Geophysical Research Abstracts
Vol. 20, EGU2018-14352-1, 2018
EGU General Assembly 2018

Exhumation and topography of the High Atlas (Morocco)

Riccardo Lanari (1), Maria Giuditta Fellin (2), Claudio Faccenna (1), Maria Laura Balestrieri (3), Frank Pazzaglia (4), Youbi Nasrrddine (5), and Colin Maden (2)

(1) Università di Roma Tre, Roma, Italy (riccardo.lanari@uniroma3.it), (2) ETH Zurich, Switzerland, (3) CNR, Istituto di Geoscienze e Georisorse, Firenze, Italy, (4) Lehigh university, Bethlehem, PA, USA, (5) Université Cadi Ayyad, Marrakech, Morocco

The High Atlas of Morocco is a double-vergent mountain belt with a maximum elevation over 4 km, which developed during the Cenozoic by the transpressive inversion of Triassic-Jurassic rift structures. Its Cenozoic evolution is tied to that of the Anti-Atlas, its southern foreland, and of the Siroua volcanic massif. In order to unravel the exhumation and surface evolution of the orogen, we compare the spatial exhumation pattern at the broad scale with geomorphic parameters as, for instance, topographic swath profiles and steepness index of rivers. We integrate our analysis also with the deformation history along the main faults bounding the High Atlas. We present 35 new mean (U-Th-Sm)/He (AHe) and 24 new fission-track ages (AFT) on apatite from the High Atlas and from the Anti-Atlas. Our new AHe ages range from 141.1 Ma to 5.1 Ma and our new AFT ages range from 196.0 Ma to 10.4 Ma. The Miocene-to-Pliocene cooling ages are found in the axial region of the High Atlas whereas in the Anti-Atlas the youngest cooling age is Oligocene (33.8 Ma). In the High Atlas, our new data together with previously published results, constraint the amount of Cenozoic exhumation between > 4 km and < 6 km and the maximum exhumation rate in the range of 0.22 - 0.25 Km/Ma. In the Anti-Atlas, the maximum amount and rate of Cenozoic exhumation are $\leq$ 2km and $\sim$ 0.05 Km/Ma, respectively. Close to the southern and northern bounds of the High Atlas belt, exhumation from a depth >1.9 km and <4 Km occurred in the Miocene along transpressive and thrust faults. In the High Atlas, the spatial patterns of the amount and rate of exhumation and of the topography are similar. In fact, exhumation peaks along the belt axes where the topography is higher, the belt is narrower and the steepness indexes of rivers are higher. Moreover, it decreases with the topography northward and southward towards the forelands, and westward and eastward as the belt becomes wider and as stratigraphically younger units are exposed at surface. Uplift of the Anti-Atlas and of the Siroua group likely controlled the different base levels along the southern flank of the High Atlas and affected the river steepness. The topography across the mountain belt is asymmetric with the southern flank steeper and narrower than the northern flank but the precipitation pattern is symmetric suggesting that tectonic is the primary control in the surface evolution of the High Atlas.