Geophysical Research Abstracts
Vol. 13, EGU2011-4113-1, 2011
EGU General Assembly 2011

Changing rates and patterns of surface uplift at the southern margin of the Central Anatolian plateau (Turkey): New data from marine stratigraphy and cosmogenic nuclide dating of river terraces

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Despite recent advances in understanding the uplift of the Anatolian Plateau, the exact onset, rates, and the underlying mechanisms of uplift for one of the world's great orogenic plateaus have remained largely enigmatic. We use detailed stratigraphic and chemo-stratigraphic observations, geomorphic data, and cosmogenic nuclide dating of fluvial terraces in the Mut Basin and adjacent areas to decipher the uplift history of the southern margin of the plateau. Uplifted marine sediments together with geomorphic markers of fluvial incision record surface uplift magnitudes and rates through time. In addition to this record of growing topography, changing patterns of uplift throughout the region provide an unprecedented opportunity to assess potential mechanisms of uplift.

The Mut Basin spans the 2 to 3-km-high southern margin of the Central Anatolian plateau. The basin's middle to late Miocene marine sediments are exposed at up to ca. 2 km elevation. Biostratigraphic and Sr-isotope data for the youngest and highest marine sediments indicate that surface uplift must have started after ca. 7 to 8 Ma, suggesting a long-term average surface uplift rate of 0.2-0.3 mm/yr. An additional Pliocene to Early Pleistocene marine succession, inset within the older marine succession, but currently found at elevations as high as 1.2 km, shows that the Mut Basin experienced a period of incision, renewed marine sedimentation, and subsequent surface uplift. This younger uplifted marine succession implies an average post-Early Pleistocene surface uplift rate of ca. 0.7 mm/yr. Within the Mut Basin, a series of fluvial strath terraces from ca. 150 to 30 m above the thalweg of the Göksu River record its incision through the basin sediments. Chert clasts from gravel deposits atop the terraces yield cosmogenic 10Be and 21Ne exposure ages that generally agree within error, and yield incision rates of ca. 0.6-0.7 mm/yr from ca. 200 ka to 30 ka. The good agreement between the terrace-derived incision rates and the post-early Pleistocene uplift rates suggests that the river incision resulted from surface uplift rather than climatic or sedimentologic changes within the catchment. Differences between the post-7 to 8 Ma uplift rate (0.2-0.3 mm/yr) and the post-Early Pleistocene uplift rate (0.6-0.7 mm/yr) imply that the margin experienced either increasing uplift rates through time, or multiple phases of uplift separated by one or more hiatuses.

Recent work comparing this record of surface uplift to the subsidence and uplift history of the Adana Basin, located south of the southern margin of the plateau (Radeff et al., 2011, EGU General Assembly), gives clues to spatial patterns of uplift. Initial uplift of the southern margin after 7 to 8 Ma was associated with subsidence of the Adana basin, while later margin uplift was coupled with uplift of the Adana basin. While lithospheric delamination combined with slab break-off or slab break-off alone can explain the pattern and magnitude of early margin uplift, a different mechanism is likely for the later coupled uplift, such as blockage of the subduction zone south of Cyprus when the Eratosthenes seamount entered the trench in Early to Middle Pleistocene time.