

Paleothermal and thermochronological indicators to constrain the foot-wall exhumation of the Altotiberina low angle normal fault system (Northern Apennines, Italy)

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ABSTRACT

We present a kinematic reconstruction of the Altotiberina normal fault (Northern Apennines) constrained by using thermochronological and paleothermal analyses.

The Altotiberina fault system (ATF) has been acting since late Pliocene times as a low angle extensional detachment dipping to the East, characterized by both along dip and along strike irregularities, a staircase trajectory and shallow part flattened to horizontal.

The kinematic evolution, the evaluation of extension amount and the minimum topography were reconstructed by restored cross section by Mirabella et al., 2011. Relative difference between “Minimum topography” and present-day topography provided an elision of some Km of sediments.

In order to constrain the amount of the missing sediments and reconstruct the burial and exhumation history of the Umbria Marche succession related to the latest Neogene-Quaternary extension due to the ATF activity, we performed thermochronological (U-Th/He and apatite fission tracks) and paleothermal (vitrinite reflectance and illite content in mixed layers illite-smectite) analyses. The upper Triassic-Serravallian sedimentary succession cropping out in the area was sampled at three different structural levels of the extensional fault system crossing the ATF foot-wall and hanging-wall. Within the stratigraphic succession, paleothermal data indicate a general increase from top ($R_o\%$: 0.26-0.4% I% in I-S: 40-50%) to bottom ($R_o\%$: 1.03-1.22, I% in I-S: 77-85%) of the succession. These thermal maturity trends were confirmed by that observed in the Mt. Civitello well. In fact, the thermal maturity of the Triassic unit sampled at surface was similar to that calculated for subsurface samples suggesting a strong exhumation of the foot-wall of Altotiberina fault.

Low temperature U-Th/He data are generally reset and indicate an increase of exhumation age from the internal (mean age of 3 Ma) to the external (mean age of 4.3 Ma) sector. Moreover exhumation rates indicate values up to 0.8 mm/yr at the ATF foot-wall, and up to 0.5 mm/yr at the fault hanging-wall. We discuss our data and interpretations on exhumation ages and

rates in the framework of the ATF foot-wall uplift induced by the Neogene-Quaternary fault activity.

KEY WORDS: Apatite fission tracks, Altotiberina fault, mixed layers illite-smectite, Northern Apennines, (U-Th)/He dating, vitrinite reflectance.