

**Master's Thesis**

**FACIES AND DEPOSITIONAL GEOMETRY OF A MIXED SHALLOW MARINE  
SYSTEM IN A CHANGING BASIN MORPHOLOGY  
(EOCENE ÀGER BASIN, CENTRAL SOUTH PYRENEES)**



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## Abstract

The Àger basin in the South Pyrenean Foreland Basin has similarities with other Tethys realm basins, particularly in the deposition and proliferation of large-benthic foraminifera during the lower Eocene period following the PETM crisis. While previous studies have focused on siliciclastic-dominated systems, little attention has been given to the limestone successions containing *Alveolina*, specifically the Barranc de Contorna limestone. This unit is of interest due to its resemblance to potential reservoir facies in the Middle East. A comparison is made between the Barranc de Contorna limestones and the underlying Cadí Formation. Latter formed during a period of slow tectonic activity, while the Barranc de Contorna limestone was deposited concurrently with siliciclastic formations showing progressive unconformities towards thrust- or salt-related structures, indicating faster uplift rates. The study aims to investigate the basin's morphological changes and their implications for platform system evolution and reservoir potential. The analysis of facies associations and microfacies reveals a shallow-water setting of an inner ramp with restricted environments, a shallow-water mixed carbonate inner platform transitioning offshore, and a progradational-retrogradational slope setting. The evolution of basin morphology suggests differences in reservoir potential, favoring the mixed carbonate platform system as a better candidate. In particular, the qualitative examination of thin sections from identified microfacies 5 and 8 demonstrates relatively higher porosity. The prograding clinofolds of the mixed carbonate platform can be considered to possess enhanced permeability properties, attributed to their sharp and erosive contacts between the beds, as well as the presence of faults and fractures. However, it is recommended to further study petrophysical aspect and quantify porosity and permeability.

## Introduction

The Àger basin in the South Pyrenean Foreland Basin, as other basins of the Tethys realm, records the deposition and shallow water proliferation of large-benthic foraminifera during the lower Eocene, which diversified shortly after the PETM crisis. Most published works from the Àger basin have focused on the study of the Ypresian shallow marine siliciclastic dominated systems of the Ametlla and Baronia formations. However, less work has been done on the limestone successions with *Alveolina*, and especially the Barranc de Contorna limestone, which interfingers with the Ametlla formation in the western part of the basin (Zamorano, 1993). Particular research interest in this unit is sparked by first the limited studies that have been done on it and secondly due to its similarity with potentially analogous reservoir facies in the Middle East, particularly the Paleocene-Eocene Umm Er Rhaduma / Jafnayn formations, and Eocene Seeb / Dammam formations in Oman, Kuwait and Saudi Arabia (e.g., Nolan et al., 1990; Beavington-Penney et al., 2006; Alsharhan, 2014; Bernecker, 2014; Mattern and Bernecker, 2019).

Another interesting research question is how these Barranc de Contorna limestones compare to another *Alveolina* limestone succession from the lowermost Ypresian (Cadí Formation), located stratigraphically below the Barranc de Contorna unit have a great resemblance due to a similar carbonate factory. However, the Cadí Formation limestone is supposed to belong to a period of slow tectonic activity