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The Ombrina-Rospo Plateau (Apulian Platform): Evolution of a Carbonate Platform and its Margins during the Jurassic and Cretaceous

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ABSTRACT

In this paper we analyze the Jurassic and Cretaceous evolution of the buried northwards stretch of the Apulia Platform (Southern Italy) (Ombrina-Rospo Plateau – ORP), and adjacent Adriatic Basin. Exploration wells indicate that inner platform carbonate facies across the ORP in the Jurassic and Lower Cretaceous are capped, along a subaerial exposure surface, by Oligocene/Miocene carbonates. A NW-trending intra-platform basin ("Casalbordino Corridor") was infilled with shallow- to deeper-water sediments in the late Early to Late Cretaceous interval, while platform margins were experiencing tectonic reactivation.

The ORP-to-basin transitional belt formed a corner, defining a NW and a NE margin. The NW margin was essentially stationary. A syn- and early post-rift platform-toe bypass wedge formed when late Hettangian–Sinemurian extension produced the platform/basin relief. Export of platform material, coupled with a halt of faulting, made the platform/slope profile continuous in the late Early or early Middle Jurassic (possibly across an ooidal rim). Late Jurassic *Ellipsactinia*/coral reefs passed downdip into bioclastics. The Maiolica Fm. displays two cycles (M1, M2), where M2 onlaps the slope built by M1. In the Aptian, with lithospheric arching, a high angle fault rejuvenated the margin. Off this margin, a narrow basin, locked between the ORP and a pelagic carbonate platform, was largely infilled with turbidites sourced by the ORP, but the high hampered the dispersal of the sand fraction. The NE margin displays prograding ooidal to bioclastic clinoforms (Middle and Upper Jurassic) downlapping onto the rift basin. In the Lower Cretaceous, the platform recovered after a slow-down of carbonate productivity (M1/2 boundary). The Marne a Fucoidi Fm. thickens at the toe of, and seals, a fault backstepping the margin. Further backstepping occurred ~5 km platformwards along a (Cenomanian?) normal fault, producing room for a rudist factory. A retreating rocky shoreline sourced breccias, while downdip the shallow water facies graded into the Scaglia Fm. basin along a ramp-like profile with low angle clinoforms, merging with turbidites.

1. Introduction

This study presents the results of a regional project on the geologic evolution of the central Adriatic Sea and adjacent onshore areas (Fig. 1). It is mainly based on a grid of 2D seismic profiles, a 3D good-quality seismic survey and re-interpreted 35 wells in the public domain, summarizing the past exploration efforts by oil companies in the area (see also VIDEPI Project, 2012). The center of the study area is the Ombrina-Rospo Plateau (ORP), a buried segment of the Apulia carbonate platform (henceforth called Apulia Platform) (Fig. 2), hosting Triassic to Miocene shallow-water carbonates, with transitions to the pelagic environment. Parts of the Apulia Platform are exposed in the Montagna della Maiella, the Gargano, Murge, and Salento areas of Central and Southern Italy, a region which was part of the foreland of the Apenninic orogeny. Unaffected by active thrusting and folding (with the exception of the Montagna della Maiella), the area displays evidence for large-scale arching and tilting, and is indeed dissected by deep-seated strike-slip faults with dominantly E–W or NE–SW trend (e.g.

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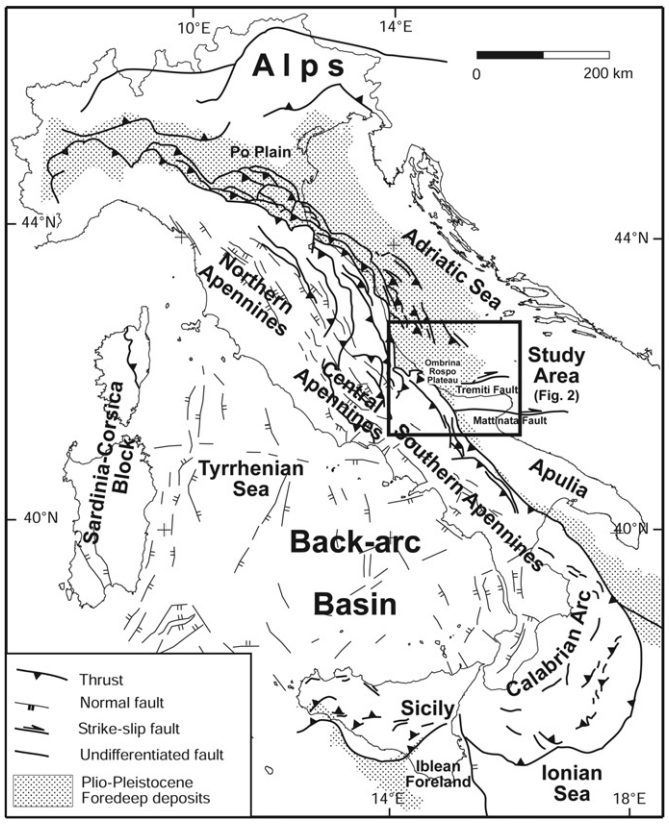

Figure 1. Main structural features of Italy (modified from Bigi et al., 1992). Foredeep deposits are delimited by the −1000 m isobath.

