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PLANT SPECIES (POACEAE, ASTERACEAE, FABACEAE AND SOLANACEAE) AT AN ARCHAEOLOGICAL SITE IN THE SOUTHERN ARGENTINE PUNA

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ABSTRACT.– This research studied the use of plant species, mainly from the family Poaceae but also from others (Asteraceae, Fabaceae and Solanaceae), by hunter-gatherer groups during the Archaic period (10000-3000 years BP). The work is based on materials recovered at an archaeological site in the southern Argentine Puna, Province of Catamarca: Quebrada Seca 3. The starting point for this study of the archaeobotanical record was a survey of current flora of the area and the ethnobotanical information recovered there. From the comparative anatomical and morphological analysis of the current and archaeological plants, these latter were identified. The results indicated presence of six species of the family Poaceae together with other plant remains from the Asteraceae, Fabaceae and Solanaceae. From these results, both areas of origin and probable uses of these species as well as some seasonality in the site occupation, were inferred.

Key words: Paleoethnobotany, archaeobotanical record, plant remains, plant use, seasonality

RESUMEN.– Este trabajo consiste en una investigación acerca del uso de especies vegetales pertenecientes a la familia Poaceae principalmente y a otras familias (Asteraceae, Fabaceae y Solanaceae) por grupos cazadores-recolectores durante el período Arcaico (10000-3000 años AP). Se basa en los materiales recuperados en un sitio arqueológico de la Puna Meridional Argentina, Provincia de Catamarca: Quebrada Seca 3. El punto de partida para el estudio del registro arqueobotánico fue el relevamiento de la flora actual del área y la información etnobotánica recogida en la misma. El análisis anatómico y morfológico comparativo de los vegetales actuales y arqueológicos permitió la identificación de los últimos. Los resultados indican la presencia de seis especies de la familia Poaceae y de otros restos vegetales pertenecientes a las familias Asteraceae, Fabaceae y Solanaceae. A partir de estos resultados se infieren las áreas de procedencia y el probable uso de estas especies y cierta estacionalidad en la ocupación del sitio.

RÉSUMÉ.– Ce travail est une recherche sur l'usage des espèces de végétaux-qui appertiennent principalment a la famille Poaceae et a d'autres familles (Asteraceae, Fabaceae et Solanaceae), par des groupes de chasseurs-recolecteurs pendant la période Archaique (10000-3000 AP). Il se base sur des materiaux recuperés dans un siège archéologique à la Puna Meridionale Argentine, Province de Catamarca: Quebrada Seca 3. Le point de départ pour l'étude du régistre archéobotanique fût le relèvement de la flore actuelle de la région et l'information ethnobotanique cueillie dans lá même. A partir de l'analyse anatomique et morphologique compare des végétaux actuels et archeologiques, ces derniers ont été determinés. Les résultats indiquent la présence de six éspèces de la famille Poaceae et de restes

végétaux appartennant aux familles Asteraceae, Fabaceae et Solanaceae. A partir de ces résultats on infére les regions d'origine et l'usage probable des pièces et une certaine regularité stationnelle dans l'ocupation du stège.

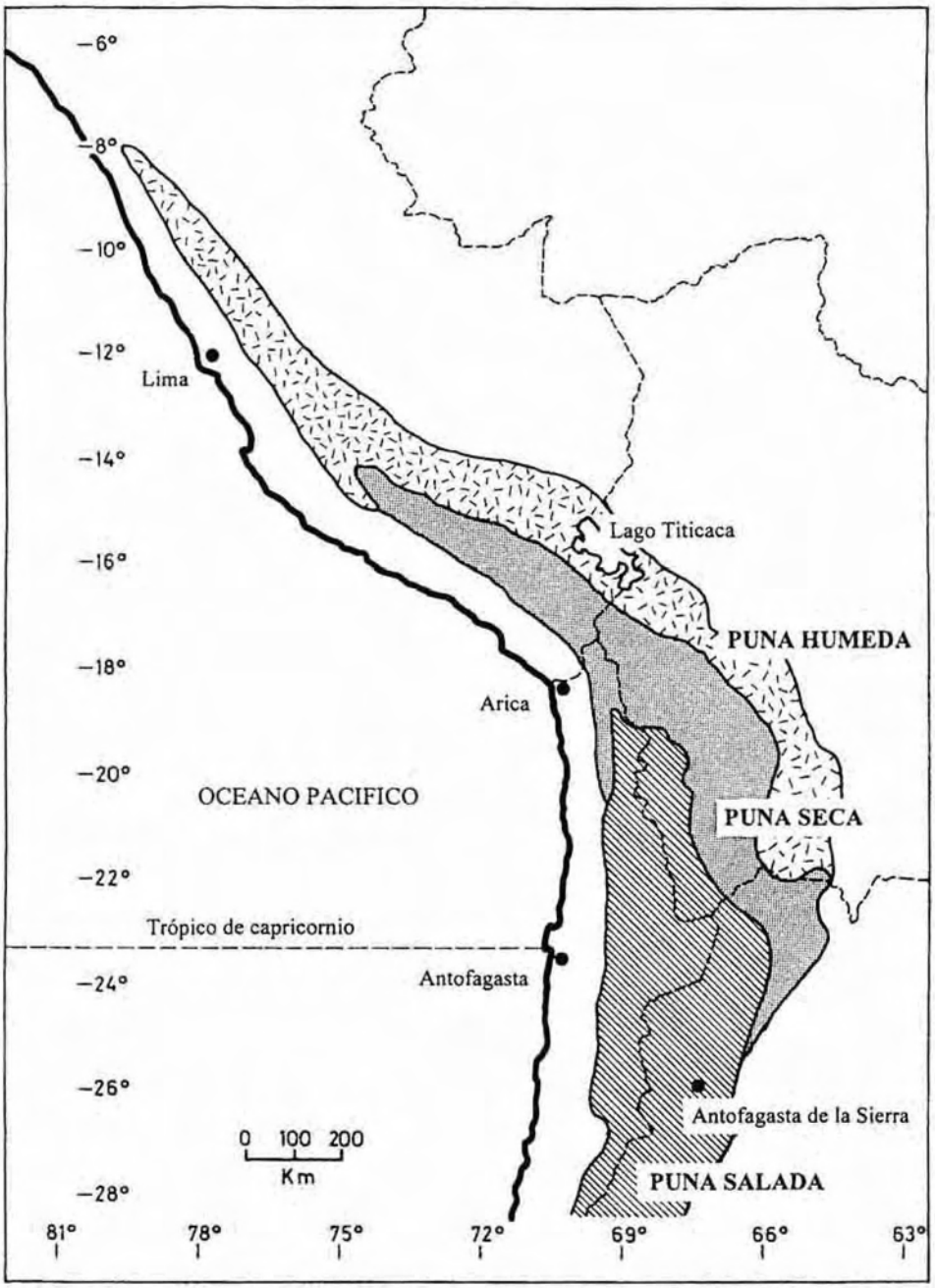

FIGURE 1.– Environmental division of the Puna (taken from Elkin 1996; adapted from Baied and Wheeler 1993, Fig. 1).

