Geophysical Research Abstracts
Vol. 13, EGU2011-13187, 2011
EGU General Assembly 2011

Constraining the slip rate of active faults on Mt. Etna using cosmogenic He exposure dating of basalts

Davide D'Amato (1), Luigia DiNicola (2), Finlay Stuart (2), Bruno Pace (1), and Francesco Visini (1)

(1) Department of Science, University of Chieti, Chieti Scalo, Italy (d.damato@unich.it), (2) Scottish Universities Environmental Research Centre, East Kilbride, United Kingdom (f.stuart@suerc.gla.ac.uk)

Mount Etna, Sicily, is situated at the intersection of the outer front of the late-Quaternary S-verging Apennine Maghrebian thrust, and N-S oriented extensional structures formed in response to a possible reactivation of Malta Escarpment. Consequently it is tectonically, as well as volcanically, active. The eastern side of the volcano is affected by extension, and the flank is sliding eastward. The Pernicana fault system (PFS) represents the northern boundary of the unstable eastern flank. It is a W-E left transtensive fault that is down-thrown to the south. It has been active since the late Pleistocene-Holocene, it cuts basaltic lavas over a length of about 18 km, with a maximum throw of 30 m. The system is a complex of dextral en echelon segments with an overall direction of N°110 E. The western and central sectors are characterized by stick-slip behaviour and frequent earthquakes over magnitiude 4.0 (e.g. 02/04/2010, M = 4.2). The eastern part is characterized by stable-sliding motion with aseismic creep. The slip rate of the central part of the fault (5 to 35 mm/yr) has been determined by geodetic levelling in the last 20 years, and antropic manufact displacement measurements from 1920. In the western sector, slip rates of 5 to 20 mm/yr have been determined from the displacement of lavas erupted since 1614 AD. In order to determine the long-term vertical displacement rates of Pernicana fault system we have initiated a program of dating lava flows that are cut by the fault using in situ cosmogenic He exposure ages. Initial effort has concentrated on the western sector, and the first site chosen is a basalt flow near Mongibello that is cut by a 13 m fault scarp. Pyroxene phenocrysts from six samples of uneroded flow tops from the hanging wall of fault scarp yield exposure ages ranging from 0.9 to 1.2 kyr yielding an average age of 1,088 $\pm$ 96 years. This suggests that the western sector of the PFS has had an average vertical slip rate of 11-12 mm/year over the last 1,000 years. This is close to the average rate determined from historical data and implies that slip rates have not changed significantly in the last 1,000 years. More dating work is underway to calculate the slip rate in an longer temporal window with the aim of understanding the fault behaviour in the past and improving predictions of earthquake occurrence.