R.C.M.N.S. Interim Colloquium

Vertebrate Migration in the Mediterranean & Paratethys

Neogene Park

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Field Guide to the Post-Conference Excursions (Scontrone, Palena and Montagna della Majella)

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Edited by

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INTRODUCTION TO THE GEOLOGY OF THE CENTRAL-SOUTHERN APENNINES

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The post-Conference excursions will give the participants the opportunity to visit one of the most interesting regions of the Central-Southern Apennines (Fig. 1), where geology is quite complex but exposures are superb and subsurface features well known. A geological lineament running from the eastern foot of Majella to Alfedena (the latter is located just south of Scontrone), which corresponds to the emergence of the lateral ramp of a stack of rootless nappes transported over the Apulia foreland (Molise and Sannio Nappes), divides the region into two areas characterized by different structural architectures. In the western area the mountain chain consists of an imbricate fan of carbonate thrust sheets transported piggy-back towards the Adriatic Sea. These thrust sheets, grouped in major tectonic units that may reach a thickness of 5-6 kilometres, are composed of Mesozoic-Tertiary platform-derived and basin-derived carbonate sequences capped by siliciclastic flysch deposits (see Figs. 1, 2 and 3). The flysch deposits, Tortonian in the most internal (western) units, Messinian in the intermediate units and Pliocene in the most external ones, indicate the flexure-hinge retreat of the lower plate and the progressive forward migration of the thrust belt-foredeep-foreland system. In the eastern area, a pile of rootless nappes composed of Mesozoic-Tertiary basinal deposits up to 7-8 kilometres thick (Sannio and Molise nappes, the latter represented by the Frosolone, Agnone, Tufillo-Serra Palazzo and Daunia units) overlies a buried duplex system composed of Mesozoic-Tertiary platform carbonates with a very long thrust flat. Mesozoic-Tertiary platform carbonates with a very long thrust flat.

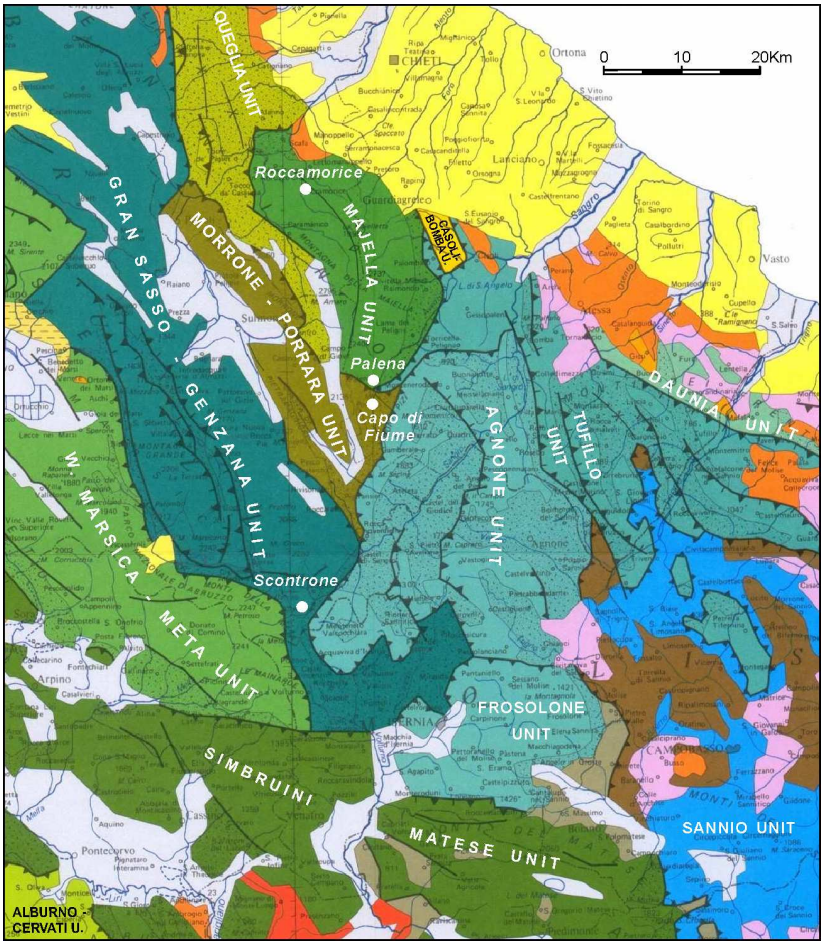

Figure 1. *Simplified geological-structural map of the Abruzzi-Molise region. In the different tectonic units dots indicate siliciclastic flysch deposits. Brown, pink and orange colours refer to early Messinian, late Messinian and Pliocene thrust top deposits respectively, while yellow indicates post-orogenic Pleistocene deposits. Red refers to small outcrops of volcanites. Modified after Patacca & Scandone (2007).*