INTRODUCTION

In this study, the use of plant species primarily from the family Poaceae and additionally from other families (Asteraceae, Fabaceae and Solanaceae) by hunter-gatherer groups during the Archaic period (10000 to 3000 years BP) was investigated. The work is based on materials recovered at an archaeological site in the southern Argentine Puna: Quebrada Seca 3 (QS3) (Figures 1,2), located in the Hoyada of Antofagasta de la Sierra, Province of Catamarca. This research was part of the project: "Subsistence, interaction and social mobility in the Indian prehispanic past", conducted by Lic. Carlos Aschero and financed by Consejo Nacional de Investigaciones Científicas y Técnicas.

The starting points of this study were analysis of the current flora of the area and of ethnobotanical information obtained from interviews with inhabitants there. These data permitted assessment of the archaeobotanical record of the site.

To use information on current flora of the study area, it was necessary to evaluate in tandem the palaeoenvironmental changes that operated in the region. There is no recent information on this for Antofagasta de la Sierra. For this reason, data obtained in the northern Puna were considered. In general terms, the climate would have been cold and humid between ca. 10,000-7,500 BP, arid and somewhat warmer between ca. 7,500-4,000 BP, and similar to modern conditions from 4,000 BP on (Markgraf 1985, 1987; Elkin 1996). At present, there are zones of high concentration of resources in the Puna (Yacobaccio 1994). It was therefore probable that the locations of the plant resources remained stable through time, with variations instead being in the quantity and extent relating to the paleoclimatic changes described.

In relation to the archaeobotanical record, it is important to consider that plants could be present at the site because of human or natural (wind, animals) processes. Many of the plants there could thus be part of the chance deposits. These plants could still be useful in reconstructing the prehistoric environment and detecting the climatic changes operating through time (Dincauze 1987 in Schiffer 1988; Ford 1988), since many species show adaptation of anatomy to environmental conditions (Cutler 1978).

The ethnobotanical record offers a good basis on which to formulate hypotheses which could be tested in the archaeobotanical record. However, it is always necessary to use independent ways of contrasting and comparing these records. For example, consider the fact that the presence now of an edible species does not necessarily indicate that it was also consumed in the prehistoric past. Such conclusions require independent analysis with isotopic elements in human bones and coprolites, if any, to demonstrate both consumption and importance in the diet (Hastorf 1988).

Finally, the analysis of anatomy of current and archaeological plants and comparisons between them permit the identification of the latter plants and, in this way, the reconstruction of aspects of the prehistoric economy, i.e. the use of plant resources before the outset of domestication.

Thus, the following objectives were established:

(1) To identify the archaeological plants through comparison, by morphological and anatomical analysis, with current species of the study area.

(2) To analyze, according to the contextual associations and the known ethnobotanical information, the use that occupants of QS3 made of the plant resources.

(3) To determine, taking into account the environmental changes known to have operated, the origins of plant species used in QS3 based on their distributions in the current environment.

(4) To evaluate the possibility of considering plants as indicators both of seasonality in occupation of the sites and of the climatic changes through time.

Moreover, the following hypothesis was tested that the site QS3 was seasonally occupied according to the resources available in the surrounding area and was therefore part of a settlement system, i.e., of a group of sites with different function, located at different heights.

Geographical and environmental framework.– The Hoyada of Antofagasta de la Sierra is located towards the southern end of the puna. This region ranges from the south of Peru and center of Bolivia to the north-west of Argentina (Cabrera 1957), at coordinates 7°- 27° S and heights of 3,500-5,500 meters above sea level (a.s.l.) (Baied and Wheeler 1993) (Figures 1 and 2).

In Argentina, the puna has an arid climate with great temperature range and low atmospheric pressure. However, there are differences throughout its extent, mainly due to the decrease in precipitation both north to south and east to west. Troll (1958) recognized three zones based on characteristics of the vegetation and patterns of human behavior: humid puna, dry puna and salt puna. In this study, interest lies with the salt Puna, since Antofagasta de la Sierra is located there (Figure 1).

The modern climate is dry and cold and is characterized by great daily temperature range; it rains almost entirely in summer alone yet for most of the year snow is lacking. Precipitation occurs as hail or snow in the high mountains. These forms of precipitation vary in different areas of the puna, as well as during the year and from year to year. This variation in precipitation allows one to divide the Argentine puna into two zones: the puna of Jujuy, which occupies the more humid part of the north-west, with permanent rivers and more abundant vegetation, and the puna of Atacama to the south-west, which is very dry, lacking in rivers, and with large salt mines (Cabrera 1957). Antofagasta de la Sierra is located in this puna of Atacama.

From the phytogeographical point of view, Antofagasta de la Sierra corresponds to the Puneña Province of the Andino Dominion (Cabrera 1953, 1957, 1976). In this Province, the dominant vegetation is bushy steppe, but herbaceous, halophilic and sammophilic steppes and lowland are also present (Cabrera 1957, 1976; Cabrera and Willink 1980).

In the area surrounding the site a pasture of Poaceae has developed, where bushy species of the genera *Adesmia*, *Baccharis*, *Parastrephia* and *Fabiana* are abundant. These plant resources have at present foraging importance for the llama herds which graze there (Haber 1988). The area corresponds to the plant association of a range land (Cabrera 1953) at 3800 m a.s.l. Along the bottom of Quebrada Seca lowland develops, characterized by plant cover which includes species of Poaceae and Juncaceae (Pérez de Micou and Ancibor 1994). At 2.3 km from QS3 and below

