

WORKSHOP

Late Triassic-Early Jurassic events  
in the framework of the Pangea break-up

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**Abstracts**

# Paleogeographic restoration of the Lagonegro Basin. New constraints from subsurface data

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The Lagonegro basin is one of the most important seaways of the Central Mediterranean region that during the Middle Triassic and Late Triassic, before the breakup of Pangea, linked the platform-and-basin depositional realms of the Alpine Triassic system with the open-marine Paleotethys ocean, allowing the westward penetration of pelagic faunas in quite internal areas of the Paleomediterranean Gulf. In spite of the extensive stratigraphic and structural investigations on the Lagonegro units and on their counterparts in Sicily (Imerese and Sicani units), a lot of uncertainties persists about first-order problems, such as:

1. Paleogeographic location of the Lagonegro Basin in the Mesozoic-Tertiary platform-and-basin system of Central-Southern Italy;
2. Size, namely width, of the basin;
3. Nature of the crust (oceanic crust? thinned continental crust?) flooring the Lagonegro Basin.

As concerns the mutual relations between the Lagonegro Basin and the so-called "Western Platform" (or "Apenninic Platform") during Mesozoic times, several palinspastic relocations have been proposed in the geological literature, with the Lagonegro Basin located either east or west of the Apenninic Platform. In addition, different reconstructions of the platform-and-basin system itself have been proposed, with simple schemes in which the Lagonegro-Molise Basin separated two carbonate platforms (the Apenninic Platform and the Apulia Platform) and complex schemes in which the Lagonegro Basin was part of a depositional system including five basins and six platforms (starting from the Campania-Lucania-Calabria Platform in the west and ending with the Apulia Platform in the east). As concerns the width of the Lagonegro Basin, different values have been proposed in the literature, ranging from tens of kilometres to hundreds of kilometres. Moreover, some reconstructions depict the Lagonegro Basin wider and wider moving from the north to the south, that is from the present-day Basilicata region towards the Ionian Basin, whilst other reconstructions postulate a narrowing of the basin towards the south and its termination at the latitude of the present-day Pollino mountains because of a junction of the Apenninic and Apulia platforms that gave origin to a wide shallow-water carbonate domain extended from the present-day Tyrrhenian coast to the present-day Murge-Salento region. As concerns the Lagonegro Basin individuation, there is large agreement among the authors about a Middle Triassic tectonic activity responsible for the dissection of an original shallow-water domain, but the geodynamic regime and the faulting mechanisms are not fully clarified. Finally, as regards the nature of the substratum of the Lagonegro deposits, some authors postulate the existence of a typical oceanic crust whilst other authors consider more probable a thinned continental crust.

New information mostly deriving from petroleum exploration in the Apennine mountain chain, allows us to give more precise answers to questions 1 and 2. Conversely, no answer to question 3 supported by indisputable geological or geophysical data is presently available.

**Palinspastic relocation of the Lagonegro Basin.** The paleogeography of the platform-and-basin system in Central-Southern Italy cannot be described by 2D cylindrical restorations. In fact, the mutual relations between the deep-marine domains represented by the Lagonegro and Molise basinal realms and the shallow-marine domains represented by the carbonate platform realms changed considerably in the time and space, together with the shape and size of the carbonate platforms. Maximum complexity was reached during the Late Jurassic in correspondence to the present Matese and Southern Abruzzi regions where a complicated system of isolated platforms and tongues of a wider basin has been reconstructed (see Figure 1). Wells drilled for oil research in

Southern Italy (e.g. Acerno 1, San Gregorio Magno 1, Giano Pepe 1) show that in the Campania-Lucania Apennines the Lagonegro units systematically underlie the Alburno-Cervati or Monti della Maddalena units and overlie the carbonates of the Apulia Platform. In the same region, the Sannio Nappe, constituted of the upper portion (Lower Cretaceous-Middle Miocene) of the Lagonegro sequence detached from its Middle Triassic-Lower Cretaceous substratum, systematically overlies the Molise nappes (Tufillo-Serra Palazzo and Daunian units). The latter, in turn, tectonically overlie the Apulia Platform whose imbricates form a buried duplex system recognised along the whole Southern Apennines. The described geometrical relations point to the existence of a single, wide basin (Lagonegro-Molise Basin) developed from the Ionian Basin to the present-day Picentini region. Moving northwards, the paleogeographic array becomes more complex because of a narrowing of the Lagonegro-Molise basin and because of the partition of the basin itself into two branches separated by the Matese-Simbruini carbonate platform. The Taburno 1 well, located a few kilometres east of Benevento, encountered a thick section of Galestri that was completely unexpected in the region. Seismic lines tied to Taburno 1 show that these Galestri deposits tectonically overlie the Mesozoic-Tertiary carbonates exposed at Monte Camposauro, which surely belong to the Matese Unit. The occurrence of a Galestri section in this area and in the described geometric position may be easily explained considering its derivation from the inner (western) branch of the Lagonegro-Molise basin. We do not know how far this branch penetrated northwards between the Matese-Simbruini and Campania-Lucania platforms. The northernmost outcrops of rock units referable to the Lagonegro sequence, though structurally belonging to the Sannio Nappe, have been observed in the Monte Maggiore region near Caserta. As concerns the outer (Molise) portion of the Lagonegro-Molise basin, field evidence shows that the basin extended northwards as far as the present-day Mainarde region. A minor branch of this basin probably penetrated between the Matese-Simbruini and Western Marsica platforms.

