*Phragmites australis*), and *Cortaderia rudiuscula* are found. Due to local conditions of elevation, temperature, and humidity, the vegetation is highly adapted to drought and wind, as well as to herbivorous animals. Compact, hemispherical, cushion-like species abound. The description of the microenvironment is summarized in Table 2.

Cueva de Luna (36°05’ S 69°43’ W) is a cave located on the right bank of the Río Grande, at an

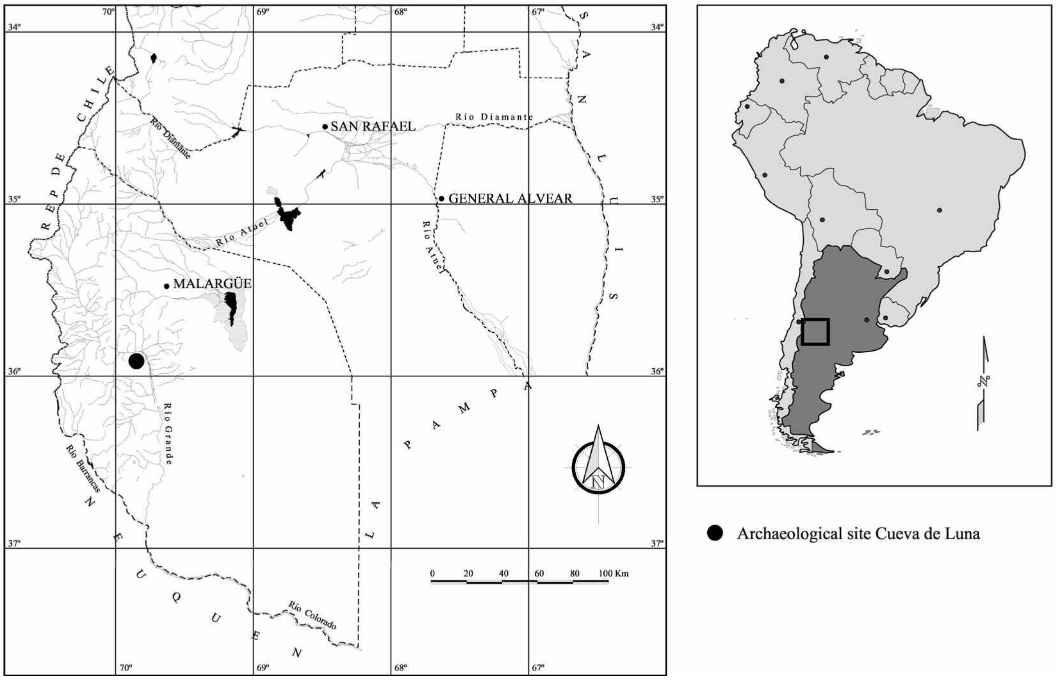

Figure 1. Location of Cueva de Luna.

elevation of about 1,300 m asl, and approximately 1.5 km to the north of the El Manzano stream (Figure 1). The cave is 9 m high by 8.5 m deep and has a southwest-northeast orientation. Excavations were carried out in 1996 by Victor Durán. The units were oriented north-south and were placed across the middle part of the cave. They covered an area of 3.5 m^2. The excavation reached a depth of 60 cm from the surface (Figure 2). Three natural layers are identifiable in the stratigraphic profile (Figure 3). Layer I is closest to the surface and varies in depth from 2 cm in grid square D4 to 20 cm in grid square G4. Layer II is the most important because it has the largest number of archaeological remains. This stratigraphic unit is very homogeneous and is made up of grayish-brown sandy loam. Within this matrix we identified a concentration of Gramineae and mixed branches that may have been a "bed." Layer III consists of reddish-brown loamy sediment that starts to appear between 50 and 55 cm below the surface. No plant macro-remains were recovered in this layer.

