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Role of low angle normal faulting and basement thrusting on the structural architecture of the Northern Apennines (Italy)

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The Northern Apennines of Italy are a classical site for studying fundamental issues in thrust wedges, such as ophiolite formation and emplacement, interplay between tectonics and sedimentation, role of out-of-sequence thrusting, syn-orogenic versus post-orogenic extension, along strike segmentation, etc. Accordingly, the Northern Apennines have been extensively studied since more than two centuries ago. Despite the huge amount of available data with different resolution, a 3D comprehensive regional view combining in a modern framework all available surface and subsurface information for contiguous sectors of the chain is still lacking. We performed such an attempt in the area framed between the Taro valley to the north and the northern termination of the Alpi Apuane to the south. The region includes the main morphostructural zones of the North-West Apennines from the Tyrrhenian coast West-Northwest of La Spezia, through the main topographic divide of the Apennines, to the external frontal part of the chain. The area has been investigated through a multidisciplinary approach that integrated: 1) surface geological data collected during the last two decades of structural and stratigraphic field works in the internal as well as external sectors of the chain; 2) subsurface geological data including: a) interpretation of ∼1200 Km of seismic reflection profiles tied to surface geology and b) analysis of 39 boreholes stratigraphies. The construction of two regional NE-SW trending cross-sections (the Levanto-Pontremoli-Parma to the North and the La Spezia-Sarzana-North Apuane-Cerreto to the South), connected by the NW-SE trending Taro River-Lunigiana Area-Alpi Apuane composite section, allowed us to illustrate (i) the role of out-of-sequence blind thrusting in the basement, (ii) the presence of low angle normal faulting and its relationships with recent to active high angle normal faulting. Both extensional and contractional systems have relevant implications for the tectonics of the Northern Apennines as well as the seismotectonics of the studied region.