

THE NORIAN/RHAETIAN BOUNDARY IN THE LAGONEGRO BASIN, SOUTHERN APENNINES, ITALY

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Geological Setting

The Lagonegro Basin was part of the southernmost Mesozoic oceanic basins of the Tethyan realm (FINETTI, 1985; 2005; STAMPFLI & MARCHANT, 1995; CIARAPICA & PASSERI, 2002; 2005). Its stratigraphy consists of a lower part represented by the “Lagonegro lower sequence” (MOSTARDINI & MERLINI, 1986; CIARAPICA & PASSERI, 2005: Monte Facito Fm., Calcari con Selce Fm., Scisti Silicei Fm., “Flysch Galestrino” (Late Paleozoic-Early Cretaceous in age). This lower part, always detached from its basement, is now dissected into many tectonic units that are piled up between the Apenninic and Apulian carbonate platforms due to the Apenninic orogenesis and forms a part of the Southern Apennines chain (Potenza province, southern Italy).

Our studies focus on the transitional interval between the Calcari con Selce and Scisti Silicei Fms, well represented in the Pignola, Monte Sant'Enoc, Monte Volturino, Sasso di Castalda and Madonna del Sirino sections, in which the Norian/Rhaetian boundary has been documented.

The Calcari con Selce Formation is characterized by thin-bedded limestones with cherty layers and nodules. In particular, they consist of mudstone-wackestone beds with radiolarians and bivalves (genus *Halobia*) and scattered calcarenitic (packstone-grainstone) layers. It is possible to recognize parts of the Bouma sequence (Tb and Tc) in very few beds, that testify that they were deposited by density currents (turbidites). The main part of Calcari con Selce beds is due to platform-derived micrite exported to the basin from the adjacent carbonate platforms and are organized in meter-thick cycles emphasized by very thin silt horizons (few centimeters). The overlying Scisti Silicei Fm. mostly consists of radiolarian cherts and shales. Intercalations of calcirudites and calcarenites, often silicified, are documented and usually contain material (e.g. foraminifers) exported from the carbonate platforms adjacent to the basin. The transition from the carbonate sedimentation of the Calcari con Selce Fm to the siliceous deposition of Scisti Silicei Fm documents the relative progressive lowering of the basin floor below the Carbonate Compensation Depth (CCD). This event already occurred during the Carnian stage (RIGO et al., 2007). The base of the “Transitional Interval” (AMODEO, 1999), is conventionally marked by a 3 m-thick interval of red shales, a useful lithomarker recognizable throughout the Lagonegro Basin. This lithomarker does not contain residual materials (low content of Al₂O₃) due to prolonged

weathering as pointed out by X-ray analyses by REGGIANI et al. (2005). Above this 3m thick horizon of red shales, carbonate layers are still present, but they fade away upwards, becoming thinner and often silicified while radiolarites and shales become more common and thicker towards the overlying Scisti Silicei Fm. The Scisti Silicei Fm. has been informally subdivided in four members that are, in stratigraphic order from bottom to top, Buccaglione, Nevèra, Serra and Acqua Sulfurea members (AMODEO, 1999).

Different facies from proximal to distal, basing on the amount of re-sedimented platform materials such as calcarenites and calcirudites, have been traditionally recognized in the Calcarì con Selce and Scisti Silicei Fms (SCANDONE, 1967; AMODEO, 1999; BERTINELLI et al., 2005). On this base, Pignola and Monte Sant'Enoc sections should be considered as "proximal" whereas Sasso di Castalda, Madonna del Sirino and Monte Volturino as "distal". It is necessary to point out that this differentiation is more evident in the Jurassic portion of the successions (PASSERI et al., 2005).

Evolution of the Lagonegro Basin

Despite the Norian – Rhaetian boundary is matter of discussion for its biostratigraphic problem, this interval is peculiar to understand the evolution of the Neotethys during the Late Triassic time. In the Tethyan basins important facies change occurred during the Late Triassic: around the Norian/Rhaetian boundary the marine fauna shows a turnover which has been interpreted as the precursor of the Triassic/Jurassic extinction event. The faunal changes, connected also to environmental changes, are evident in the well-exposed Lagonegro successions. The transitional interval between Calcarì con Selce and Scisti Silicei Fms well represents the Norian/Rhaetian stratigraphic interval. In this interval the late Norian carbonate sedimentation was gradually replaced by a siliciclastic-radiolaritic deposition (PASSERI et al., 2005), beginning with a marked increase of shales, silicified limestones and some radiolarites (=meant as 30% of radiolarians in content). Although the beginning of the transitional interval from Calcarì con Selce Fm to the overlying Scisti Silicei Fm results diachronous in proximal and distal facies basing on conodont investigations, the increase of shales and silicified limestones is evident throughout the Lagonegro Basin.

Biostratigraphical investigations

According to CARTER & ORCHARD (2007) radiolarians are of primary importance for the definition of the Norian – Rhaetian boundary due to the apparent provincialism of conodonts and the rarity of ammonoids. The Lagonegro Basin successions yielded a very rich record of conodont and radiolarian fauna, allowing a good calibration between these two important tools for biostratigraphical investigations.

The transitional interval between Calcari con Selce and Scisti Silicei Fms is characterized by the presence of conodont *Mockina bidentata*, *Parvigondolella andrusovi* and *Misikella hernsteini* (BERTINELLI et al., 2005; RIGO et al., 2005; GIORDANO et al., 2008), while the overlying Scisti Silicei Fm is characterized by a rich assemblage of radiolarians. According to radiolarian biozonation made by CARTER (1993), the radiolarians found in the first part of Buccaglione member (lowermost part of the Scisti Silicei Fm) are late Norian in age (GIORDANO et al., 2008). The remaining part of Buccaglione member is characterized by a Rhaetian radiolarian association (sensu CARTER, 1993), according to the occurrence of *Misikella posternsteini* in the upper portion of Buccaglione Member (BERTINELLI et al., 2005; RIGO et al., 2005).

The integrated biostratigraphy based on conodonts and radiolarians from the Lagonegro successions shows that *Betraccium deweveri* is still present within the *Misikella hernsteini*-*Parvigondolella andrusovi* Zone (sensu KOZUR and MOCK, 1991). According to CARTER (1993) and CARTER & ORCHARD (2007) the *Betraccium deweveri* Zone is the last of the Norian. Thus, basing on radiolarian zonation, the FAD of *Misikella hernsteini* does not mark the beginning of the Rhaetian, as already suggested by KOZUR (2003).

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