Materials and Methods

Archaeobotanical materials from Cueva de Luna were screened through a 2-mm mesh. The fraction larger than 2 mm was sorted visually, while the fraction smaller than 2 mm was examined in full under the microscope (a Nikon SMZ800). Recovered materials were found to be intact and in a dry state of preservation. The section on results provides a list of the families, genera, and species identified from the sample. The only quantitative results were frequency data calculated on the basis of absolute counts. Density and ubiquity could not be measured given that the volume of sediment excavated was not recorded. Eppendorf containers indicating site, layer, grid square, and level of occupation were prepared for all plant macrofossils. They are stored in the Anthropology Department of the Museo de Historia Natural de San Rafael, Mendoza (MHNSR).

Results

The results of screening are presented by grid square. All squares contained taxa from the families

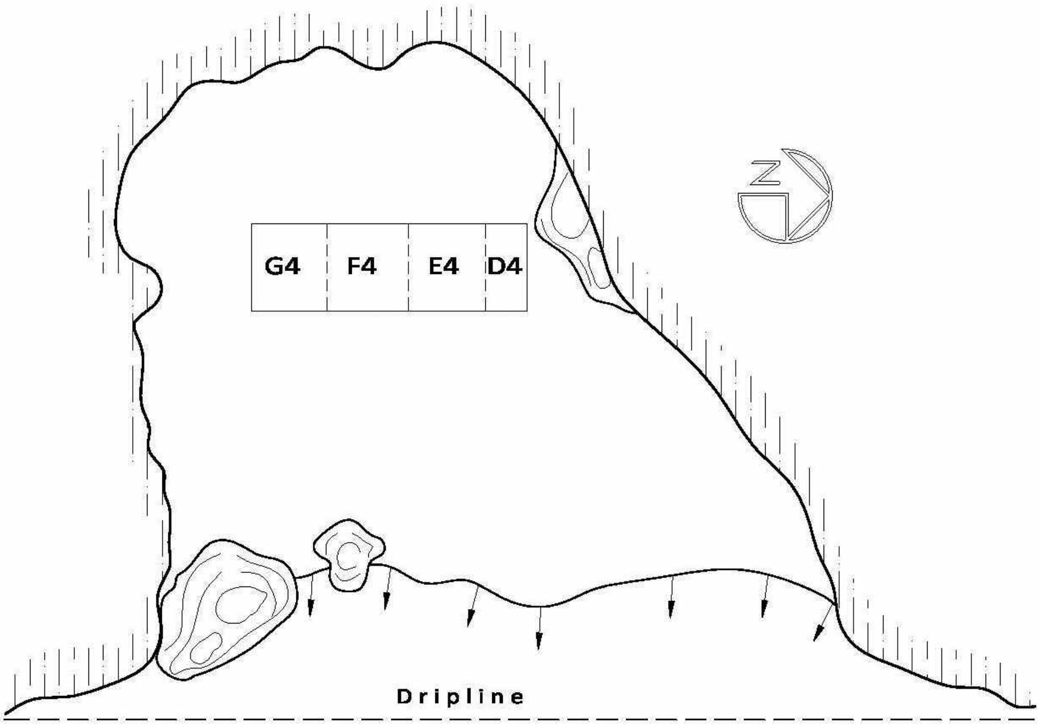

Figure 2. Plan view of Cueva de Luna, after Durán (2004).

Anacardiaceae and Zygophyllaceae. In addition to these taxa, square D4 contained taxa corresponding to the families Poaceae, Ephedraceae, and Cactaceae (Table 3); square E4 contained taxa from the families Fabaceae, Poaceae, Ephedraceae and Juglandaceae (Table 4); square F4 contained taxa corresponding to the family Fabaceae (Table 5); and finally, square G4 contained various taxa corresponding to the families Fabaceae, Ephedraceae, and Poaceae (Table 6).

