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Resedimented carbonate and volcanic rocks in the Berriasian-Hauterivian of the Subbetic (Alamedilla, Betic Cordillera, southern Spain)

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ABSTRACT

Sedimentary rocks of the Lower Cretaceous in the Subbetic of the Alamedilla area (province of Granada) were studied. In this area, a significant amount of redeposited sediments within the Carretero Formation were recorded. Resedimented material is mainly composed of Jurassic oolitic limestones and volcanic rocks, as well as of Neocomian hemipelagic sedimentary rocks (marly limestones and marls). All these redeposited sediments corresponding to rock fall and debris flow originated as the result of significant slopes in a very sharp submarine topography. Volcanism and the resultant volcanic edifices created this sharp slopes making up in some cases guyots. The volcanism was mainly active in the Middle Jurassic, although it persisted locally until Late Jurassic and Early Cretaceous, and controlled the sedimentation in this area of the Subbetic basin during most of the Mesozoic. The proposed genetic model is in agreement with a base-of-slope apron model with two significant special features: (1) the provenance of the clasts mainly from Jurassic outcrops with oolites deposited in guyots and isolated marine platforms, and volcanic submarine rocks, and (2) the palaeobathymetry of the deposits, relatively shallow and sporadically affected by storm waves.

1. Introduction

During the Jurassic and Cretaceous, the South Iberian Continental Margin was located in the westernmost end of the Tethys, adjacent to the Iberian continent (Vera, 2001; Vera et al., 2004). In this South Iberian margin a palaeogeographical domain (Subbetic) was differentiated during most of the Jurassic (from the late Pliensbachian) and the Cretaceous. This domain was located in a more distal setting with respect to the Iberian continent than the Prebetic domain. The Subbetic was characterized by the dominance of hemipelagic facies (Vera et al., 2004), in contrast to the other palaeogeographic domain (Prebetic) nearest to the continent in which the shallow marine and coastal environments facies were widespread (Fig. 1A). From the end of the early Miocene to the beginning of the late Miocene the sediments deposited in this continental margin were detached from the Palaeozoic basement and were deformed making up the External Zones of the Betic Cordillera (Martín-Algarra and Vera, 2004) in southern Spain (Fig. 1A).

In the Jurassic, several areas may be distinguished according to subsidence rate and sedimentary facies in the Subbetic. In one of these areas (the Median Subbetic) there are abundant submarine volcanic rocks interbedded in Jurassic, and to a lesser extent in Cretaceous, hemipelagic rocks. In the Median Subbetic, Jurassic radiolarite facies are also recorded, similar to the radiolarites present in other Alpine-Mediterranean chains (Alps, Apennines, Tell, Rif, etc.; e.g., Jenkyns, 1986; De Weber and Baudin, 1996), making up one of the most characteristics lithostratigraphic units (Jarropa Radiolarite Formation; O'Dogherty et al., 1997; Molina et al., 1999) in the Jurassic of the Subbetic.

During the Middle Jurassic in the Median Subbetic, isolated carbonate platforms were developed on submarine volcanic edifices, making guyots (Vera et al., 1997; Molina and Vera, 1999). These edifices, several square kilometres in size, were generated in several volcanic phases during the Middle Jurassic. Between these volcanic rocks, hemipelagic sedimentary rocks are intercalated. In the upper interbeds and especially in the deposits on the top of the guyots, shallow marine platform carbonate rocks were deposited. The shallow marine carbonate deposits enclose shallowing upward sequences with Bahamian-type ooliths and in some cases show subaerial exposure and palaeokarst development. The guyots rised some hundred metres over the surrounding marine bottom and at the end of the volcanic activity they were slowly covered by the Upper Jurassic and Cretaceous sediments until their disappearance as topographical highs. The first deposits in the areas immediately surrounding the guyots were Upper Jurassic, first the radiolaritic facies (Jarropa Radiolarite Formation) mainly of Callovian-Oxfordian

