



Palynology of Aptian and upper Albian (Lower Cretaceous) amber-bearing outcrops of the southern margin of the Basque-Cantabrian basin (northern Spain)

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ABSTRACT

The Lower Cretaceous deposits of the southern margin of the Basque-Cantabrian basin (northern Spain) are characterised by continental deposits interbedded with amber-bearing marine-influenced facies. These facies crop out in various localities and have yielded well-preserved palynological assemblages. The palynoflora is dominated by gymnosperm pollen grains, and shows relatively diversified spore content but scarce dinoflagellate cysts. The palynofloral evidence and regional geological setting indicate that the studied successions are dated as Aptian (Montoria-La Mina outcrop) and late Albian (Peñacerrada 1 and 2 and Salinillas de Buradón outcrops, and the Pancorbo site). Angiosperm pollen does not constitute a significant part of the Aptian assemblages but becomes diversified and numerically abundant in those dated as late Albian. Although broadly similar to contemporaneous palynofloras from eastern Spain, the Aptian assemblages of Montoria-La Mina do not yield tricolpate angiosperm pollen. Conversely, the inferred late Albian assemblages show a high content in polyaperturate angiosperm pollen grains, as occurs in other localities in Portugal, Western Europe and North America. The studied palynoflora shows significant differences from published assemblages located further north, in western France and Canada.

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1. Introduction

The Lower Cretaceous outcrops of the southern margin of the Basque-Cantabrian basin (northern Spain) are renowned for their exceptional content in amber (Alonso et al., 2000; Delclòs et al., 2007; Najarro et al., 2009, 2010). Over the past 10 years, numerous descriptions of insect taxa and microorganisms included in amber have been published (Peñalver and Delclòs, 2010 and references therein). However, the stratigraphic and palaeoecological context associated with these amber-bearing outcrops has received little research attention. To date, only two palynological studies with a local emphasis have been published (Barrón et al., 2001; García-Blanco et al., 2004). Thus, it becomes

necessary to carry out an integrated analysis of these sites in order to better elucidate the structure and development of such unusual palaeoenvironments.

Coinciding with the initiation of a generalised and widespread period of warmth (Wilson and Norris, 2001; Jenkyns, 2010), amber deposits extended from 27°N to near 70°N during the mid-Cretaceous (Delclòs et al., 2007; Najarro et al., 2009). During this period, the Iberian Peninsula was situated at low latitudes, under prevalent megathermal climatic conditions characterised by orbitally-paced climate episodes (Chumakov et al., 1995; Tiraboschi et al., 2009; Rodríguez-López et al., 2012). Located between the European and African plates, the Iberian plate was an authentic centre of biotic interchange between the Gondwanan and Boreal realms (Heimhofer et al., 2007; Villanueva-Amadoz et al., 2010). The plant micro- and macro-remains indicate the predominance of tropical/subtropical vegetation extending from the equator to mid-latitudes

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(Vakhrameev, 1991; Spicer et al., 1994; Morley, 2003), while arid to humid palaeoenvironments developed locally in the Iberian Peninsula (Villanueva-Amadoz et al., 2011; Heimhofer et al., 2012).

The present paper reports a comprehensive study of the palynological content of Lower Cretaceous sedimentary rocks including amber-bearing material from the southern area of the Basque-Cantabrian basin. Since the age of these deposits remained uncertain, special attention was paid to the biostratigraphic significance of the components constituting the recovered assemblages. So, a critical review of previously published palynological studies was conducted, focussing particularly on other Lower Cretaceous palynofloras from Western Europe and North America. To our knowledge, the present study is the first to describe the palynological content of an entire array of amber-bearing Lower Cretaceous outcrops.

2. Geological setting

The study area (Fig. 1) is located in the Cantabrian range, which is an E–W trending narrow mountain belt that constitutes the western extension of the southern Pyrenees. The evolution of the Basque-Cantabrian basin is related to the kinematic relationships between

the Iberian and European plates and to the opening of the North Atlantic ocean and the Bay of Biscay (Martín-Chivelet et al., 2002). The basin developed on thinned continental crust between the European and Iberian plates during the Cretaceous Period. The studied outcrops form part of fault-related folds associated with a thrust system constituting part of the South-Pyrenean Frontal Thrust (Capote et al., 2002). The regional stratigraphy of the studied area includes Triassic, Jurassic, Cretaceous and Tertiary units (Martínez-Torres et al., 2003). The Triassic is represented by reddish and greenish mudstones and gypsums related to the Keuper facies. The Jurassic includes carbonate units. Some of them show alternations of limestones and marlstones with ammonites and other bioclasts, indicating open marine conditions, whereas others show shallower carbonate facies with oolites and shallow-water bioclasts (Martínez-Torres et al., 2003). The Cretaceous is represented by the Escucha Formation, the Utrillas Group (*sensu* Rodríguez-López, 2008) and Upper Cretaceous carbonate formations. The Palaeogene and Neogene are represented in the Basque-Cantabrian region by a variety of sedimentary rocks. These Cenozoic deposits appear as disconnected outcrops associated with WNW–ESE and W–E trending thrust fault-related synclines (Alonso-Zarza et al., 2002).