The species recovered in each component are shown in Figure 4. It is interesting to note that there are only two species present in the oldest component (dating to 3800 B.P.), *Schinus polygamus* and *Prosopis* sp. *Prosopis* dominates the component dated to 1400 B.P., but the genus declines markedly in later components. Materials from the four grid squares analyzed are grouped below to describe the characteristics on which the identifications were based. They are arranged at

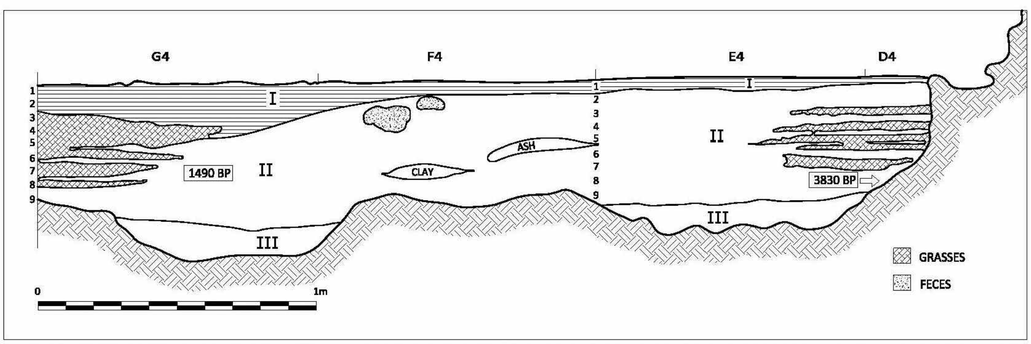

Figure 3. Stratigraphic profile of Cueva de Luna.

Table 3. Plant Macro-Remains Recovered from Cueva de Luna, Grid Square D4.

		Square D4		
Layer	Component	Label	Taxon	Frequency
I	1	1 & 2	*Schinus polygamus*	6
			Larrea nitida	14
			Prosopis sp.	12
			Triticum aestivum/durum	1
II	2	3	*Schinus polygamus*	2
			Prosopis sp.	3
			Triticum aestivum/durum	1
	3	4	*Schinus polygamus*	2
			Prosopis sp.	19
			Triticum aestivum/durum	14
			Larrea nitida	2
			Ephedra sp.	10
	4	5 & 6	Poaceae	-
			Schinus polygamus	1
			Maihuenia poepiggi	2
			Prosopis sp.	48
	5	7–8 & 9	*Prosopis* sp.	7
			Schinus polygamus	1

Table 4. Plant Macro-Remains Recovered from Cueva de Luna, Grid Square E4.

		Square E4		
Layer	Component	Label	Taxon	Frequency
I	1	1 &2	*Prosopis* sp.	7
			Triticum aestivum/durum	1
II	2	3 & 4	*Triticum aestivum/durum*	63
			Schinus polygamus	7
			Prosopis sp.	24
			Larrea nitida	1
			Phaseolus vulgaris	1
			Ephedra sp.	1
			Juglans aff. regia	1
			Unidentified	3
	3	5	Poaceae	-
			Prosopis sp.	7
			Triticum aestivum/durum	56
	4	6–7 & 8	*Prosopis sp.*	9

Table 5. Plant Macro-Remains Recovered from Cueva de Luna, Grid Square F4.

		Square F4		
Layer	Component	Label	Taxon	Frequency
I	1	1 & sector SW 2	*Larrea nitida*	3
			Prosopis sp.	2
			Schinus polygamus	4
II	2	2-3 & 4	*Larrea nitida*	3
			Prosopis sp.	6
			Schinus polygamus	1
	3	5	-	-
	4	6–7 & 8	-	-
	5	9	-	-

Table 6. Plant Macro-Remains Recovered from Cueva de Luna, Grid Square G4.

