Using thermochrometry to image topographic evolution in the Northern Apennines, Italy

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Shallow isotherm surfaces tend to follow the overlying surface topography, with the degree of smoothing increasing with depth. The closure isotherms for (U-Th)/He and fission-track (FT) apatite are shallow enough (< ~3 km) that they are strongly affected by surface topography. Thus, these cooling ages should provide information about the surface topography at the time of closure. We exploit this concept here using a dense suite of (U-Th)/He and fission-track apatite ages from the northern Apennines, and numerical inverse methods that allow estimation of the evolution of surface topography from the cooling ages.

Stratigraphic evidence indicates that the Apennines emerged above sea level at ~5 Ma. Our expectation was that topography and relief would have increased over the last 5 m.y., reaching the maximum elevations observed today of ~2500 m. Age-elevation relationships show a linear increase in age with elevation at the local scale. However, at the regional scale, the cooling ages are inversely correlated with elevation. This relationship is diagnostic of a *decrease* in relief with time. We have analyzed both the FT and He apatites ages using a finite-element routine (PECUBE) and also a fourier-based routine. The best-fit solution was found by numerical search. We find that the relief of the range has decreased since emergence, by a factor of 2 or 3 starting at ~8 Ma. This result makes sense given that the Apennines started at ~30 Ma as a large submarine subduction wedge. The large relief before 8 Ma reflects the large submarine relief of the wedge at that time and the relatively constant sea floor tempetures in the Mediterranean (~14 C). This wedge was reduced in size when it emerged as it overrode the passive margin of the Adriatic platform.

Geodynamic implications of rapid denudation of the granitoids at about 50 and 20 Ma in the Eastern Pontides, Turkey: Apatite fission-track results

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The Cretaceous to Recent geological evolution of the Turkish eastern Pontides has been governed by the fate of two "Neo-Tethyan" ocean basins. The northern branch of the "Neo-Tethys" was bounded by the Eurasian plate (EP) in the north and the Tauride-Anatolide platform (TAP) in the south, and the southern branch was limited by the TAP in the north and by the Arabian plate (AP) in the south. In the eastern Pontides, the northern "Neo-Tethyan" convergence between the EP and TAP seems to have been responsible for the widespread Cretaceous to late Palaeocene extensional arc magmatism, the late Palaeocene to early Eocene denudation-accompanied, post-collisional magmatism, and the middle to late Eocene within-plate extensional magmatism. The closure of southern "Neo-Tethys" was followed by Oligo-Miocene intra-continental convergence that maintained regional shortening and crustal thickening in the eastern part of Turkey, from the eastern Pontides in the north to the BZS in the south. This ongoing convergence between the EP and AP has also governed the neotectonics of Turkey. The apatite fission-track age versus elevation profile of the Dereli-Sebinkarahisar granitoids, in the eastern central Pontides reveals rapid (>1 mm a^{-1}) denudation between 48 and 57 Ma, which is interpreted as a result of the late Palaeocene-early Eocene collision between the EP and TAP along the IAES zone. The age versus elevation profiles along a N-S transect from the Black Sea coast to the Coruh river valley through the composite Kackar batholith in the eastern Pontides indicate tectonic exhumation between 17 and 23 Ma at rate of 0.4 – 0.5 mm a^{-1}. This episode is interpreted as related to the Oligo-Miocene collision between the EP and AP.