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Journal of South American Earth Sciences 20 (2005) 33–43

Journal of
South American
Earth Sciences

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First record of fossil wood and phytolith assemblages of the Late Pleistocene in El Palmar National Park (Argentina)

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Received 1 April 2003; accepted 2 July 2005

Abstract

Two paleoxylologic assemblages and two phytolith assemblages were recovered from Late Pleistocene sediments of El Palmar Formation. These deposits are found in outcrops along the western margin of the Uruguay River. The spectra of taxa obtained in both sets by different methods is complementary. The fossil remains are characterized in terms of floristic composition and paleoclimate. Seven families are recognized: Podostemaceae, Myrtaceae, Anacardiaceae, Mimosoideae, Arecaceae, Poaceace, and Cyperaceae. Sponge siliceous spicules also have been found in these assemblages. The state of preservation of the phytoliths and their weathering degree is analyzed. These studies can be used as a potential paleoecological tool for alluvial sediments. The comparison of fossil assemblages with modern analogs clarifies the paleoecological requirements and composition of two paleocommunities, one dominated by woody forests and the other by palms. The climatic conditions inferred from the reconstructed vegetation and sedimentary deposits indicate a temperate-warm, humid climate. The results constitute the first evidence of the floral diversity of the vegetation in El Palmar National Park during the Late Pleistocene.

Keywords: Argentina; Fossil wood assemblages; Late Pleistocene; Paleovegetation; Phytolith assemblages

1. Introduction

El Palmar National Park (31°55′S; 58°16′W, 8500 ha) protects the largest remnant population of *Butia yatay* (Mart.) Becc. and its associated temperate savanna ecosystem. *B. yatay* is an endemic species of the temperate-humid savannas of southern South America, and populations at El Palmar National Park represent the southernmost expression of this community. From a phytogeographic standpoint, the park belongs to the Uruguayense district of the Pampean province (Cabrera, 1976) and, in addition to the savannas dominated by *B. yatay*, includes a diverse array of vegetation, such as gallery forests and marshes, psammophytic steppes, and shrublands (Ciccero and Balabusic, 1994).

The climatic conditions appear to have been mainly responsible for the geologic evolution in Entre Ríos province sediments during the Quaternary. Several geological formations have been defined for this region from the Lower Pleistocene to the Upper Holocene (Iriondo, 1980). The area corresponding to El Palmar National Park was drastically shaped by the Uruguay River during the Quaternary. El Palmar Formation, assigned to the Late Pleistocene (Iriondo, 1980), constitutes the upper terrace on the western bank of the Uruguay River and is conspicuously represented in the park.

Thus far, no systematic studies of the paleoflora of this region have occurred, except for studies of the macrofloristic remains of fossil woods (Lauraceae, Anacardiaceae, Mimosoideae, Combretaceae, and Myrtaceae) of El Palmar Formation (Brea, 1998, 1999; Brea and Zucol, 2000, 2001; Brea et al., 2000, 2001; Zucol et al., 2004). This lack of information is a major impediment to the reconstruction of the history of vegetation and climate in these savannas and to the interpretation of possible changes that may be key to the conservation of the remnant population of *B. yatay* and its associated ecosystem.

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doi:10.1016/j.jsames.2005.07.007

In this study, we present an analysis of fossil wood and phytolith assemblages that characterize El Palmar Formation. This analysis represents the first stage of the paleobotanical studies under way for the Pleistocene–Holocene period in this region.

2. Geologic setting, stratigraphy, and sedimentology

El Palmar Formation is a fluvial unit deposited during the Late Pleistocene (Iriondo, 1980) that probably belongs to the Last Interglacial (IS 5) (Iriondo, 1996, 1998), an interval considered the most humid and warm of the Late Pleistocene. The presence of *Stegomastodon platensis* Ameghino (Tonni, 1987), a fossil vertebrate of Lujanian stage age (*sensu* Cione and Tonni, 1995) characterizes the formation. Recently, El Palmar Formation was TL dated 80,670 ± 13,420 years BP (Iriondo and Krohling, 2001).

These deposits typically are found along a 4–15 km wide strip in outcrops along the 200 km western margin of the Uruguay River, between the Mocoretá River and Concepción del Uruguay city (Iriondo, 1996). The typical stratigraphic profile that characterizes this formation has been excavated within El Palmar National Park, near El Palmar stream (Iriondo, 1980).

All materials sampled for the analysis were extracted from what we name FL El Palmar 1-99. This fossiliferous locality (FL) is found within El Palmar National Park (Departamento de Colón, Entre Ríos; topographic chart reference: Arroyo Barú 3158-31, Instituto Geográfico Militar topographic chart 1:100.000 of Argentina Republic), near the Uruguay River and El Palmar stream and corresponds to El Palmar Formation (Fig. 1).

