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Ancient pine forest on inland dunes in the Spanish northern meseta

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Abstract

We present a new stratigraphic (pollen and nonpollen microfossils and charcoal particle) sequence with five AMS dates, covering about the last 9000 yr, of a core collected from the Spanish northern meseta, one of the territories of the Iberian Peninsula for which little paleobotanical information is available. The results support the hypothesis of the permanence of the pine forests, in more or less pure masses or large timber stands, during the Holocene in some Iberian continental zones. The typical substitution in postglacial dynamics of heliophyllous species, such as pines or Cupressaceae, by broadleaf trees did not occur in this inland region. Presumably, factors linked to the substrate, in this case very deep sand dunes covering vast areas, may have contributed to the scarce local competitiveness of the broadleaf trees, which would account for the hegemony of pines in this region. Based on the dynamics of aquatic plants and nonpollen microfossils, an initial phase previous to 7500 ^{14}C yr B.P. of high levels in the lake can be identified by high percentages of hydrophytes. A progressive increase in helophytes and the gradual infilling of the lake over the last 5000 yr appear to indicate a phase of aridification similar to those established for the western Mediterranean. Study of charcoal particles, more abundant in the last 2500 yr, has given rise to certain hypotheses regarding the incidence of recurring fires of a local or regional nature.

Keywords: Pollen; Paleovegetation; *Pinus*; Proxy records; Holocene; Northern meseta; Spain

Introduction

There is very little available information on the dynamics of Holocene vegetation in territories like the Iberian mesetas for two fundamental reasons: (1) these areas are currently subjected to a high degree of human disturbance, with little remaining of the natural vegetation and (2) the lack of paleopollen deposits in these mesetas (Martínez Atienza, 1999) has hindered study of the history of the vegetation.

Relative to the first point, the interpretation of the pine forests occupying this region has traditionally been controversial due to the fact that management of the pine forests has impeded an elucidation of their naturality. Secular exploitation, for resin tapping and production of pine kernels, has given them an artificial appearance. Reforestation has often been employed in order to extend the area of the forests, and the masses have become homogenous through selective logging. Doubts regarding the naturality of these pine forests became widespread among botanists when, in Spain, they assumed the evolutive ideas of Clements (1939) regarding the climax. Landscapes began to be interpreted in terms of dynamics related to the theory of ecological succession and more importance was gradually given to the models of potential vegetation.

Willkomm (1852) interpreted the large open spaces of the inland peninsula as natural treeless steppes, although

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he described the large forests of *Pinus pinea* to the south of the river Duero from Valladolid to the Central System (Willkomm, 1896). Reyes Prosper (1915), in his treatise on the steppes, also defended Willkomm's naturalist interpretation. Huguet del Villar (1925), however, disagreed, linking them to the decisive degradation of the inland Holm oak forests. Along these same lines, he considered the frequent remains of existing Holm oaks in the area to be indicators of the native vegetation. Font Quer (1954), however, disagreed with this interpretation, opting for the autochthonous nature of the two pines characteristic of the vegetation of the large sand dune fields of Old Castille. His arguments are based on the preference of these species for sandy, deep substrates, in the case of the Stone pine, and slightly acidic ones for the Cluster pine. Ceballos (1938) developed a regression model of Spanish forest vegetation that attributed to the pines a secondary role in the dynamics. This model was subsequently well developed under the auspices of the school of phytosociology and inspired the outline of series of vegetation proposed by Rivas Martínez (1987) that does not recognize any Mediterranean pine forest as potential vegetation for this territory.

With regard to the second aforementioned aspect, although the mountains surrounding the northern meseta have been well studied, there are hardly any pollen deposits in the lowlands. Noteworthy among these are Calatañazor (Menéndez Amor, 1975) and Quintana Redonda (García Antón et al., 1995) far to the east, at the foot of the Iberian System, and in the center of the meseta, the most recent one, Espinosa de Cerrato (Franco Múgica et al., 2001), the first high-resolution long sequence with seven dates covering the whole Holocene.

The sequence we present here is uniquely situated in the center-south of the northern meseta, in a region known as Tierra de Pinares (due to the historic importance of its forest formations), dominated by *Pinus pinaster* and *P. pinea*. The interest of a pollen analysis in this area, apart from adding to the little information available on this vast territory, lies in settling an old controversy in relation to whether or not the character of these pines is natural.

Study area

Localization and geologic framework

The El Carrizal lake is located close to the village of Cuéllar (Segovia province), at an altitude of 860 m (geographical coordinates 4°08′49.1″W, 41°19′12.1″N UTM 30 N 404000, 4575000), in the region known as Tierra de Pinares (Fig. 1). Tierra de Pinares takes up part of the provinces of Segovia, Valladolid, and Ávila, in the southern strip of the northern meseta. It stretches as far as the northern piedmont of the Guadarrama mountains

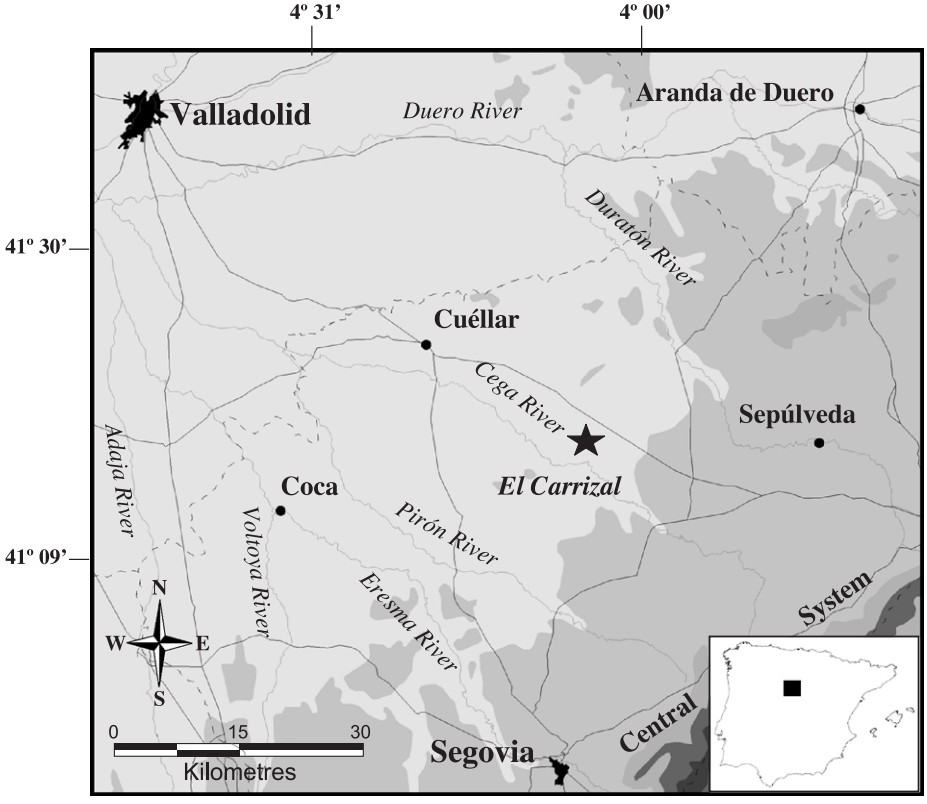

Figure 1. Location map of El Carrizal lake site. The altitude in graded grey ranges from 800 to 1600 m asl with 200-m intervals.