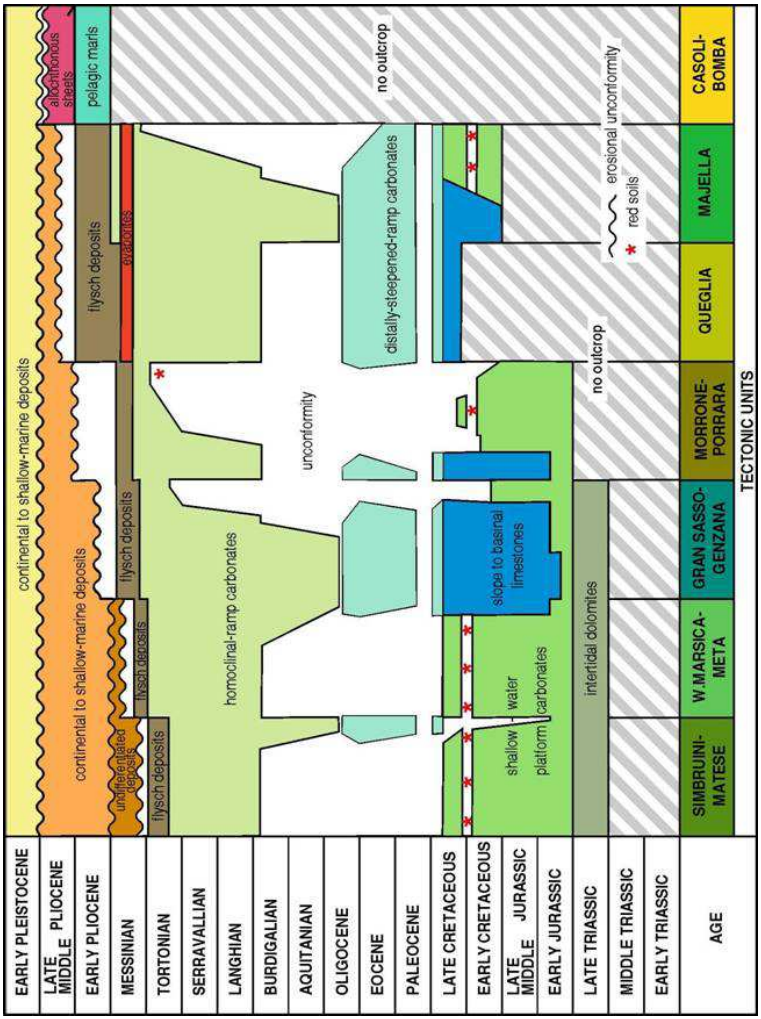

***Figure 2**. Stratigraphic sequences characterizing the tectonic units exposed in the western area. Modified after Patacca & Scandone (2007).*

