Low temperature thermochronology data along a transect through Catena Costiera and Sila Massif, southern Italy

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The Calabrian-Peloritani arc is a little emerged-above-sea-level portion of an orogenic wedge seated on top of a narrow and active subduction zone. The evolution of the orogenic wedge accompanied a process of southeastward slab retreat which led to Tertiary Tyrrhenian sea opening. The concomitance of forward migration of the subduction trench and back-arc crustal extension led within the wedge to the nearly coeval processes of nappe thrusting and orogenic extension. Low temperature thermochronology allow to trace the evolution of the rocks through the last kilometer of exhumation toward the surface. During the last two decades, low temperature thermochronology provided an ideal method to constraint both the importance of postorogenic extension and timing of shortening-extension pear migration. In this work we integrated AFT literature data with a new apatite (U-Th)/He along an orthogonal to main structures transect between Tyrrhenian to Ionian sea. In Eastern Sila, AFT data show that most of the different portions of the Sila basement cooled at 18 -13 Ma with an inception of the main exhumation phase at 17–18 Ma driven by top to the east thrust imbrication and erosion. (U-Th)/He ages results to be slightly younger but close to the AFT age values. This indicate a rapid phase of exhumation followed by an abrupt decrease of the exhumation rate. Literature AFT data from Catena Costiera and western Sila massif are similar and slightly younger than in the Sila eastern side. So are new U-Th/He data. Low temperature data constrain between 12-10 Ma the latest stage of the exhumation mainly driven by top-to-the-W ductile-to-brittle extensional tectonics, involving both areas as a single block only later on interested by high angle normal faults forming the Crati Valley that now separate the two areas. High-angle controlled opening of Crati valley and marine ingression occurred immediately after.

Integrating geophysical evidences and new seismological data in the Calabrian Arc subduction area

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The geodynamics of the Western Mediterranean region has been characterized in its recent history by southeast-ward rollback of the Ionian subducting slab and progressive detachment of its deepest portion. Detachment is believed to have occurred with a tear process propagating from the edges of the subducting structure to the center of it, corresponding to the Calabrian Arc area. Regional tomographies of body wave velocities at intermediate depths have better detailed the key sector of the Calabrian Arc by showing an in-depth continuous slab only beneath the central part of the Arc itself. A review of these results and the most recent geophysical investigations (see e.g., D'Agostino et al., GRL 2011; Faccenna et al., TECT 2011; Polonia et al., TECT 2011; Neri et al., IJES 2012) seem to indicate a residual rollback of the Ionian subducting slab and a consequent very slow trench retreat just in the central part of the Arc (roughly corresponding to southern Calabria), and approximately locate the lateral borders of this central sector close to NW-trending seismogenic faults of northeastern Sicily (i.e. the Tindari zone) and northern Calabria (i.e., Crotone Basin). In agreement with the model introduced by Govers & Wortel (EPSL 2005) to describe the dynamics at the borders of retreating subduction slabs, these seismogenic faults have been proposed by several authors as possible STEP (Subduction-Transform Edge Propagator) fault zones. New estimates of focal mechanisms and hypocenter locations of shallow-to-deep earthquakes have been performed in order to better detail the main geometric and kinematic features of these potential STEP fault zones. The spatial distribution of earthquakes and their source kinematics framed in the local geodynamic scenario and jointly evaluated with the above mentioned geophysical data give new insights on the subduction system structure and dynamics.

Pattern and rate of post-20 ka vertical tectonic motion around Capo Vaticano promontory (W Calabria, Italy) based on offshore geomorphological indicators

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The magnitude and rate of Late Pleistocene – Holocene vertical tectonic movements offshore Capo Vaticano (western Calabria) have been quantified on the basis of the depths of infralittoral prograding wedges (IPWs) and associated abrasion platforms formed during the stillstand of the Last Glacial Maximum (LGM). These features were identified on high-resolution reflection seismic profiles acquired along the continental shelf and upper slope around the promontory. The pattern of vertical movements of the Capo Vaticano promontory is characterized by a marked asymmetry associated with a NE-directed tilt. Removal of the non tectonic component of vertical changes using an ice-volume equivalent eustatic sea-level compilation indicates ~11 (± 5) m of uplift and ~25 (± 5) m of subsidence during the post-LGM from southwest to northeast along the promontory over a distance of ~22 km. The resulting uplift and subsidence rates (including both regional and local components) for the last 20.350 (± 1.35) years are 0.52 (±0.28) mm/ka and 1.23 (±0.32) mm/ka, respectively. Results are consistent with estimates from the analysis of raised Upper Holocene shorelines and from longer-term estimates based on uplifted 215-80 ka old coastal terraces. Integration of offshore and coastal markers indicates a pattern of episodic tilting of Capo Vaticano. Our data provide also evidence that the WNW–ESE striking Coccorino and Nicotera normal faults offshore the SW coast of the promontory were inactive during the post-LGM, and thus are not responsible for tilting of the promontory during the last 20 ka.