Evidence of Late-Pleistocene Monte Formation in Central West Argentina

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The present knowledge on late-Quaternary environmental change in subtropical central-western Argentina is fragmentary, particularly because dates and organic records are scarce (Martínez Carretero et al. 2004), pollen analyses are mostly restricted to the Holocene, and a general model of Pleistocene glacial advances is not yet available. Within this context, a paleoecological record obtained from recent stratigraphic excavations at the Gruta del Indio site (34° 45′ S, 68° 22′ W, 660 m a.s.l.) provides important evidence of paleoenvironments of the area, particularly for the late Pleistocene (García 2003; García and Lagiglia 1999). This record, unique for this part of South America, is composed of coprolites from small rodents (medium-sized *Lagidium viscacia*) and large mammals (*Hippidion* sp.) (García et al. 2006, 2008). Two xeric phytogeographical regions are currently present in the area: the Monte, on flatlands and foothills, dominated by shrubs and scarce trees, and the Cardonal, on sunny slopes, dominated by cactaceae and small shrubs.

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Microhistological and phytosociological analyses were performed on this record. Results point to the presence of Monte conditions in the area as early as ca. 31,000 RCYBP.

Considering both the current and the paleobotanical local flora, and analyzing macrobotanical remains, 42 plant taxa were identified, 35 to the species level (Table 1). In the current local flora, 77 percent of the 35 species recorded belonged to the Monte and 4 percent to the Cardonal, whereas in the fossil record, dated between 24,140 ± 510 (LP 1075) and 30,800 ± 700 (LP 918) RCYBP, 17 plants were found, 10 of them (58.8 percent) identified to the species level and all belonging to the Monte formation. In agreement with plant taxa distribution, chorological types were defined as Monte, Cardonal or other. Taking the chorological spectrum into account, Monte plant species are present in all samples, and those from Cardonal (the warm region closely related to the Monte) are less abundant.

From this analysis, *Prosopis flexuosa* var. *depressa*, *Pappophorum caespitosum*, *Capparis atamisquea*, *Cercidium praecox* ssp. *glaucum,* among others, emerge as indicative species of a warm and dry environment, typical of the Monte.

Midden floras contain perennial C3 shrubs (*S. aphylla, P. flexuosa* var. *depressa, L. divaricata*), C4 summer-flowering perennial grasses (*P. caespitosum, Boutelowa* sp., *D. californica*), and C4 annual grasses (*A. adscensionis*). *Pappophorum* is common in Argentina and southern Peru, and scarce in Chile, whereas *P. caespitosum* is a common grass in the Monte (Argentina). On the whole, megathermal species and the C4 photosynthetic path indicate that plant species adapted to environments of high temperature, high solar radiation, and low water availability dominated both records.

According to these results, vegetation in Gruta del Indio and the surrounding area for the period of 31,000 to 24,000 RCYBP provides evidence of arid conditions similar to the current ones. This does not mean that the plant community structure was the same, since aspects like distribution, density and quantity of each species could be different. Nevertheless, as a whole, the presence of a group of megathermal species characterizing current Monte formation indicates that this type of vegetation prevailed over the area in the analyzed period, in relation to a climatic trend dominated by warm and dry conditions.

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Table 1. Current and fossil flora (24–31 kybp) from Gruta del Indio area. M= Monte; C = Cardonal; N= Nanophanerophytes; Ch= Chamaephytes; H= Hemicryptophytes; T= Terophytes; E = Epiphytes; ft= climb phanerophytes; S= Succulents

	Current flora	Paleo flora	Chorological type	Life form
*Ephedra triandra**	■		M	N
*Lycium chilense ovalifolium**	■			N
*Condalia microphylla**	■		M	N
Glandularia crythmifolia	■		M	Ch
*Aloysia gratissima**	■		M	N
*Zuccagnia punctata**	■		M	N
*Larrea divaricata**	■	■	M	N
*Lecanophora heterophylla**	■	■	M	Ch
*Tephrocactus aoracanthus**	■		M	S
*Bulnesia retama**	■		M	N
*Trichocereus candicans**	■		M	S
*Lycium tenuispinosum**	■		M	N
*Larrea cuneifolia**	■		M	N
*Senna aphylla**	■	■	M	Ch
*Prosopis flexuosa depr.**	■	■	M	N
*Pappophorum caespitosum**	■	■	M	H
Acantholippia seriphioides	■	■	M	Ch
*Boutelowa af. curtipendula**	■		M	H
*Capparis atamisquea**	■	■	M	N
*Stipa sanluisensis**	■		C	H
Clematis denticulata	■			ft
Bowlesia tropaeolifolia	■		C	T
*Schinus fasciculata**		■	M	N
Senecio gilliesianus	■		M	N
Baccharis salicifolia	■		M	N
*Salvia gilliesii**	■		C	N
*Geoffroea decorticans**	■		M	N
*Digitaria californica**	■	■	M	H
*Aristida adscencionis ?**	■		M	H
*Budleja mendocensis**	■		C	N
*Cercidium praecox**	■	■	M	N
Eupatorium patens	■		M	N
*Hyalis argentea**	■		M	Ch
Caesalpinia gilliesii	■			N
Ligaria cuneifolia	■			E
Chenopodiaceae		■		
Chloridea		■		H
Poa ?		■		H
Fabiana sp.		■		
Lycium sp.		■		
Setaria sp.		■		H
Hordeum sp.		■		H

* Megathermal species

■ Presence

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