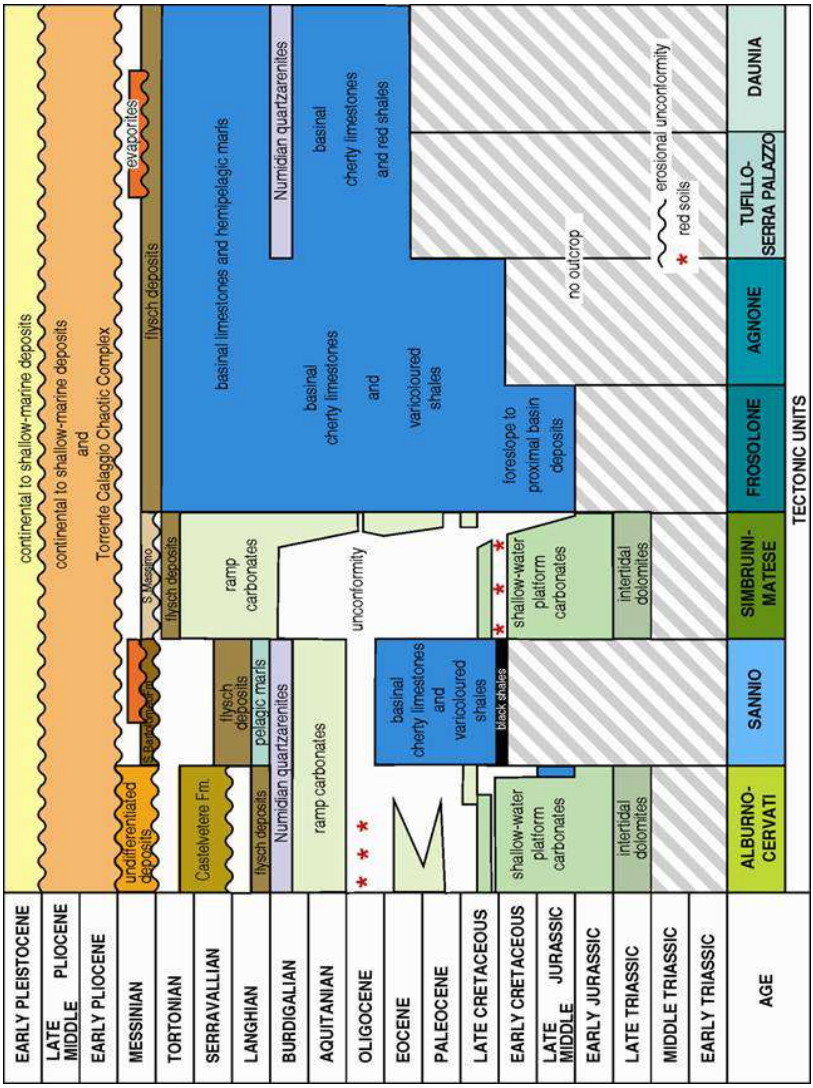

***Figure 3**. Stratigraphic sequences characterizing the tectonic units exposed in the eastern area. Modified after Patacca & Scandone (2007).*

Before tectonic shortening, the buried carbonate duplex system was part of the Apulia Platform. The Majella and Morrone-Porrara units, which were incorporated in the mountain chain in the latemost Messinian and in the early Pliocene, have also derived from this paleogeographic domain. Presently the Apulia Platform is a segment of the foreland of the peri-Adriatic fold-and-thrust belts. Before mountain building the Apulia Platform and the surrounding depositional domains constituted a complex system of platforms and basins the whose bulk originated in the middle Liassic consequently to the extensional tectonic processes that caused the dissection of an original upper Triassic-lower Liassic shallow epeiric area. The Lagonegro-Molise Basin is an exception in this framework since it formed around the end of the middle Triassic as a deep seaway linked, like the other Pindos-type basins of the Mediterranean region, towards the east with the pre-Jurassic Tethys Ocean. Around the end of the Cretaceous, platform edges turned into carbonate ramps characterized by overall prograding stacking pattern. Figure 4 shows a palinspastic restoration of the Apulia Platform and surrounding areas referred to the late Jurassic, around 150 Ma, a moment in which the paleogeographic characters of the different depositional domains were very well defined. In this reconstruction Apulia and the other segments of the Adriatic foreland have been rotated and translated more than 1500 kilometres SW of their present-day position according to the path of stable Africa with respect to Europe. The adjacent areas which during the Neogene were incorporated in the Apennine mountain chain have been relocated using classical criteria of retrodeformation and structural balancing. Figures 5 and 6 provide two images of the same area at Tertiary times in two very well documented moments. The first image refers to 29 Ma, when the "Mid-Oligocene" sea-level drop determined in the platform domains maximum subaerial exposure. The second one refers to 18 Ma (Burdigalian) when an important

transgressive event determined marine flooding over the greatest part of the platform areas.

