Geophysical Research Abstracts
Vol. 13, EGU2011-3219, 2011
EGU General Assembly 2011

Crustal strike-slip kinematics in Sicily (Central Mediterranean)

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The central Mediterranean region is represented by a complicate tectonic framework originated in the large context of convergence between Afro-Adriatic and European plates. The major structural domain is formed by the orogenic belt, which rose up during the Neogene to Quaternary orogenic shortening.
During the orogenic building the area was characterized by the coexistence of extensional and compressive processes interacting with each other in the later orogenic phases. These processes gave rise to new structural features and strongly modified those pre-existing, thus creating complicated structures in the area.
Thanks to geophysical investigation a collision stage has been recognized below the Tyrrhenian shoreline of Sicily. The Panormide continental crust is colliding with the Africa continental crust of the Pelagian Block. The geological evidence of this collisional stage is manifested in the NW-SE oriented South Tyrrhenian System (STS) characterized by dextral faults, affecting both the offshore and the onshore of Sicily. The Patti area (located in north-eastern Sicily, is characterized by a set of dextral faults belonging to the STS. Further, NE-SW left-lateral faults and N-S oriented normal faults, as well as south-verging thrusts occur. The structural data obtained by geological mapping suggest that this complicate set of faults could look as the superficial expression of main NW-SE crustal elements, which drive the shifting of the orogenic belt toward south-east, in the Calabrian Arc where the subduction is still active. Thus, surface expression of these crustal features is represented by en-echelon arranged fault segment widely diffused along northern Sicily. Updated geological field maps indicate that the STS is well developed in western Sicily. A clear example can be observed in the east-west oriented Rocca Busambra-Monte Kumeta ridges, located south of Palermo town. There a Meso-Cenozoic carbonate sequence, belonging to the Pelagian-Sicilian Thrust Belt, crops out. The ridges are bounded by reverse faults and controlled by NW-SE oriented transcurrent faults with dextral component. Two main shear zones are drawn, based on the mesostructural measurements carried out in the field work. The sigmoidal characters of the ridges, as well as those of the fold axis, indicate a dextral movement.
The boundary between the collisional setting to the west and the still subducting Ionian slab to the east is represented by the Vulcano Line, a NNW-SSE oriented fault, that cross the Eolian Islands and separates the sector with active volcanic islands to the east (Lipari, Vulcano, Panarea, Stromboli) from the western islands (Alicudi, Filicudi), where volcanism is not active. At the same time, Etna volcano, located along the Ionian coast, lies close to the boundary between the collisional area and the still subducting Ionian slab, and it appear bounded by two main right-lateral kinematic junctions. These latter, which nucleated in response to general indentation at orogenic hinge, are characterized by dextral motion as suggested by focal mechanism of deep earthquakes and large dragging folds in the Messinian – Early Pliocene deposits. The propagation of main trascurrent faults produced in the etnean region associated deformations consisting of roughly N-S striking tension structures near parallel to the maximum stress axis. This extensional fault system caused crustal thinning and could have favoured a more efficient magma uprise from the mantle that led to the growth of the main bulk of Etna stratovolcano during the past 120 ka.
Moreover, new high resolution morpho-bathymetric data, collected on the Ionian Sea reveal that NW-SE trascurrent faults seems to propagate in the etnean off-shore.