Geophysical Research Abstracts
Vol. 15, EGU2013-11575, 2013
EGU General Assembly 2013

Thermo-rheological mechanism for forearc high uplift at accretionary margins: Explaining the uplift of southern Turkey.

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Various mechanisms including slab break-off and asthenospheric upwelling have been proposed as drivers behind the post-8 Ma surface uplift of the southern margin of the Central Anatolia orogenic plateau, in central Turkey. However, recent tomography studies clearly show the intact Cyprus slab underlying this area. Previous studies confirm that this domain is controlled by diffuse shortening, related to slab subduction beneath the Cyprus arc. Here, we use a compilation of own and available geologic studies as constraints for 2D thermo-mechanical finite elements models of the central Cyprus arc. We demonstrate that sediment accretion and deposition at the central Cyprus arc causes growth of the Anatolian upper plate including the associated forearc basin system. Crustal thickening leads to higher temperatures at the base of the crust, thermal weakening and thus viscous deformation. This viscous deformation drives subsequent surface uplift of the modern Taurus Mountains. These models not only explain the formation of the Taurus forearc high, but also successfully reproduce the modern sedimentary thicknesses and geometries of the central Cyprus forearc basin system, as demonstrated by comparison with a transect running from the Cyprian arc trench to the Central Anatolia Plateau interior. This forearc basin system is formed by (i) the Messaoria Basin trench-slope, (ii) the Kyrenia Range trench-slope break, (iii) the Outer Cilicia Basin, as an active seaward forearc basin and (iv) the Central Taurides, representing the forearc high and enclosing behind (v) the Mut Basin, a relict landward forearc basin.
Our models show that, even in the less favorable low viscous rheologies, forearc highs eventually arise without the need of a “backstop-type” lithological contrast. Thus, forearc highs should be considered not singular features but rather an integral part of forearc systems that develop at advanced states of evolution of accretionary wedges.