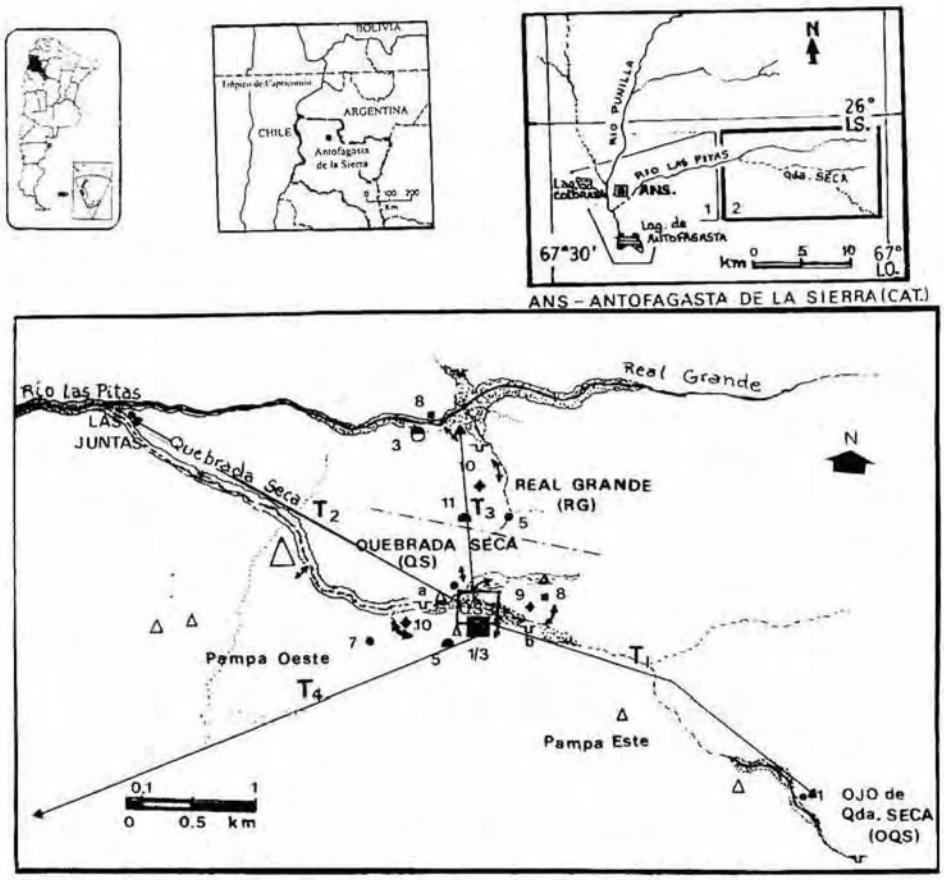

FIGURE 2.– Location of Antofagasta de la Sierra (Catamarca) and the locality of Quebrada Seca. Transects carried out during the analysis of areas of exploitation of plant resources around QS3: T1, transect, E direction; T2, transect, W direction; T3, transect, N direction, and T4, transect, SW direction.

3800 m a.s.l., commences the *tolar*, where bushy and sub-bushy species of the genera *Parastrephia* and *Acantholippia* are abundant.

Description of the site.– QS3 is a shelter located in the Hoyada of Antofagasta de la Sierra (Catamarca), on the southern margin of the lowland of Quebrada Seca, at 4100 m a.s.l. (Figures 2,3). It is oriented toward the NE and presents a protected area of 9 m x 5 m (Figure 4). This surface was divided into an outer sector and an inner sector, designed as eaves and cave respectively, because of the existence of an inner rocky peak which limited the space useful to live in. According to characteristics of each of these sectors, the first (with highest artefact densities) would correspond to an area where most of the activities were carried out and the second to a sleeping area (Aschero *et al.* 1991; Aschero *et al.* 1993-94).

Four main stratigraphic units were found. Layer 0/lens 1 x (muddy-sandy free surface layer with guano, contained carbonaceous sediments of apparent an-

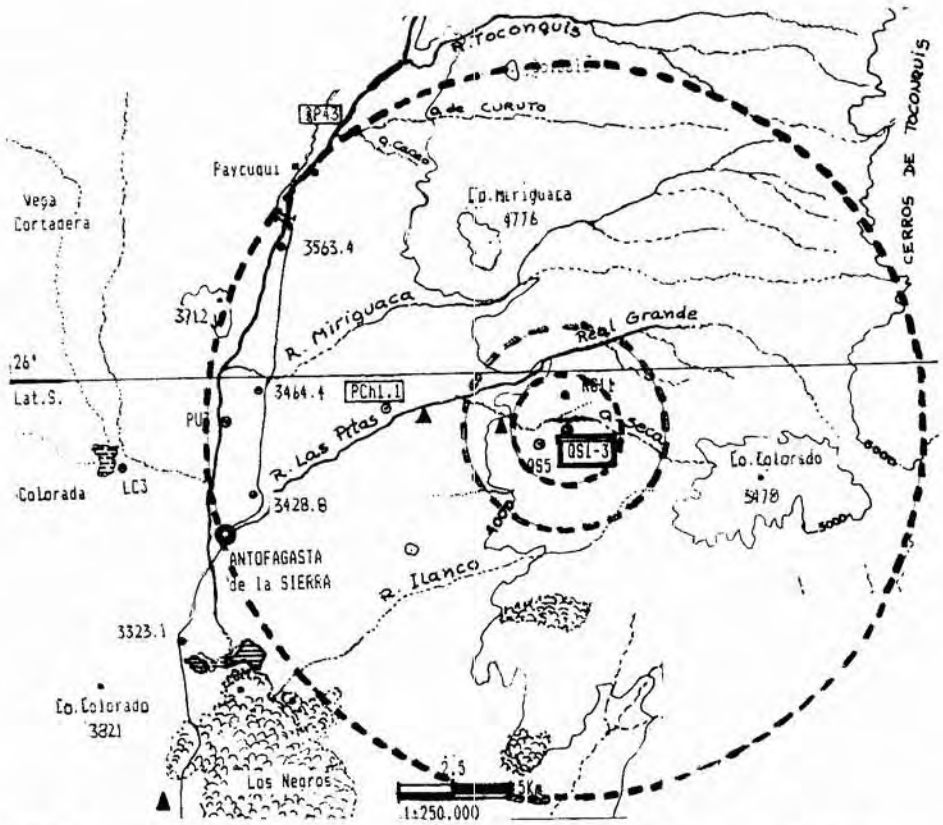

FIGURE 3.– Antofagasta de la Sierra (Catamarca). Areas of capture of native plant resources from QS3.

thropogenic origin); layer 1 (muddy-sandy compact sediment, archaeologically sterile); layer 2a (non-compact sandy sediment; grey to light brown colouration at the top, with scarce anthropogenic remains); layer 2b (sandy to sandy-muddy light brown sediment, with important anthropogenic contributions) (Aschero *et al.* 1991). Within this last layer, 25 levels of occupation were differentiated (Aschero, personal communication 1996) [1] (Table 1).

A date of 2480 ± 60 BP (LP – 278) was obtained in layer 2a, which corresponds to the Initial Lower Formative (Late Holocene). For this work, special interest was in layer 2b. The radiocarbon dates assessed from different levels of occupation gave an important archaeological sequence about the Archaic period (Early and Middle Holocene). These datings lay between the extremes of 4510 ± 100 BP: Level 2b2 (BETA 27801) and 9410 ± 120 BP: Level 2b25 (LP - 881) (Table 1).