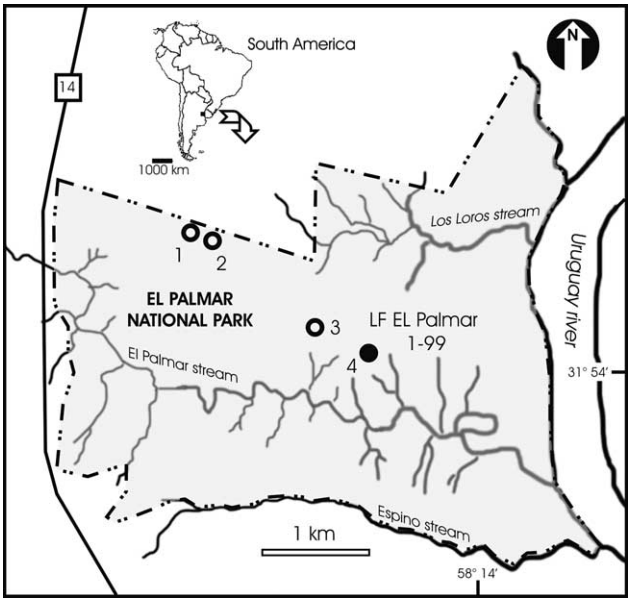

Fig. 1. Geographical map of the studied region showing the sampling areas of extant palm forests (1, dense palm forest; 2, semi-dense palm forest; 3, open palm forest) and FL El Palmar 1-99 (4).

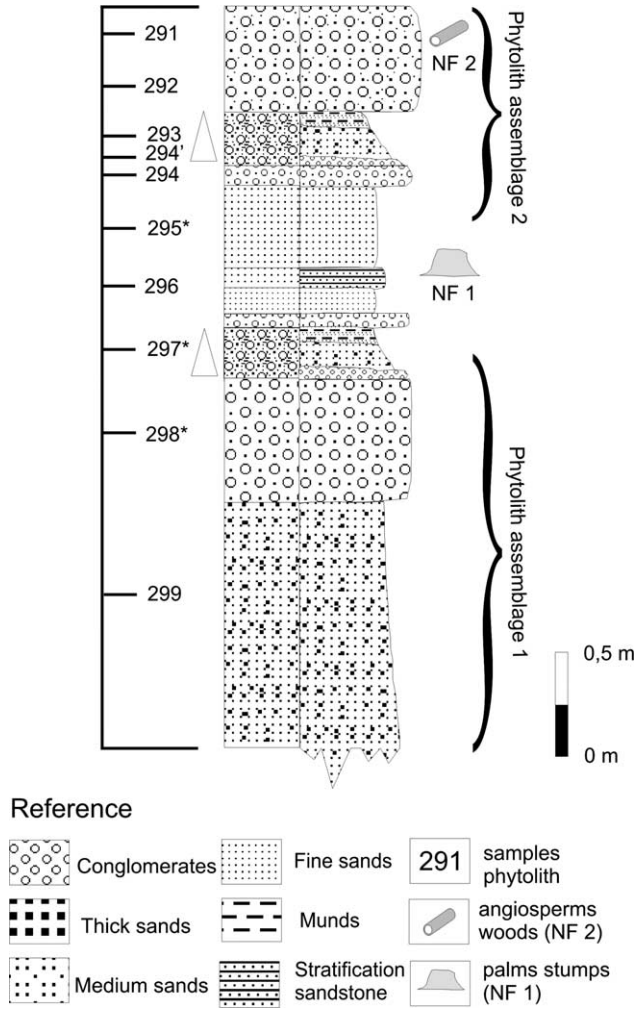

Fig. 2. Sketch section of El Palmar Formation; * denotes sterile samples.

The outcrop sequence (3.54 m thick, Fig. 2) is mainly composed of medium, reddish and yellowish sand. Lenses of gravel and pebbles, dozens of meters long and up to 2 m thick, are interspersed in quartzose sand mass. The coarse fractions are composed of chalcedony (Iriondo, 1998). In sectors lateral to these conglomerate lenses, the presence of medium to thick sandstone with planar stratification rich in fossil woods remains is common. Wood fossils were collected from two fossiliferous levels, and phytolith samples were obtained throughout the profile.

3. Materials and methods

Fossil wood remains and sedimentary samples were collected from FL El Palmar 1-99 (31°54'S; 58°14'W). The fossil woods exhibit a siliceous cellular permineralization. For each sample, thin sections and cellulose acetate peels were prepared for microscopic examination. The subsequent descriptions of the fossil woods are based on standard terminology (Heimsch, 1940, 1942; Webber, 1941;