Geophysical Research Abstracts
Vol. 12, EGU2010-11196, 2010
EGU General Assembly 2010

Pleistocene deformation and landscape evolution in the Tehran plain: results from tectonic geomorphology and TCN-dating

Angela Landgraf (1), Lucilla Benedetti (2), Regis Braucher (2), Didier Bourles (2), Paolo Ballato (1), Manfred R. Strecker (1), Anke M. Friedrich (3), Saeid H. Tabatabaei (4), and Majid Shahpasandzadeh (5)

(1) Universität Potsdam, Inst. für Geowissenschaften, Golm, Germany (landgraf@rz.uni-potsdam.de, +49 331 977 5700), (2) CEREGE, CNRS-IRD-Université Aix-Marseille, F-13545 Aix-en-Provence, France, (3) Department für Geo- und Umweltwissenschaften, Universität München, Germany,, (4) Building and Housing Research Center, Tehran, Iran, (5) Kerman Graduate University of Technology, Kerman, Iran

The ENE-to NW-striking North Tehran Fault (NTF) is an active frontal thrust that delimits the Alborz Mountain range to the south with an up to 2000 m topographic break with respect to the adjacent Tehran plain. Eocene rocks of the Alborz range are thrust over Neogene and Quaternary sediments of the Tehran plain. The NTF constitutes right-stepping segments and merges to the east with the active Mosha-Fasham strike-slip fault (MFF). The historical record of destructive earthquakes lists numerous events on faults in this region, but instrumentally recorded seismicity appears to be focused on the eastern segment of the MFF. The youngest manifestations of deformation along the eastern segment of the NTF and the MFF are faults with normal and left-lateral oblique normal fault kinematics. Along the NTF, this youngest phase of activity is documented by meter-scale fault gouge zones, multiple colluvial wedges with drag features, subsidiary faults, and numerous striated and rotated conglomeratic clasts. Rupture traces and filled extensional cracks reaching the surface document the seismogenic nature of these features. The middle and western segments of the NTF, however, show evidence for Quaternary left-oblique and pure thrusting. These faults displace Quaternary fluvial sediments and alluvial fan deposits. This pattern of deformation also characterizes the Tehran plain in the southern foreland of the Alborz mountains. The western sector of the plain is deforming by (partly blind) thrusting, as manifested by a segmented and internally deformed anticline and abandoned and diverted channels on both sides of this structure. The recency of faulting at depth and corresponding surface deformation can be inferred from 10Be-dating of an adjacent river terrace and possibly postdates 25ka. The central sector of the plain, which forms the substratum of the Tehran megacity, is affected by thrusting and left-lateral strike-slip faulting and contains several sets of uplifted fluvial terraces. These terraces and the associated deformation pattern are reminiscent of a transpressional foreberg structure, with part of the deformation occurring on a blind fault. The age of these terraces, however, is uncertain. Chi^2-fitting of a TCN depth profile reveals that the second-highest terrace level is in steady–state, yielding an effective age of $\sim$195ka, hence indicating a Pleistocene deformation age. In contrast to these environments, the eastern footwall of the NTF is affected by left-transtension, possibly related to either the left-bending of the NTF or a horsetail-termination of eastern NTF strike-slip faulting. The topography reflects the geometry of a relay ramp with an elevated footwall, which progressively decreases towards west and terraces which become increasingly abandoned westward. The second highest terrace level of this ramp-structure is $\sim$195-ky-old, as independently determined by Chi^2-fitting of 10Be- and 36Cl-depth-profiles, indicating activity at least since the middle Pleistocene. Where the eastern NTF bounds this structure, a channel is currently incising a dioritic sill, forming a pronounced knickpoint and leaving behind two abandoned narrow bedrock channels at 5m and 1.70m above the recent channel. 36Cl dating of these paleo-channels resulted in 3290 +/- 408 and 1591+/-223 years, respectively. This could indicate pulsed incision ($\sim$ 1.5 and 1.1 mm/a, respectively) related to dip-slip motion of the NTF. In contrast, farther downstream and south of the ramp structure, another fluvial terrace (81m above the Jajrud channel), dated by Chi^2-fitting of 10Be- and 36Cl depth profiles, reveals an age of $\sim$ 46ka, corresponding to an incision rate of $\sim$1.8mm/a. Thus, the incision observed at the NTF might just mimic the change in base level, caused by the Jajrud incision downstream and may thus not reflect pulsed tectonic activity during late Holocene time. In any case, although the manifestations of ongoing deformation along the NTF are scarce, numerous faults and deformed Quaternary units in its footwall and in the Tehran plain unambiguously demonstrate that this region is tectonically active, although perhaps not on time scales spanning the ultimate

millennia.