MATERIALS AND METHODS

The starting point of this study was the surveying, identification and anatomical analysis of plant species of the area in order to compare these results with the archaeological record of QS3.

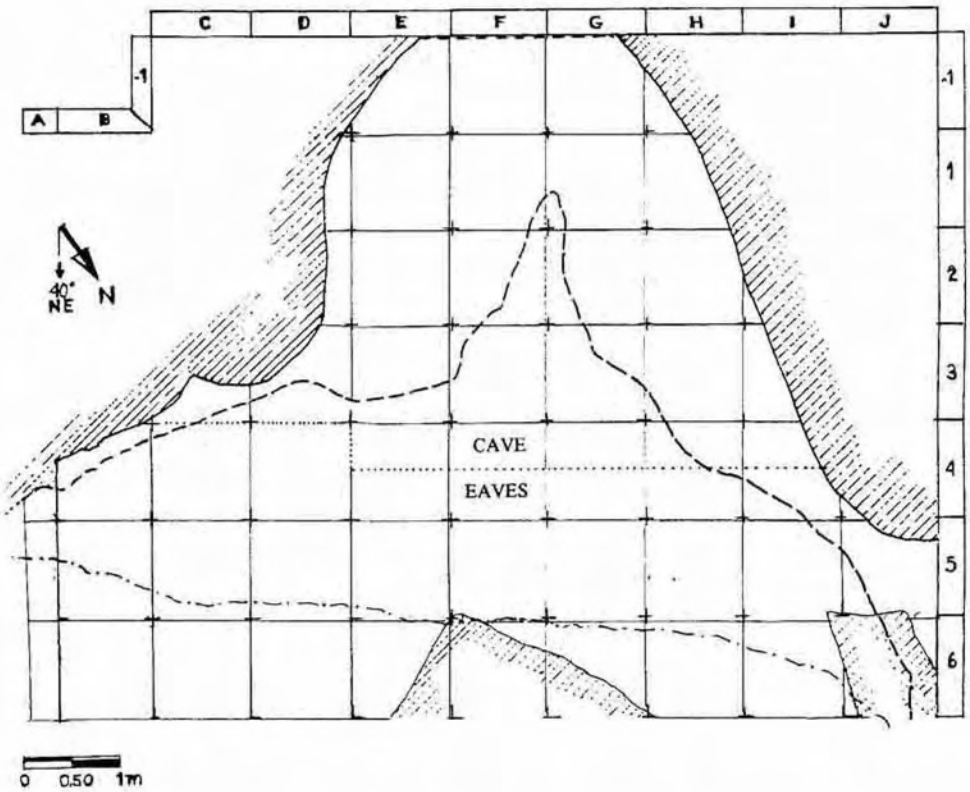

FIGURE 4.– Floor of level 2b4 of QS3, indicating the squares (letter and number). Survey carried out by Lic. Carlos Aschero.

The ethnobotanical information was used to determine the probable use that human groups who occupied the site made of the plant resources. In this context, four inhabitants of Antofagasta de la Sierra were interviewed.[2] They were selected because they are very old inhabitants of the area. The questions asked of them were related to use of the plants that grow in the area.

Current material.– Four transects were carried out in different directions from QS3, following natural topographic lines which connect different microenvironments (Figure 2). The area surrounding the site considered as the most probable area of economic exploitation with minimum energy consumption was determined previously (Bailey 1983). For each transect, the direction, route, distance, duration of the walk, characteristics and changes in vegetation relating to types of soils and presence or absence of water, were all considered. In all transects, relevant geographical points (ravines, water courses, plant associations) were taken as reference and the time taking in walking to get there was recorded. On the return, the collections of plants were made. These were subsequently identified at the Instituto de Botánica Darwinion (SI), where they were later deposited in the Herbarium as part of the reference collection for analysis of the archaeological material.

TABLE 1.–Stratigraphy and chronology of QS3.

LAYER and LEVEL	DATE (years BP)	PALEOCLIMATE–PERIOD	
0- lens 1x			
1		Late Holocene	Formative
2a	2480 ± 60		
2b1	5400 ± 90		
2b2	4510 ± 100		
2b3	4770 ± 80		
2b4			
2b5	5380 ± 70		
2b6			
2b7		Middle Holocene	Archaic
2b8	6160 ± 100		
2b9	7220 ± 60		
2b10			
2b11	7130 ± 110		
2b12			
2b13			
2b14	7350 ± 80		
2b15			
2b16	8330 ± 110		
2b17			
2b18	8640 ± 80		
2b19			
2b20		Early Holocene	Archaic
2b21			
2b22	9050 ± 90		
2b23			
2b24			
2b25	9410 ± 120		

For anatomical analysis of structure of Poaceae, leaves and floral stems of these specimens were taken. Transparency of the former was emphasized following the technique of Dizeo de Strittmatter (1973). For floral stems, cross-sections were made manually. All histological sections were stained with safranine fast-green (D'Ambrogio 1986), later examined and photographed by optical microscope. The epidermis of leaves was also examined and photographed by Scanning Electronic Microscope (SEM). This material is also part of the reference collection (Numbers: SI 28209 to 28211, 28337 to 28342).

Archaeological material.– The excavation of the site was carried out by sectorial *decapage* following natural layers. For layer 2b, with sandy matrix, the work was carried out following the distribution of ecofacts and artefacts on site. When concentration of remains was observed, the extractions were separated until the concentration terminated. In this manner, cultural levels were obtained and named as levels of occupation.

At each level of occupation, squares of 1 m x 1 m were drawn (Figure 4) and subdivided into microsectors of 0.5 m x 0.5 m. These latter were the real units of excavation. Within each, the documented material was separated in floors of scale

1:10. In each floor, the depths of beginning and end of each extraction for the extremes of each microsector were recorded as were those of artefacts, combustion and accumulation structures. In this way, it was possible to determine the density of remains by microsector in cubic meters and to obtain a tridimensional record of the instruments and structures of the site (Aschero *et al.* 1993-94).

Plant remains comprised the archaeobotanical record of the site. The macroremains recovered were gathered in the following ways:

(1) **Ecofacts** (plant remains which gave no evidence of human modification before use): firewood (wood and charcoal); grasses with and without reproductive organs; other smaller plant remains (flowers, fruits and leaves). These appeared many times in the archaeobotanical record as parts of *structures*, i.e., of non-portable artefacts, such as fires and straw layers (Renfrew and Bahn 1993).