Tremiti/Gondola and Mattinata faults), and by normal faults (De Dominicis and Mazzoldi, 1987; André and Doulcet, 1991; Doglioni et al., 1994; Patacca and Scandone, 2004; Scrocca, 2006; Scrocca et al., 2007; Patacca et al., 2008a, 2008b; Scisciani and Calamita, 2009; references therein). Besides this, the region offers a rare opportunity to examine an only mildly deformed cross-section of a Mesozoic rifted passive continental margin.

The general stratigraphy of the Apulia Platform is summarized in Ricchetti et al. (1988), while papers by Borgomano (2000), Graziano (1999, 2000, 2001), and by Bosellini and Morsilli (2001) address key aspects of the geology of the Gargano peninsula. The buried extensions (on- and off-shore) of the Apulia Platform, based on the interpretation of seismic data, have been described in a number of papers (e.g. De Alteriis and Aiello, 1993; Patacca et al., 2008a, 2008b).

The transition from the Apulia Platform to the adjacent Adriatic Basin is exposed on land in the Gargano and Maiella outcrops, and is well imaged on seismic sections in the offshore (see references above). The Maiella platform margin has been described and modeled in several papers, including those by Eberli et al. (1993), Mutti et al. (1996), Vecsei et al. (1998), Morsilli et al. (2002), Rusciadelli (2005) and Rusciadelli and Ricci (2008). The paper by Eberli et al. (2004) attempts a comparison of the Maiella Platform margin with the western Great Bahama Bank. The stratigraphy of the basin surrounding the Apulia Platform is essentially the same as in the Umbria–Marche Apennines and the Ionian zone in Greece (Bernoulli and Renz, 1970). Besides the shallow-water part of the Maiella, another Mesozoic shallow-water carbonate platform was the Latium–Abruzzi Platform outcropping in the Central Apennines, exposing also formations (Upper Triassic to Middle Jurassic) older than those in the Apulia Platform. Finally, an instructive analog for the proximal Adriatic Basin, a deeper basin receiving material shed from an adjacent carbonate platform, is represented by the Sabina Basin (e.g. Galluzzo and Santantonio, 2002).

During our work, we made extensive use of the interdisciplinary knowledge existing for this selected group of outcrop analogs for interpreting the geological evolution of the Ombrina-Rospo Plateau and adjacent deeper-water areas. The evolution of the Apulia platform margins during the Jurassic and the Cretaceous was analyzed by contrasting the north-western ("Rombo-type", after the name of a prominent well) and north-eastern ("Branzino-type") margins.

2. Datasets

The database used for this study consists of well and seismic reflection data and includes (Fig. 2):

- A sparse grid of 2D regional publicly accessible seismic profiles (Zone B, available at the Italian Ministry of Industry, VIDEPI Project, 2012).
- A few deep-penetration 2D regional seismic lines (CROP M13, M14 and M15 profiles), acquired within the framework of the Italian Deep Crust Exploration Project (see Scrocca et al., 2003 for further details).
- 2D commercial seismic profiles, mainly concentrated in the B.R269.GC Ombrina permit area (Medoilgas Italia S.p.A. database).
- 3D seismic survey acquired over the Ombrina Oil & Gas Field within the B.R269.GC permit (Medoilgas Italia S.p.A. database).
- Publicly available Composite Logs for 35 wells (Table 1), corresponding to 22.683 m of stratigraphy analyzed and re-interpreted, plus additional confidential well data (Medoilgas Italia S.p.A. database).
- Velocity data for 10 wells (1 VSP and 9 Check-shots).

In analyzing the composite logs (VIDEPI Project, 2012), the following aspects had to be taken into account: 1) Erratic quality of stratigraphic information (part of the wells were cored during the late 1950's to 90's, by several different oil companies); 2) Sedimentological or paleontological detail is often missing; 3) The lithologic successions were subdivided by different operators adopting very different criteria: lithostratigraphic units (formations); biostratigraphic units; chronostratigraphic units; facies units; or by using the generic occurrence of fossil taxa without proper biostratigraphic value.

The tools we used in order to overcome some of the above problems, and to produce consistent data for time- and rock-correlation, have been the following: 1) A literature survey for the following areas: Apulia Platform (outcrop and subsurface), Maiella, Latium–Abruzzi Platform, Sabina Basin and Plateau; 2) Cross-check of the different biostratigraphic charts; 3) Correlation of various lithostratigraphic charts; 4) Use of personal field data (Central and Northern Apennines).

Our goals thus were: 1) To correlate objects labeled differently, in order to a) obtain reliable thickness variations, and b) to identify the chronostratigraphic range of stratigraphic units – namely the age of the top of the Mesozoic formations; 2) To select well documented outcrop analogs, in order to better understand the geological context and build a sedimentological and facies model; 3) To attempt to trace the paleoenvironmental evolution.

The most useful biostratigraphic charts for the Jurassic and Cretaceous were those found in the explanatory notes of Geological Sheets 367 "Tagliacozzo" and 376 "Subiaco" of the Servizio Geologico d'Italia (Central Apennines) (Servizio Geologico d'Italia, 1997, 2005). The biostratigraphy commonly used in Apulia is essentially in the same vein. A valuable addition is the beautiful synthesis by