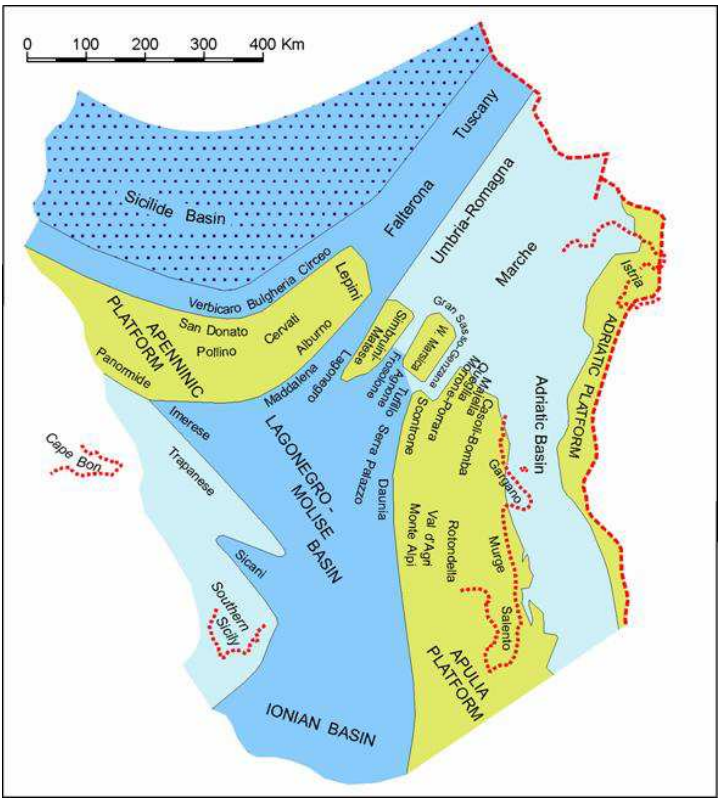

Figure 4. *Palinspastic restoration of the Apulia Platform and surrounding platform-and-basin system in late Jurassic times (about 150 Ma). Green areas are Bahamian-type carbonate platforms separated by more or less deep basins (dark blue and light blue, respectively). The Sicilide and Lagonegro basins are supposed to have been floored, at least in part, by oceanic crust.*

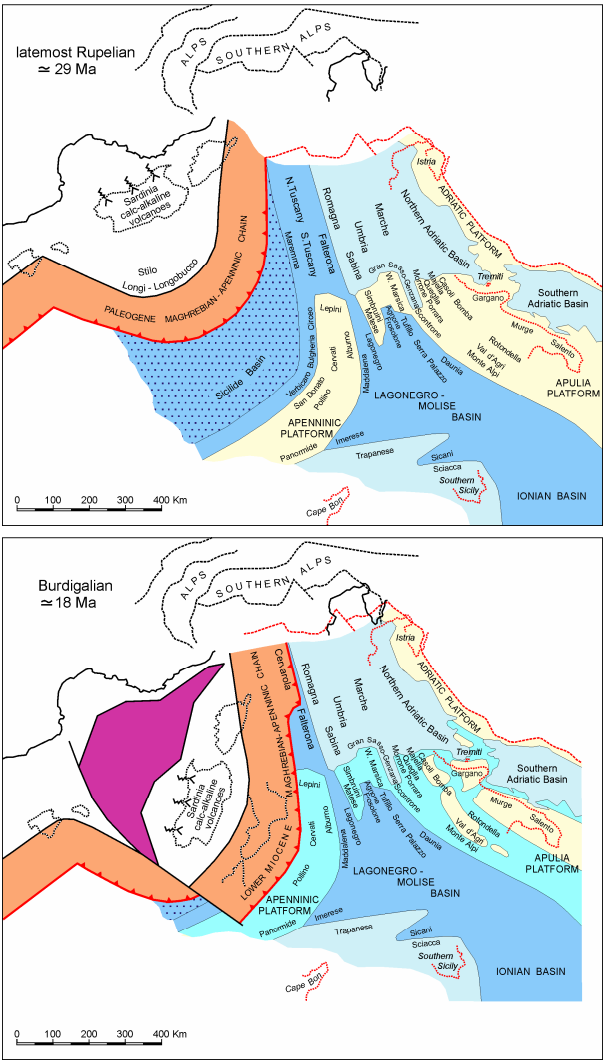

Figure 5 and 6*. Images of the Apulia and adjacent platform-and-basin system in a moment of maximum sea-level drop (Rupelian, 29 Ma) and in a moment of maximum transgression (Burdigalian, 18 Ma).*

Note that in these palinspastic reconstructions the Apulia Platform was located about 290 kilometres SE of its present-day position in figure 5 and around 130 kilometres in figure 6.
After the Burdigalian the compression front in the Central-Southern Apennines moved around 400 kilometres towards the east reaching in the early Pleistocene the position indicated in figure 7.