		Square G4		
Layer	Component	Label	Taxon	Frequency
I	1	1 & 2–3 & 4 (SW & NW) 5 (SW)	*Prosopis* sp.	2
			Schinus polygamus	12
			Larrea nitida	19
			Ephedra sp.	2
			Unidentified	1
II	2	3 & 4 (SE & NE)	*Larrea nitida*	1
			Unidentified	1
	3	5	*Poaceae*	-
	4	6–7 & 8	*Prosopis* sp.	1
			Larrea nitida	1
			Schinus polygamus	2
			Ephedra sp.	1
	5	9	-	-

the lowest identifiable taxonomic level:

I. Family Anacardiaceae

Schinus polygamus (Cav.) Cabrera

Provenience: Grid square D5, levels 1 to 9. Grid square E4, levels 3 and 4. Grid square F4, levels 1 to 4. Grid Square G4, levels 1 to 8 (see Tables 3–6).

Description: 43 intact endocarps. Dimensions run from 5 to 6.5 mm in length by 6 to 8 mm in width; shape is mostly oval. Dorsal and ventral prominences are observed on all specimens (Figure 5A).

II. Family Zygophyllaceae

Larrea nitida Cav.

Provenience: Grid square D4, levels 1, 2, and 4. Grid square E4, levels 3 and 4. Grid square F4, levels 1 and 2. Grid square G4, levels 1 to 8 (see Tables 3–6).

Description: 42 mericarps. The vegetal part recovered corresponds to the *Larrea nitida* fruit, which, when intact, is spherical with a slight pubescence, grayish-white in color, and can be divided into 5 mericarps. Of all the mericarps, only two were intact; the other 32 had come apart (Figure 5B).

III. Family Fabaceae

Prosopis sp.

Provenience: Grid square D4, levels 1 to 9. Grid square E4, levels 1 to 8. Grid square F4, levels 1 to 4. Grid square G4, levels 1 to 8 (see Tables 3–6).

Description: 140 endocarps and 2 intact seeds. The measurements of the endocarps run from 8 to 11 mm in length and 7.5 to 8 mm in width. Their shape is rhomboidal or, in some cases, circular. Seed measurements run from 3.5 to 5 mm in length and 3 to 4 mm in width. Their shape is oval with a rounded chalazar end and a subacute hilar end. The fissure line is horseshoe-shaped (Figure 5C).

Prosopis strombulifera (Lam.) Bentham

Provenience: Grid square D4, level 4 (Table 3).

Description: 1 pod. Its measurements are 6 mm in length by 1 mm in width. It is yellow and the fruit shape is spirally (Figure 5D).

Phaseolus vulgaris L.

Provenience: Grid square E4, levels 3 and 4 (Table 4).

Description: Two kidney-shaped cotyledons. Their measurements are 6 mm in length by 11 mm in width. Taking into account the external morphological characteristics, both macro-remains were identified as *Phaseolus vulgaris* (Figure 5E).

IV. Family Poaceae

Triticum aestivum/durum

Provenience: Grid square D4, levels 1 to 4. Grid square E4, levels 1 to 5 (Tables 3 and 4).

Description: 136 complete grains. The vegetal part recovered during screening corresponds to a whitish ellipsoid caryopsis between 5.5 and 8.5 mm long. The morphological differences between the