(2) **Artefacts** (plants, with modifications of anthropogenic origin, to be used for some purpose): instruments to make fire, shafts, wood cut in bevel, decorated woods, worn culms, cords, baskets and remains of basketwork.

It is important to indicate the presence of a funeral bundle at level 2b2. It was a cover of camel-hide, tied with a woollen cord, which contained the bony remains of a human foetus (Aschero et al. 1991). The bundle was surrounded by, and rested on, bunches of grasses (Figure 5).

In this study, species of Poaceae and small plant remains of Asteraceae, Fabaceae and Solanaceae were examined. The woody specimens of the latter three families were analyzed in a recent publication (Rodríguez 1998c). The materials

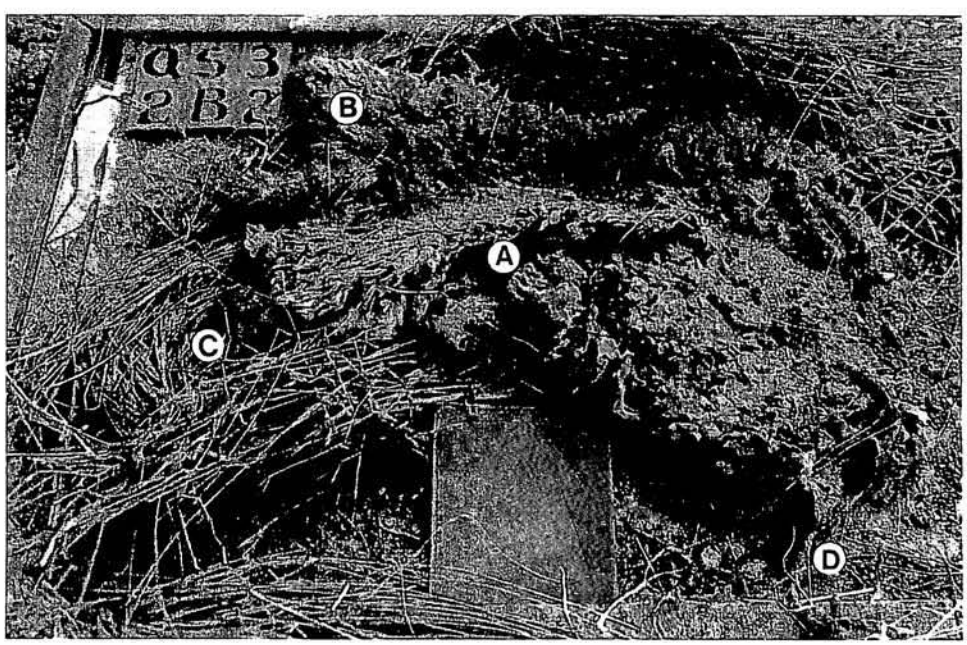

FIGURE 5.– Funeral bundle, level 2b2: A, human foetus; B, camel-hide; C, truss of grasses; D, woollen cord.

recovered are held in the Instituto Nacional de Antropología y Pensamiento Latinoamericano. The grasses with reproductive organs were identified. Some leaves and floral stems of these specimens were separated and current material was examined as detailed above. These histological sections are also part of the reference collection. The leaves and floral stems of Poaceae lacking reproductive organs and forming part of accumulations and straw layers were studied in the same way.

The analysis of leaf anatomy, through morphology of stomata, silica bodies and cork cells, and of structure of the floral stem permitted identification of some genera. In such cases, histological sections from the reference collection were used as basis for comparison with standard botany texts (Metcalfe 1960; Nicora and Rúgolo de Agrasar 1987).

Finally, amplified color laser copies of smaller plant remains were taken; the epidermis of selected remains was examined and photographed by SEM. Families involved were identified by morphological characteristics of reproductive and vegetative tissues.

RESULTS

Ecofacts.–Poaceae. Grasses (Table 2) were present at some levels of QS3, forming layers of considerable size at 2b10 but more isolated elsewhere. At 2b2, they were part of the funeral bundle mentioned above (Figure 5). Some specimens possessed both vegetative and reproductive tissues. The remains generally consisted of isolated leaves, husks and floral stems. Analysis of the latter by optical microscope and SEM permitted identification of tribe Festucaceae throughout and placed certain specimens in genera *Deyeuxia, Festuca, Puccinellia* and *Stipa.*

It is important to emphasize the excellent conservation state of specimens with flowers, identifiable to species in most cases. For each such species from the archaeobotanical record, the origin of current specimens used as comparison material was recorded.

Figure 6, based on Table 2, represents graphically the number of archaeological specimens of each species or genus from the different levels of occupation.

Deyeuxia eminens J. Presl. Origin of current material: Punilla river (20 km from QS3). Plant association: lowland. Archaeological material: epidermis consisted of long cells with ondulating walls, silica bodies and cork cells. The adaxial epidermis was covered by unicellular hairs and the abaxial epidermis by prickles. The complex of the stomata was of subrectangular shape. Silica bodies and cork cells were grouped in pairs, lying between the long cells. Two inflorescences were also observed. Specimens with vegetative and reproductive tissues of *Deyeuxia eminens* were found at layer 2a and at levels 2b2 (funeral bundle, Figure 5), 2b4, 2b5, 2b10 and 2b12 of layer 2b. Isolated vegetative tissues of this species were also found at 2b2 (funeral bundle), 2b5, 2b10, 2b11, 2b12 and of material of the genus *Deyeuxia* at additional levels, such as 2b11. *Deyeuxia eminens* was the most frequent member of the Poaceae in the archaeobotanical record of QS3. It was abundant in straw layers and the funeral bundle. Some leaves and husks from genus *Festuca* were

also identified in the latter. *D. eminens*, because of morphological characteristics, formed soft layers suitable for sleeping, possibly therefore being preferred by occupants of the site.

Festuca weberbaueri Pilg. Origin of current material: field of the Hoyada of Antofagasta de la Sierra. Very scarce at present, but more abundant in the recent past (Haber 1987). Dense and relatively hard bushes of material. Plant association: *tolar*. Archaeological material: specimens in flower were found at level 2b4 of QS3.

TABLE 2.–Poaceae and other plant remains in the archaeobotanical record of QS3. Symbols: **Spp**. Species, **Dey**. *Deyeuxia eminens*, **Fwe**. *Festuca weberbaueri*, **Fort**. *Festuca ortophylla*, **Fchry**. *Festuca chrysophylla*, **Sti**. *Stipa sp*, **Puc**. *Puccinellia frigida*, **Ast**. Asteraceae, **Fab**. Fabaceae, **Sol**. Solanaceae, **cap**. capitula, **rec**. receptacles, **fr**. fruits with pappus, **cip**. cipsela, **hus**. husks, **infl**. inflorescences, **flow**. flowers, **leav**. Leaves. For Poaceae, only specimens with reproductive tissues were considered. The following frequencies are indicated: +++= very frequent; ++= frequent and += less frequent.

