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Depositional sequences in a foreland basin (north-western domain of the continental Duero basin, Spain)

Antonio Herrero [a,*], Gaspar Alonso-Gavilán [b], Juan Ramón Colmenero [b]

[a] Universidad de León, Facultad de Ciencias Biológicas y Ambientales, Área de Geodinámica Externa, Campus de Vegazana s/n, 24071 León, Spain
[b] Universidad de Salamanca, Facultad de Ciencias, Área de Estratigrafía, Plaza de la Merced, s/n, 37007 Salamanca, Spain

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ABSTRACT

The Cenozoic record of the north-western domain of the Duero basin is articulated at the surface through a set of continental depositional sequences called, from base to top, the Vegaquemada sequence, the Candanedo sequence, and the Barrillos sequence. These depositional sequences were deposited in continental sedimentary environments. The deposition of the first sequence occurred through a fluvial system with floodplains cut by low-sinuosity channels. The Vegaquemada sequence was developed between the Middle Eocene and the Early Agenian. The second sequence was formed by a set of highly efficient transport alluvial fans that evolved laterally towards fluvial systems with low-sinuosity fluvial channels and an extensive floodplain, where several types of palaeosols were formed. This sequence developed between the Early Agenian and the Late Vallesian. The third unit–the Barrillos sequence (between the Late Vallesian and the Turolian/Ruscinian transition), was generated by a set of highly efficient transport alluvial fans dominated by low-sinuosity fluvial channels.

In subsurface geology, seismic and well data are used to rebuild the stratigraphic architecture. The two basal depositional sequences can be identified with two seismic units: the Palaeogene Seismic Unit (PgSU) and the Neogene Seismic Unit (NgSU), respectively. In the present work, we obtained the isovelocity, isochron, and isobath maps for the top and base of the two Cenozoic units. The Palaeozoic (PzSU) and Mesozoic (MzSU) seismic units are found under these two units. Through study of the logs of the various boreholes, it was only possible to analyse the upper 700 m of the Candanedo Sequence (NgSU), without encompassing the total thickness of the unit. Several middle-order sequences were differentiated, in general showing a sequential fining-upwards evolutionary character. Additionally, for the boreholes analysed two main types of electrofacies were identified, both representing fluvial channels and floodplain deposits.

The north-western domain of the Duero basin is interpreted to have been formed in response to the tectonic uplifting of the Cantabrian Mountains since Middle-Eocene times. Integration of the data concerning the surface and subsurface geology in this domain reveals that this basin edge behaved as a foreland basin during Cenozoic stages. The foredeep, with a depth of 2800 m, is oriented east–west and has a sediment thickness of up to 3500 m. The forebulge is located in the southwestern zone and represents an area of basement uplifting in which a minimum thickness of materials from the Cenozoic depositional sequences has accumulated.

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1. Introduction

Around the Hesperian Massif several sedimentary basins are located that were filled and deformed during Cenozoic stages. The Duero and Ebro basins developed during the Alpine orogeny, corresponding to the southern foreland basin of the Cantabrian Mountains and the Pyrenean Chain, respectively (Fig. 1B).

The Duero basin covers approximately 50,000 km^2 and the sector analysed in the present work is located in the north-western domain (Fig. 1B and C). It is surrounded by the hercynian structural regions defined by Julivert et al. (1972). To the north is the Cantabrian Zone (the Somiedo and Esla Units), the mountains showing marked relief and heights of more than 2500 m and, to the west, is the West-Asturian–Leonese Zone (Domains of Navia–Alto Sil and the Mondoñedo–Peñalba Nappe), with lower mountains (Lotze, 1945; Julivert, 1967; Pérez Estaún et al., 1990; Heredia et al, 1994). Mesozoic materials covered these zones and they are folded, separating the Cantabrian Zone from the Cenozoic sediments of the Duero basin.

A regional compilation of the lithostratigraphy of the Duero basin can be found in the work of Mediavilla et al. (1996), Armenteros et al. (2002) and Alonso-Gavilán et al. (2004). Previous works addressing the stratigraphy and sedimentology of the region are scarce. Among

* Corresponding author. Área de Geodinámica Externa. University of León, 24071, Spain. Tel.: +34 987291497.
E-mail addresses: aherh@unileon.es (A. Herrero), gavilan@usal.es (G. Alonso-Gavilán), colme@usal.es (J.R. Colmenero).

