

The Miocene tectono-sedimentary evolution of the southern Tyrrhenian Sea: stratigraphy, structural and palaeomagnetic data from the on-shore Amantea basin (Calabrian Arc, Italy)

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ABSTRACT

We report on new stratigraphic, palaeomagnetic and anisotropy of magnetic susceptibility (AMS) results from the Amantea basin, located on-shore along the Tyrrhenian coast of the Calabrian Arc (Italy). The Miocene Amantea Basin formed on the top of a brittlely extended upper plate, separated from a blueschist lower plate by a low-angle top-to-the-west extensional detachment fault. The stratigraphic architecture of the basin is mainly controlled by the geometry of the detachment fault and is organized in several depositional sequences, separated by major unconformities. The first sequence (DS1) directly overlaps the basement units, and is constituted by Serravallian coarse-grained conglomerates and sandstones. The upper boundary of this sequence is a major angular unconformity locally marked by a thick palaeosol (type 1 sequence boundary). The second depositional sequence DS2 (middle Tortonian–early Messinian) is mainly formed by conglomerates, passing upwards to calcarenites, sandstones, claystones and diatomites. Finally, Messinian limestones and evaporites form the third depositional sequence (DS3). Our new biostratigraphic data on the Neogene deposits of the Amantea basin indicate a hiatus of 3 Ma separating sequences DS1 and DS2.

The structural architecture of the basin is characterized by faulted homoclines, generally westward dipping, dissected by eastward dipping normal faults. Strike-slip faults are also present along the margins of the intrabasinal structural highs. Several episodes of syn-depositional tectonic activity are marked by well-exposed progressive unconformities, folds and capped normal faults. Three main stages of extensional tectonics affected the area during Neogene–Quaternary times: (1) Serravallian low-angle normal faulting; (2) middle Tortonian high-angle syn-sedimentary normal faulting; (3) Messinian–Quaternary high-angle normal faulting.

Extensional tectonics controlled the exhumation of high-P/low-T metamorphic rocks and later the foundering of the Amantea basin, with a constant WNW–ESE stretching direction (present-day coordinates), defined by means of structural analyses and by AMS data. Palaeomagnetic analyses performed mainly on the claystone deposits of DS1 show a post-Serravallian clockwise rotation of the Amantea basin.

The data presented in this paper constrain better the overall timing, structure and kinematics of the early stages of extensional tectonics of the southern Tyrrhenian Sea. In particular, extensional basins in the southern Tyrrhenian Sea opened during Serravallian and evolved during late Miocene. These data confirm that, at that time, the Amantea basin represented the conjugate extensional margin of the Sardinian border, and that it later drifted south-eastward and rotated clockwise as a part of the Calabria–Peloritani terrane.

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