POACEAE Frequency							Other plant remains		
Spp. Levels	Dey.	Fwe.	Fort.	Fchry.	Sti.	Puc.	Ast.	Fab.	Sol.
2a	+						6 cap. 4 rec.		
2b1							3 cap. 5 rec.		1 infl.
2b2	+++			+			18 cap. 20 rec.	4 hus.	
2b4	++	++				+	15 cap. 17 rec. 9 leav.	2 hus.	
2b5	+++		+				7 cap.	3 hus. 1 flow.	
2b8							2 cap.		
2b10	+++			++			1 cap.		
2b11	+						1 cap.	1 hus.	
2b12	++				+		4 cap. 1 fr. 1 cip. 4 leav.		1 flow.
2b14							3 cap.		
2b15							1 fr.		
2b17							2 cap.		
2b18							1 cap. 1 fr.		
2b19									
2b21							2 cap.		
2b22							5 cap. 3 fr.		
2b24									
2b25							1 fr.		
Total							147	11	2

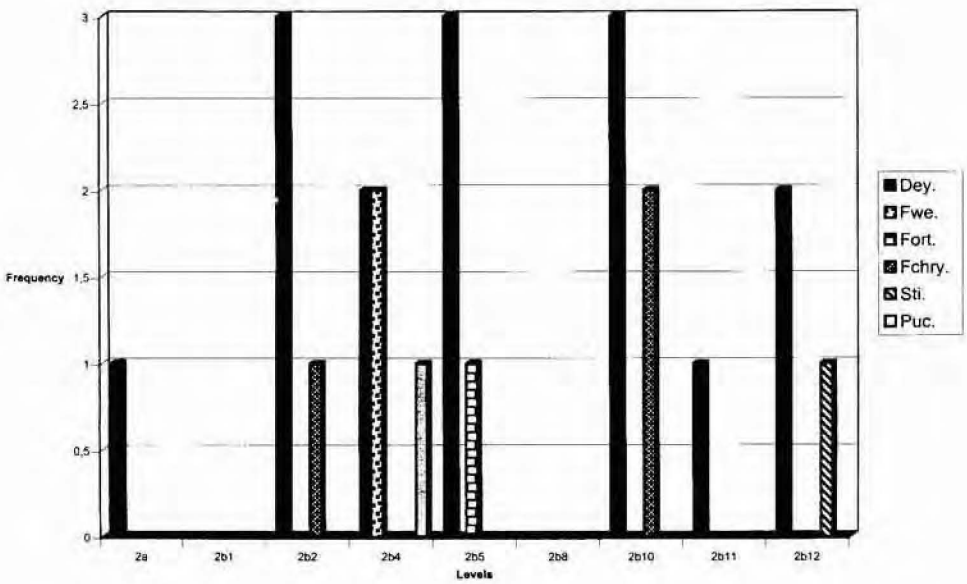

FIGURE 6.– Poaceae. Symbols: In plotting the Poaceae, the following frequencies are indicated: +++= 3 (very frequent); ++= 2 (frequent) and += 1 (less frequent). **Dey**. *Deyeuxia eminens*, **Fwe**. *Festuca weberbaueri*, **Fort**. *Festuca ortophylla*, **Fchry**. *Festuca chrysophylla*, **Sti**. *Stipa sp*, **Puc**. *Puccinellia frigida*. Only the upper levels (2b1- 2b12) from which the groups of grasses were recovered were considered.

Festuca ortophylla Pilg. Origin of current material: slopes and high hillocks of Quebrada Seca. Plant association: range land. Archaeological material: these were plants from arid areas, the leaves of this species therefore being very narrow and generally in rolled. The epidermis, in surface view, consisted of mixed long cells with ondulating walls and short cells. In cross-section, the abaxial epidermis abutted various layers of fibers in contact with the vascular truss. This adaxial epidermis was also itself strengthened by fibers and long unicellular hairs and deep furrows. The vascular trusses were characteristic of Festucaceae tribe. A specimen of *Festuca ortophylla* bearing flower and isolated vegetative tissues was found at 2b5. Given the presence of specimens in flower, this species was apparently not abundant, but could have been present among other specimens of the genus *Festuca* in the straw layers.

Festuca chrysophylla Phil. Origin of current material: Quebrada de Real Grande (Haber 1987). Plant association: range land. Archaeological material: in the epidermis, long cells with ondulating walls and short cells were clearly present. This epidermis was covered by abundant long unicellular hairs and prickles. Siliceous and suberose cells were arranged in pairs among the long cells. Specimens in flower and with isolated vegetative tissues were found in straw layers of level 2b10. These layers consisted of an important structure (See *Archaeological material)* which occu-

pied the two squares at the center of the cave. Because of its disposition this structure formed a surface suitable for sleeping.

Puccinellia frigida (Phil.) I. M. Johnst. Origin of current material: comparison material was not collected in the study area, since at present the species appear scarce there. Archaeological material: in archaeobotanical material of QS3, the first specimen of *Puccinellia frigida* with inflorescences was found at level 2b4.

Stipa sp. Origin of current material: slopes and high hillocks of Quebrada Seca. Plant association: range land. Archaeological material: long cells with ondulating walls and short cells formed the epidermis. The silica-suberose pairs were inserted among the long cells. The lower epidermis bore long unicellular hairs. Specimens of *Stipa* lacking reproductive tissues were found at 2b12. This genus was infrequent in QS3. Its morphological characteristics make it unsuitable as a bed for sleeping, probably why it appeared only isolately and not as part of layers.

Other plant remains.–In this group, isolated vegetative and reproductive tissues, such as flowers, fruits and leaves, were included (Table 2). All such material was very damaged and in most cases only identified to families or more rarely to genus or species. Some of these remains could have arrived at QS3 through natural events as mentioned above.