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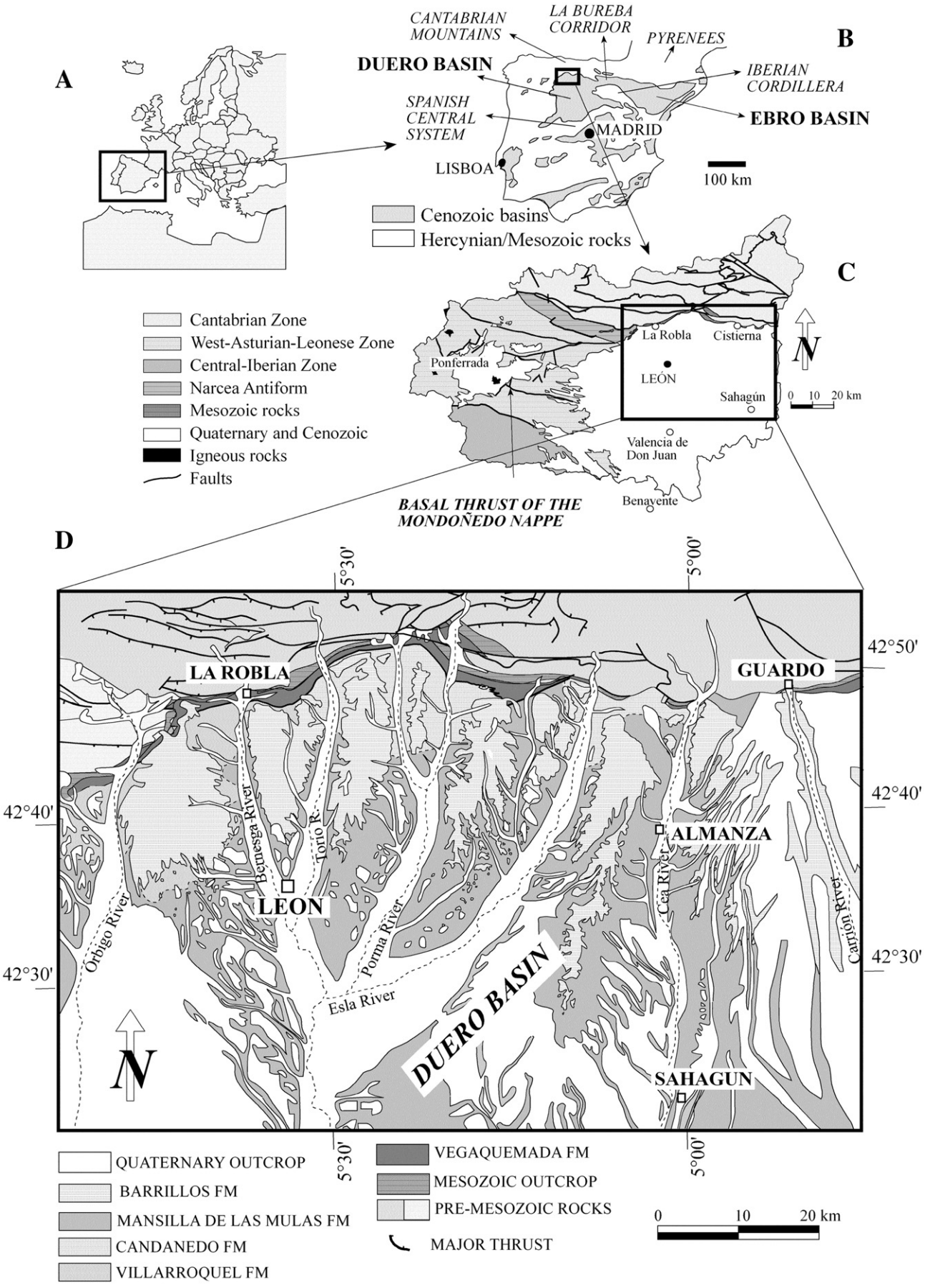

Fig. 1. Regional and geological maps of the study area.