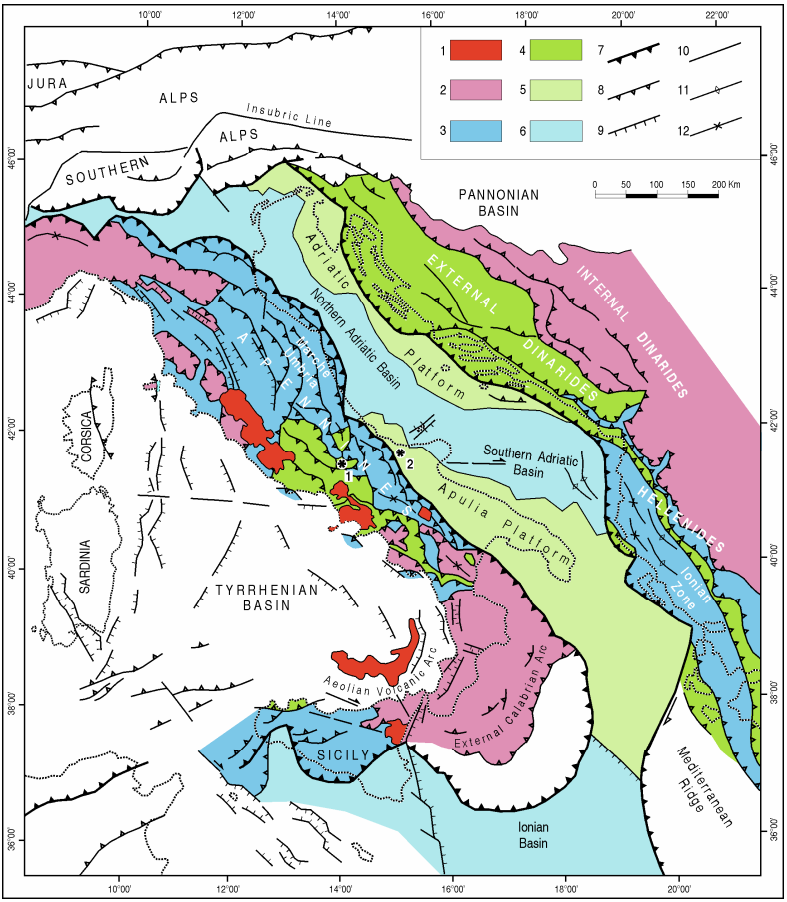

Figure 7. *Tectonic lineaments of the peri-Adriatic region with the distribution of the platforms and basins in the foreland areas and the distinction between platform-derived and basin-derived tectonic units in the Apennines and Dinarides. Asterisks indicate the Scontrone (1) and Gargano (2) fossil sites. After Patacca et al. (2008).*
1, Major subaerial Quaternary volcanoes. 2, Undifferentiated internal units of the Apennines, Calabrian Arc and Dinarides-Hellenides. 3, External units of the Apennines, Sicilian Maghrebides and Dinarides-Hellenides chiefly represented by Mesozoic-Tertiary basinal and pelagic carbonate sequences. 4, External units of the Apennines-Sicilian Maghrebides and Dinarides-Hellenides mostly represented by Mesozoic-Tertiary shallow-water carbonate sequences. 5, Foreland areas characterized by Mesozoic-Tertiary basinal and pelagic carbonate sequences. 6, Foreland areas characterized by thick Mesozoic-Tertiary shallow-water carbonate sequences. 7, Front of the Sicilian Maghrebides, Apennines, Alps, Southern Alps and Dinarides-Hellenides. 8, Major thrusts. 9, Normal faults. 10, High-angle faults, mostly strike-slip faults. 11, Anticline axis. 12, Syncline axis.

References

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