Original size of the Lagonegro-Molise Basin. In the whole Campania-Lucania Apennines from the Campagna tectonic window to the Lauria region, the Lagonegro composite nappe consists of two tectonic units separated by a long thrust flat. The lower unit (Lagonegro Unit I) is mostly composed of Upper Triassic-Lower Cretaceous deposits belonging to the Calcari con Selce, Scisti Silicei and Galestri formations, all displaying typical characteristics of very distal deposits. The upper unit (Lagonegro Unit II) is composed of Middle Triassic deposits belonging to the Monte Facito Formation followed by a stratigraphic succession similar to the succession of the Lagonegro Unit I but with characteristics of more proximal deposits. The Monte Facito Formation is systematically missing in the Lagonegro Unit I. If we remove the upper unit away from the lower one without operating any smoothing of the internal deformation, a value of 60 kilometres is obtained. This value represents the minimum width of the depositional domains that formed the western flank and the axial part of the Lagonegro basin. However, a simple backward transport of the Lagonegro Unit II is not sufficient to smooth out the tremendous internal shortening of the Lagonegro composite nappe, shortening related to the development of huge antiformal stacks. The best documentation of this telescopic shortening, which took place mostly in Pliocene times, is given by the San Fele 1 and Monte Foi 1 wells (T.D. 5315 and 5760 respectively) in which tectonic repetitions of the stratigraphic succession up to seven/eight times have been recognised. Because of these duplexing and tight imbrication structures, tabular rock bodies having an original thickness of about 1500 metres have been transformed in antiformal stacks whose maximum thickness exceeds 5500 metres. It is interesting to observe that important tectonic repetitions of the Lagonegro sequence have been also found in quite internal structural trends of the Apenninic chain (e.g. Acerno 1). Balanced sections across the Lagonegro folds in Basilicata allowed us to compute for the western and axial parts of the Lagonegro Basin a minimum width of 200-250 kilometres.

Nature of the crust flooring the Lagonegro-Molise Basin. During the Apennine mountain building, their Mesozoic-Tertiary deposits of the Lagonegro and Molise domains were completely detached from the original substratum and no trace of basement involvement is recorded in the resulting tectonic structures. The occurrence of siliceous radiolarites in the Rhaetian-Jurassic and Cretaceous deposits of the Lagonegro sequence, together with the occurrence of siliceous radiolarites in the Jurassic and Cretaceous deposits of the Molise (Frosolone-Agnone) sequences, obviously demonstrates that during the Mesozoic the sea-floor depth in the Lagonegro-Molise Basin exceeded the CCD. This fact, however, does not allow us to define the nature of the basin basement because it does not discriminate between a real oceanic crust and a thinned continental crust. Geochemical data on the rare mafic volcanites present in the Monte Facito Formation point to within-plate basalts, but also this piece of information cannot be used for discriminating

between oceanic crust and thinned continental crust. Our opinion is that at the state of the art every discussion on the nature of the crust in the Lagonegro-Molise Basin must be considered a mere speculation, since no real constraint on the subject is presently available.

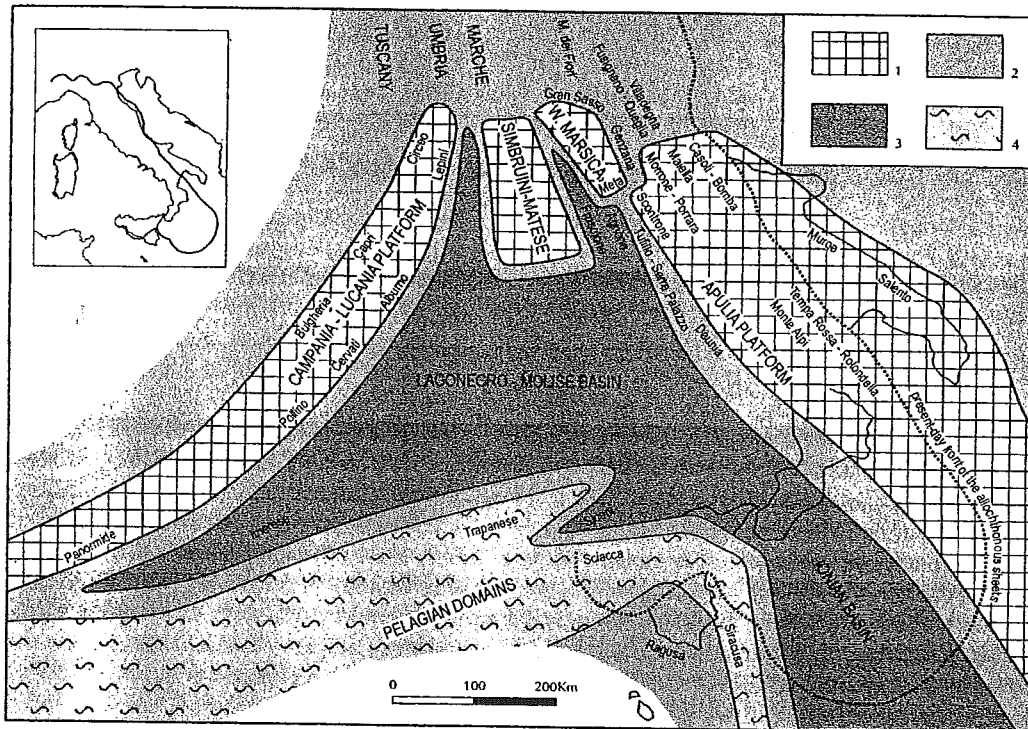


Figure 1. Palinspastic sketch of the Lagonegro-Molise basin and surrounding depositional domains during Jurassic and Cretaceous times