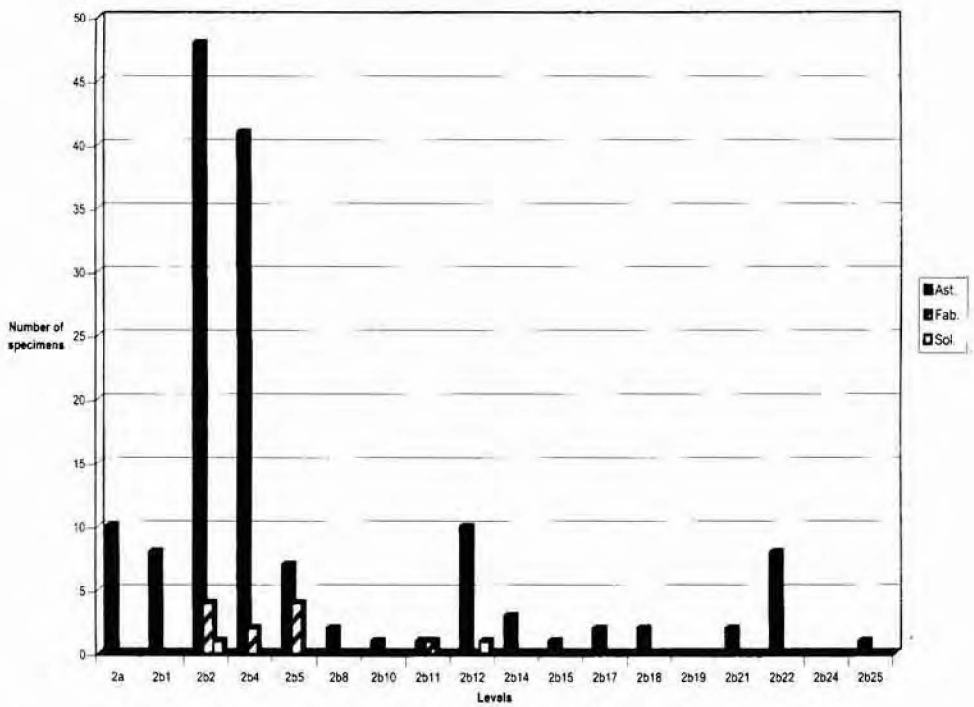

FIGURE 7.– Other plant remains. Families Asteraceae (**Ast.**), Fabaceae (**Fab.**) and Solanaceae (**Sol.**).

At all analysed levels of occupation in layer 2b (except at 2b19 and 2b24) and throughout layer 2a, plant remains were found. These were grouped by families and arranged in order of importance based on number of specimens present. Figure 7, based on Table 2, represents graphically the number of archaeological specimens of each family, at different levels of occupation.

Asteraceae. The most frequent family in the archaeobotanical record of QS3. Remains of inflorescences (capituli), mainly involucral bracts, remains of receptacles, or complete isolated flowers, in layer 2a and at levels 2b1-2b14, 2b17-2b18 and 2b21-2b22, and fruits with dispersal mechanism (the pappus) at levels 2b1, 2b12-2b15, 2b18, 2b22 and 2b25. Some remains from level 2b12 were examined by SEM. These corresponded to a *cypsela*. At levels 2b4 and 2b12, leaves of *Baccharis incarum* Wedd. were found. These were small, subrhomboid, coriaceous and with dentate edges. Those at level 2b12 were examined by SEM. The abaxial epidermis showed a great number of stomata, while in the adaxial epidermis they were scarce. Both epidermies were very papillose. On these leaves were found animal hairs.

Fabaceae. Fruits - husks or legumes- of *Hoffmanseggia eremophila* Phil. were found at levels 2b2, 2b4-2b5 and 2b11; one flower of *Adesmia sp.* was found at level 2b5; the remains of a flower, petals and shoots were found at level 2b4. At level 2b5 (5380 $\pm$ 80 AP), a broken husk of *Arachis sp.* (n. v.: peanut) was found. This probably was a wild species related to *A. monticola.* It was not a local plant, since it has not found in the study area. The distribution of the native species involved as origin of the cultivated peanut was limited to the north-west of Argentina (Antofagasta de la Sierra was excluded) and south-east of Bolivia (Krapovickas and Gregory 1994).

Solanaceae. At level 2b1, an inflorescence was recovered, and at level 2b12 a flower of *Fabiana sp.* was recovered and examined by SEM.

Finally, some plant remains, unidentifiable because very fragmented or incomplete, were found at certain levels. In layer 2a and at level 2b2 were remains of shoots and fruits; at level 2b4 were some shoots; at level 2b12 were different fruits.

Artefacts.– Two fragments of basketwork made with a coiled technique were found at level 2b11. In both cases, the work was produced by using the lateral portion of the leaf of *Cortaderia* as a basis and the mediam nerve as the stitch (Rodríguez 1998 a - b). A basketwork fragment was recovered at level 2b5 and a completely decorated basket, burnt in its lower part, was located in layer 0/lens 1 x. These employed the same raw materials found in previous fragments (Pérez de Micou and Ancibor 1994). Two straw knots made with floral stems of *Deyeuxia eminens* were recovered at levels 2b11 and 2b12 of QS3 (Rodríguez 1998; Rodríguez and Rúgolo de Agrasar 1999). Some species of subfamily Bambusoideae were also used in making artefacts. There were found three shafts and three worn culms (stems) of *Chusquea lorentziana* Griseb. and two smaller fragments of worn culms of *Rhipidocladum* sp. (Rodríguez 1998 b). None of these is a local species and the use of the culms is not clear, except for the shaft.

Structures.– At various levels of QS3, grasses were distributed forming straw layers, i.e., layers of grasses arranged horizontally; in others, they were grouped

together in small accumulations. To define locations of these structures at the different levels of occupation of the site, the following parameters were considered: orientation of QS3 in the landscape, squares (see Figure 4), and division of available space into two sectors: eaves and cave.

In layer 2a there were no other layers or concentrations of grasses. At level 2b1 was a small group in square D4, to the E side of the eaves sector. At level 2b2 there was a straw layer, described earlier, as part of the funeral bundle (Figure 5). *Deyeuxia eminens* forms the principal species in this structure (Rodríguez and Rúgolo de Agrasar 1999). There were other concentrations of grasses in G3 and H3 (W side, cave sector), H5 (W side, eaves sector) and D4 (center, eaves sector). In squares F3/G3 of level 2b4, on the west side of the eaves sector, the main group of grasses of this level was arranged as a layer. Also in F3 animal hairs were found and the wing of a locust was recovered from these same plants. At level 2b5 there were two relatively small straw layers. One was located in D4 towards the center of the eaves sector, the other in E5 to the west in the same sector. At level 2b8 practically no grasses were found.

The most important layer was located at level 2b10 in squares E2/F2/G2. This location corresponded to the center-west of the cave sector. The upper border of the layer was surrounded by stones holding it in place, and base was resting on level 2b12. Bird feathers were found mixed with the grasses.

At level 2b11, three very small straw layers occurred distributed in D4 (center, eaves sector) and in F3/F4 (to the W, cave-eaves sectors). The two fragments of basketwork associated with the layer and a bunch of compact straw with a sticky substance, mixed with stems of *Atriplex* sp., were found in F3.

