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Contribution to constraints the structural model of Sicily

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Abstract

This study focused on the structural features of Sicily.

Given its geodynamic environs, the present-day structural configuration of Sicily reflects a long tectonic history involving both intraplate extension and plate margin deformation. As a consequence, the Mesozoic-Tertiary sedimentation area has been dominated by a complex interplay between extensional, compressional and strike-slip tectonics.

Fieldwork, integrated by well and geophysical data, contributed to constrain and enhance a structural model of the region.

The stratigraphic sequences display facies and thickness variations, indicating that they were deposited onto different pre-orogenic domains. These domains, belonging to the Mesozoic Africa passive continental margin, are fault-controlled, forming carbonate platforms (Peloritani, Panormide, Hyblean-Pelagian) and intervening, strongly subsiding, pelagic basins (Imerese-Sicanian, Sicilide).

The Mesozoic-Early Tertiary successions evolve to foredeep deposits since the late Oligocene and are today in places detached from their substrate.

The main bulk of the chain is located in the north-central sectors of the island and extends from the west to the east where progressively inner tectonic units outcrop

(Hyblean-Pelagian, Panormide, Imerese-Sicanian, Sicilide and Peloritani units). The chain has a axial culmination in Western Sicily and axial depression in NE Sicily. This trend results from the increasing rotation for oblique convergence.

The tectonic units were piled-up in the early Miocene. They consist of sedimentary sequences detached from the underlying basement except from the Peloritani units. Fault-propagation-folding processes have produced widespread frontal ramp anticlines inside the thrust stack. Detachments inside the multilayer provide multiharmonic folding and blind splays, to form duplex geometries. Thrust surfaces show ramp-flat geometries and have large spacing. In-sequence thrusting occurred during convergence, as revealed by the age and the geometric relationships of the syn-tectonic deposits filling the Oligocene-Pleistocene Sicilian-Maghrebian foredeep. The foredeep deposits are progressively younger towards the external sectors of the orogen and were progressively involved in the deformation during the forelandwards propagation of the thrust front.

Inherited weakened hinge zones between Mesozoic carbonate platforms and intervening pelagic basins were positively inverted or re-activated during the Miocene chain building, as privileged bends for strain partitioning.

From the late Miocene onwards, the inner sectors of the Sicilian belt were repeatedly affected by extensional tectonics. The collapse of the tectonic edifice was realised through the activation of a low-angle extensional fault system with Tyrrhenian immersion. Extension is expressed overall by the backsliding of the inner Sicilian-Maghrebides tectonic units (negative inversion).

During the Plio-Pleistocene strike-slip tectonics affected northern Sicily, related to a W-E deep-seated dextral simple shear fault zone located in the Southern Tyrrhenian border. The neotectonic evolution continues to be imposed by the counterclockwise rotation of the African Plate. The southern Tyrrhenian dynamics acts on the northern Sicilian Maghrebides by diachronous activation of en-echelon, NW-SE to W-E dextral and N-S/NE-SW sinistral strike-slip faults or shear zones, progressively affecting the chain from west to east since the late Pliocene-early Pleistocene.

The tectonic settlement has been described with a structural map and a lot of cross sections in scale 1:250.000.