Geophysical Research Abstracts
Vol. 19, EGU2017-17123-2, 2017
EGU General Assembly 2017

Tectono-sedimentary evolution of the Palazzuolo anticline (Northern Apennines – Italy)

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The Santerno valley (Northern Apennines, Italy) offers very good exposures of the regional scale Palazzuolo anticline, a thrust-related fold that represents one of the major deep-rooted contractional structures in this portion of the chain. Good outcropping conditions allowed the study of the detailed geometry and deformational processes affecting the anticline. The growth of the Palazzuolo anticline started during the deposition of the Langhian-Tortonian foredeep deposits of the Marnoso-Arenacea Formation and affected its sedimentation forming a composite growth wedge whose thickness decreases by 70% from the basin depocenter to the anticlinal crest. The growth of the anticline was steered by a major blind thrust characterized by a flat-ramp-flat geometry that only during the latest stages of its activity (reasonably Plio-Quaternary) cut out-of-sequence through the crest-forelimb transition and produced a well-developed footwall drag syncline (Castellaccio thrust). Burial by the eroded portion of the Marnoso-Arenacea Formation and the overlying ocean-derived Ligurian units is inferred to have caused a maximum temperature in the studied sandstones of $\sim$100-110°C (from vitrinite reflectance and clay minerals data), while paleofluid temperatures inferred from calcite vein structural diagenesis (petrography, O and C stable isotope geochemistry, and microthermometry) are inferred to be lower than $\sim$70°C. The collected multidisciplinary dataset integrated with the high-resolution physical stratigraphy allowed us to constrain the tectono-sedimentary evolution of the Palazzuolo anticline along a balanced cross-section and its sequential restoration. Temporal constraints and eventual multiple stages of the fault activity are being investigated through (U-Th)/He dating of apatites and K-Ar isotopic dating of authigenic synkinematic illite related to the brittle faulting accommodated along the Castellaccio thrust.