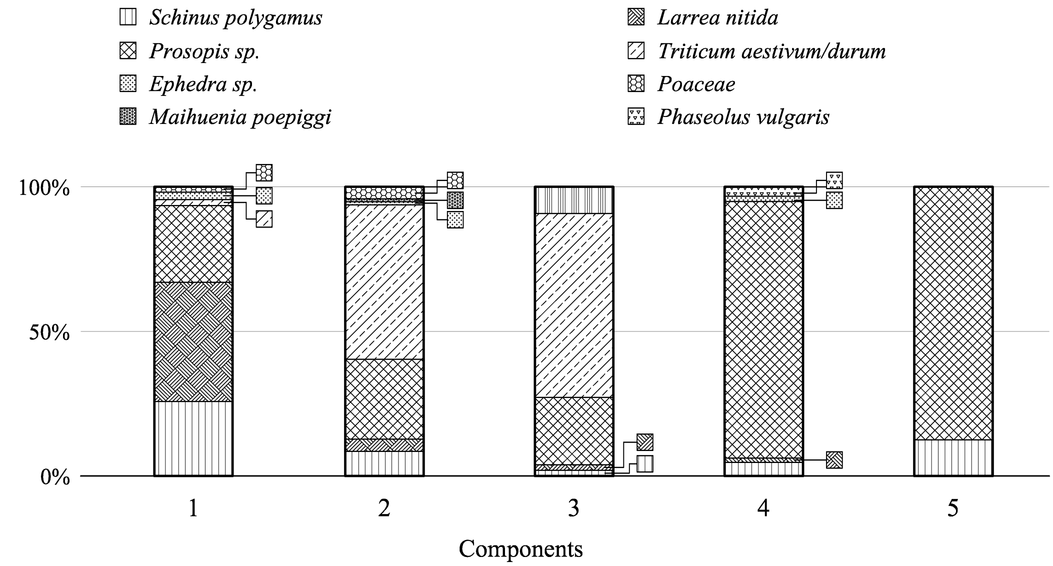

Figure 4. Relative frequencies of macro-remains in each component at Cueva de Luna.

two species are not significant enough to differentiate them in objective botanical terms (Figure 5F).

V. Family Juglandaceae

*Juglan*s aff. *regia* Linn.

Provenience: Grid square E4, level 4 (Table 4).

Description: The only part recovered was half of a walnut endocarp, 3.5 cm long. Identification is based on size, shape, the woody consistency of the thin endocarp, and the furrows on internal and external faces.

Discussion and Conclusions

The archaeological record of Cueva de Luna indicates that occupation in the area began ca. 3800 B.P. (Component 5; see Table 1). Indigenous groups inhabited the region as part of a multiannual system of mobility. This system covered a very large area, which may have extended across the Andean mountain range and as far west as the Pacific coast (Durán 2004; Sanhueza et al. 2004). After this initial occupation, there is a gap of more than 1,500 years in the archaeological record. There have been various tentative explanations for this, among which environmental change may be the most likely (Gil et al. 2005). Around 1500 B.P. the archaeological record resumes, indicating adaptations and patterns of occupation similar to those of the initial period (Component 4).

The archaeobotanical record from Cueva de Luna consists primarily of seeds and woody endocarps in a dry state of preservation and abounds with native wild taxa, including *algarrobo* (*Prosopis* sp.), *molle* (*Schinus polygamus*), *solupe* (*Ephedra*), and *jarilla* (*Larrea nitida*). Domesticated American species such as bean (*Phaseolus vulgaris*) are also present. The relative abundance of cultivated vs. native beans is noteworthy. Eurasian wheat and walnut trees are also present, but only in the youngest levels of grid squares D4 and E4, which is consistent with the chronostratigraphy of the site. It should be mentioned that, in the chronology suggested by Durán (2004), materials from Component 3 cannot be assigned to a particular time period. Nevertheless, Neme et al. (1995) propose that Component 3 should be attributed to hunter-gatherer occupations preceding European contact, given that no evidence of Spanish influence has been found in the zooarchaeological record (Neme et al. 1995).

Ethnohistorical evidence for the adoption of Old World crops in Argentina was exhaustively examined by Capparelli et al. (2005). It is important to emphasize that the neighboring country of Chile played a central role in the production and

