Geophysical Research Abstracts
Vol. 12, EGU2010-5867, 2010
EGU General Assembly 2010

Inception of a reverse fault (Changhua Fault, Western Foothills of Taiwan): chronological constraints from cosmic ray exposure modeling

Lionel Siame (1), Rou-Fei Chen (2), Florence Derrieux (1), Jian-Cheng Lee (2), Didier Bourlès (1), Régis Braucher (1), Kuo-Jen Chang (3), and Jacques Angelier (4)

(1) Centre Européen de Recherche et d'Enseignement en Géosciences de l'Environnement (C.E.R.E.G.E.) – U.M.R. 6635 CNRS-INSU, Université Aix Marseille, B.P.80, Plateau de l'Arbois, 13545, Aix-en-Provence cedex 4, France, (2) Institute of Earth Sciences, Academia Sinica, 128 Academia Road Sec. 2, Taipei 115, Taiwan, Republic of China , (3) Department of Civil Engineering, National Taipei University of Technology, Taipei, 106, Republic of China, (4) Géoazur, La Darse, B.P. 48 06235 Villefranche-sur-Mer Cedex France

To tackle the history of active thrust or reverse faults, it is often necessary to open the observation window on time scales on the order of 10^4-10^5 years by studying the morphologies associated to their activities. Because fluvial systems are particularly sensitive to recent environmental changes, geomorphic features such as alluvial terraces are frequently used as markers to gauge deformation. Together with the measurement of cumulative displacements, the chronological framework of emplacement and abandonment of these geomorphic markers is thus fundamental to determine fault slip-rates integrated over long periods of time. In Taiwan, the active faults were extensively studied and abundant geodetic and seismic data are available. If the morphology associated to the fault activity can now be detailed with a high level of resolution (e.g., digital elevation models derived from LIDAR or photogrammetry techniques), the use of alluvial terraces is often hampered by the absence of well-documented ages for the deformed, and partially preserved alluvial surfaces. The western Foothills of Taiwan are characterized by a series of sub-parallel, west-verging thrusts, which results from the westward propagation of the mountain fronts since the Plio-Pleistocene. The gently tilted Quaternary alluvial terraces that spread out on the mountain belt piedmont are likely being closely associated with the activity of these thrusts. In this study, we focused on the west side of the 100-km-long Chelungpu Fault, which ruptured on the 1999 Mw 7.6 Chi-Chi earthquake. In this populated area, the blind-thrust Changhua Fault, which runs at the western toe of the Pakua tableland, is one of the active frontal thrusts, representing a high-level of seismic hazard. As a result of the movement of the Changhua Fault, the Pakua Anticline is an active fault tip fold which deformed the sediments initially deposited in the foreland basin, as well as a series of wide unpaired river terraces that have been abandoned at the southern tip of the tableland. Since the entrenchment and abandonment of these alluvial terraces is directly linked to the growth of the Pakua Anticline, those terraces have thus long been considered as key geomorphic markers to reconstruct the chronological framework of the fold growth. This later is still a matter of debate, and to overcome this issue, we measured and modeled the in situ-produced 10Be concentrations along several meters deep profiles sampled within the alluvial material of three fluvial terraces on the Pakua Anticline. Our results indicate that (1) the chronological framework of entrenchment and abandonment of the terraces spans the last 400 kyr, (2) the folding inception associated to the Changhua Fault may have started $\sim$200 kyr ago, and (3) the uplift rate of the Pakua Anticline, integrated over the last $\sim$100 kyr, is on the order of $\sim$2.5 mm/yr. In agreement with published pedogenic studies in the same region, our results also suggest that landforms can be preserved over 10^5 years in highly dynamic context such as tropical Taiwan.