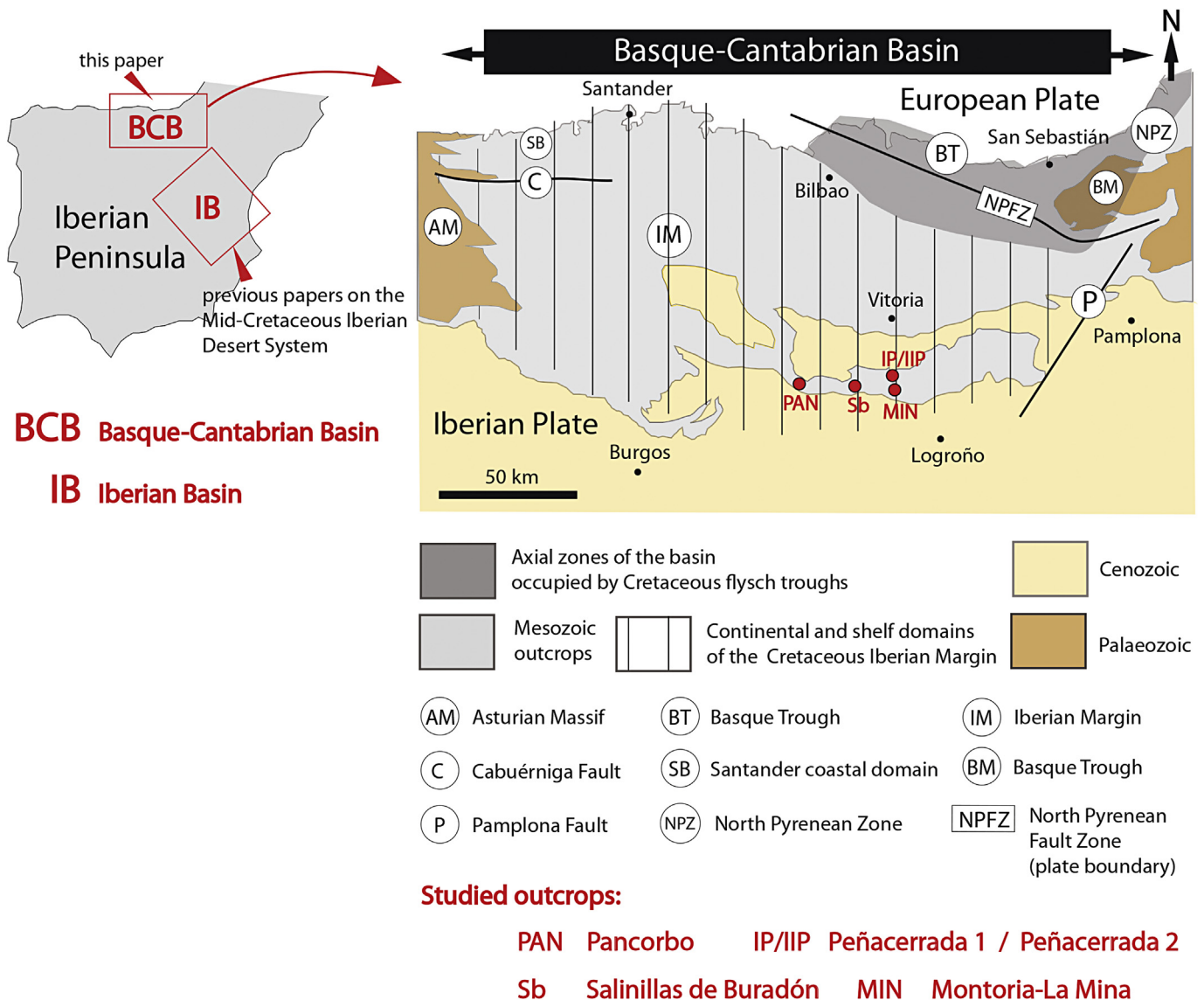


Fig. 1. Geographical and geological setting with location of the studied sections. Modified after Martín-Chivelet et al. (2002).

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