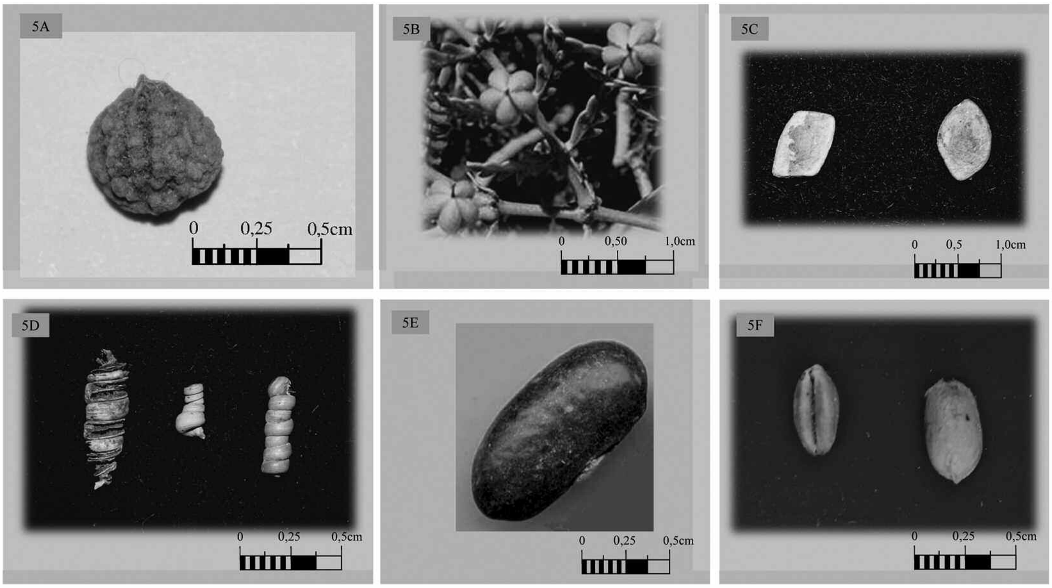

Figure 5. Plant macro-remains from Cueva de Luna: (A) *Schinus polygamus*; (B) *Larrea nitida*; (C) *Prosopis* sp.; (D) *Prosopis strombulifera*; (E) *Phaseolus vulgaris*; (F) *Triticum*.

distribution of crops like wheat, barley, and European fruit trees. Indeed, wheat may have been introduced into southern Mendoza before the city of Mendoza itself was founded in 1561 by Pedro del Castillo. Báez (1948) claims that the indigenous Huarpe traded these crops with Chilean groups prior to that time. Bengoa (1991) also states that, during the second half of the sixteenth century, with the Spanish expansion south of the Biobío River, indigenous communities began consuming new plant and animal species (Torrejón and Cisternas 2002). Given this information, it is not unreasonable to think that trade networks across the Andes may have been established fairly early on.

Furthermore, historical data show that wheat was not directly introduced by the Spaniards (Capparelli et al. 2005), but that the spread of this species occurred as a result of exchange with people from Chile during Valdivia's government (Báez 1948). This is perhaps not surprising considering the existence of trans-Andean trade routes, as documented by Bibar (1966 [1558]). These observations lend support to the hypothesis that, in some regions, Old World crops spread before permanent settlement by Spanish-speaking people, as occurred in the Calchaquí valleys (Capparelli et al. 2005). Therefore, although Component 3 contains vast quantities of macro-remains of *Triticum* ($n = 67$), it may correspond to hunter-gatherer occupations prior to European contact.

In the case of the younger Component 2, the archaeobotanical data are consistent with other authors' interpretations (Durán 2004; Neme et al. 1995) that it corresponds to Pehuenche occupation of the region in the eighteenth and nineteenth centuries. Pehuenche groups played a key role in the introduction and management of Old World species in the area, and modern rural populations (represented by ranchers) may have ancestral ties to them.

The results of this study suggest that, despite the fact that Eurasian cultivars were introduced to the American continent by Spaniards, local groups received these resources by exchange. Therefore, while the introduction of wheat and walnut trees increased the number of vegetal taxa known and probably consumed, they do not appear to have replaced local resources. Instead, they appear to have been added to the list of species consumed, indicating use of both native and introduced crops, rather than an abrupt breakdown of the traditional system. Future research should evaluate potential transformations brought about by the incorporation of Spanish Mediterranean agricultural and animal husbandry techniques. These inevitably entail both a structural modification of ecosystems and a process of cultural change, but not necessarily a loss of local knowledge.

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