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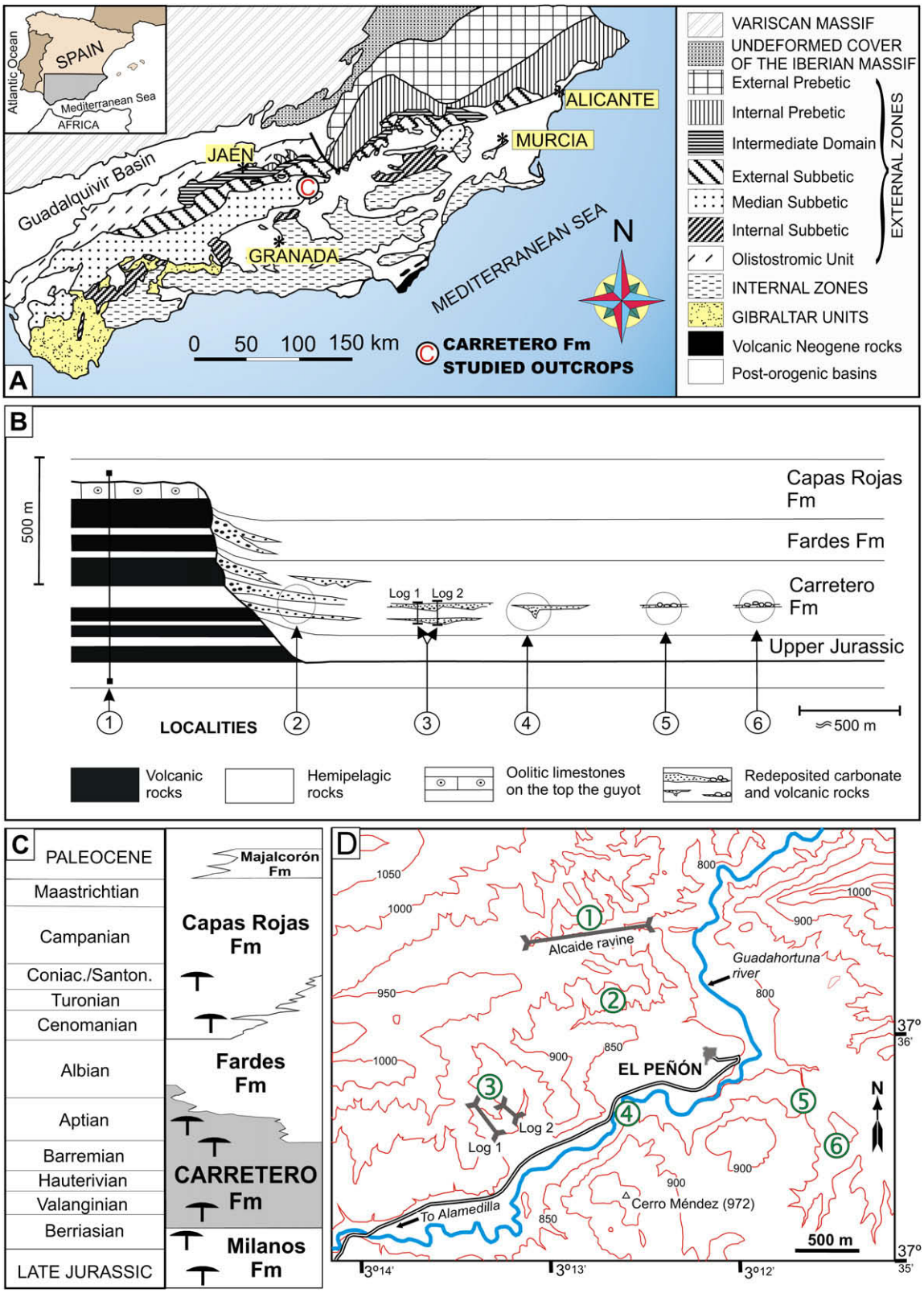

Fig. 1. A, Geologic location of the studied outcrops in the Betic Cordillera. B, Palinspastic reconstruction of the border geometry of the guyot near the Peñón hamlet, with the position of the studied localities. C, Simplified stratigraphic correlation of the Cretaceous formations in the Median Subbetic (in black: volcanic submarine rocks). D, Geographic location of the cited outcrops: (1) Alcaide ravine, (2) El Despeñadero, (3) Logs 1 and 2, (4) Rio Guadahortuna outcrop, (5) east of El Peñón, (6) southeast of El Peñón.

age, and later the Kimmeridgian-Tithonian limestones and marls (Milanos Formation, Molina and Vera, 1996) with tempestite interbeddings and shallowing upward sequences (Vera and Molina, 1998) (Fig. 1B).

The Cretaceous in the Median Subbetic is composed of three formations (Figs. 1B and C). The oldest of these is the Carretero Formation (Comas et al., 1982), which is one of the most characteristic lithostratigraphic units of the Cretaceous in the Betic