At level 2b12, the main group of grasses formed a layer arranged in E4 and extended into E5 (center, eaves sector). Animal hairs mixed with these plants and a bevelled branch of *Parastrephia quadrangularis* (Meyen) Cabrera were also recovered there. Lower concentrations of grasses occurred in G3/G4 and F3/F4 on the west side of the cave-eaves sectors. A knot made with *Deyeuxia eminens* was associated with these groups in G3 as was a shaft made with *Chusquea lorentziana* in G4.

At the other levels of occupation, grasses were very scarce, with no important accumulations. The grasses generally appeared mixed with woods and in some cases with charcoal.

DISCUSSION AND CONCLUSIONS

From the available archaeobotanical record, it is possible to compare part of the ethnobotanical information and relate it to possible use of the archaeological plants present in QS3. Taking into account both sources of information, species found at the site were grouped together into the following categories: combustible, forage, edible, medicinal and plants used for technological purposes. The forage category is not important in this case, since a hunter-gatherer site is involved.

It should be pointed out that the use of plants as fuel and for technological purposes can be corroborated with relative certainty from the archaeobotanical

record. Their uses as foods and medicines, by contrast, can only be established as hypothesis from the available information.

From those categories listed in the first paragraph, primary interest was in the last three. Within these, species present could be grouped as follows.

Edible species.– Those older people consulted mentioned very few edible plant species, probably because such plants were largely replaced by agriculture. Haber (1987) mentioned as edible the resin produced during the spring by *Baccharis incarum* ***(lejía)***. Similarly, *Hoffmannseggia eremophila,* known as *algarrobita* in Antofagasta de la Sierra, presented edible tubers (Ulibarri 1979). In relation to the husk of *Arachis sp.* ***(peanut),*** it is important to emphasize that, although this species is now considered edible, since only one specimen was recovered and that no a local plant, certain group mobility and/or probable exchange within other human groups of inhabitants of QS3 were inferred as probable main explanations.

Medicinal species.– Baccharis incarum (beneficial to liver function) and *Fabiana punensis* Arroyo ***(tolilla)*** (which relieves muscle pain). The woody specimens (the stems) of both species, used as fuel, were found very frequently within the archaeobotanical record of QS3 (Rodríguez 1998 c).

Plants used for technological purposes.– Under this heading, only archaeobotanical records were considered, since current use of plants for these purposes hardly agrees with that in the prehistoric past. From the archaeological information here, the following species grouping for plants emerged:

Artefact manufacture. *Cortaderia sp., Deyeuxia eminens* ***(pastos)****, Chusquea lorentziana* and *Rhipidocladum sp* (Rodríguez 1998 a – b; Rodríguez and Rúgolo de Agrasar 1999).

Conditioning of floors of occupation (arrangement in layers of surface grasses). Mainly *Deyeuxia eminens* but also *Festuca chrysophylla, F. weberbaueri, F. ortophylla, Puccinellia frigida* and *Stipa sp* ***(pastos)***.

Taking into account probable areas of origin and uses of the plant resources found in QS3, the following probable circuits of mobility within small distances were established (Figure 3):

Likely edible and medicinal plants. Distances traveled in these cases could have oscillated between 0 and 2.5 km from the site, in SW and N directions. This agrees with the postulated area limitations for plants used as fuel (Rodríguez 1998c).

Conditioning of occupation floors. Distances in this case increased, since the most commonly used species, *Deyeuxia eminens,* grows at present further away from QS3 (20 km; beyond range of transects which were carried out from QS3); however, different species of *Festuca* (except *F. chrysophylla*) and *Stipa* recovered, grew near the site. The area therefore includes a radius ranging from approximately 0 to 20 km west from QS3. This range probably would have been smaller in the past, because recent herding practices have somewhat reduced grass coverages.

Artefact manufacture. Lower probable distances correspond to the known raw materials used in basket work, and include a radius beginning at 4 km away from the site and ending at 17 km from the site, in a westerly direction.

In relation to mobility over great distances, as mentioned earlier, the presence of *Arachis* sp. establishes the probable existence of large circuits of considerable mobility and exchange. In QS3, artefacts made with non-local plants, such as *Chusquea lorentziana*, *Rhipidocladum* sp. *Salix humboldtiana* Willd., *Prosopis torquata* (Cavanilles ex Lagasca) DC, and *Acrocomia totai* Mart. (Rodríguez 1998 a - b).

Finally, in the hypothesis postulated initially, the possibility that QS3 was part of a settlement system and would therefore have been seasonally occupied was considered. The presence of reproductive tissues (flowers and fruits of the families Asteraceae, Fabaceae and Solanaceae) at most levels of QS3 and equally there of species whose life-cycle completes in a season, corresponding to spring-summer, such as *Deyeuxia eminens* and *Festuca weberbaueri* among others, indicated occupation during those months and the beginning of the autumn. This conclusion was reinforced by the presence of newborn camelids in the archaeofaunistic record (Elkin 1996). Smaller plant remains could be at the site because of chance natural causes; grasses are therefore in this case more secure as evidence in establishing seasonality.

However, the possibility of occupation during the rest of the year cannot be excluded. It is necessary to take into account that at the lower levels (2b15 and following levels) very few reproductive tissues were recovered, and that at some such levels (2b19 and 2b24) these were absent. Grasses too were absent there. Elkin (1996) considered feasible an occupation of the site during the coldest months, based on availability of vicunas, in the lowland and in the *pampa* near the site, during the whole year. The artifactual data provides no information in relation to seasonality.

Taking into account that, in the area of location of QS3, there were available resources during the whole year (Elkin 1992) and from the archaeobotanical data, it is possible that the site could have been temporarily occupied at different seasons. Such occupations would have been longer during the warmer months, without necessarily excluding short periods of occupation during the winter.

In this study, the potential importance of plants in reconstruction of the past has been emphasized. This emphasis involved biological and cultural aspects. On the one hand, the possibility of deducing palaeoenvironments from archaeological plant species found in the stratigraphy, has been pointed out. On the other hand and in relation to human culture and living processes, various aspects from the archaeobotanical record, such as use of plants and characteristics of the environment in the prehistoric past in the Argentine Puna, were considered.

Comparative anatomical and morphological analysis of both current and archaeological species permits levels of identification of these latter and aids subsequent conclusions. The two disciplines involved here -archaeology and botany- both constantly cross-contribute to the other throughout this analysis. The questions posed to either lead to responses derived from information acquired jointly by both.

NOTES

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[2] The population density is 0.02 inhabitants/km2. The informants who participated in this study were: Nemesio Darío Reales, Cástulo Epifanio Vázquez, Angela Vázquez and Vicente Morales.

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