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# 3D structural modeling and restoration of the Apennine-Maghrebian chain in Sicily: application for non-cylindrical fold-and-thrust belts

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Thirteen seismic reflection profiles and field observations have been used to build a three-dimensional geological model of the sub-surface architecture of the Trapanese carbonate platform unit of the Apennine-Maghrebian chain in the Mt. Kumeta and Mt. Rocca Busambra (NW Sicily, Italy). Two different kinematic evolutionary scenarios can be envisaged on the basis of seismic interpretation, either a single step or a two-step thrust-fault deformation model, but the integration of 3D model reconstruction and 3D geomechanical restoration, validates only the scenario with a single stage of deformation.
The 3D model highlights along strike variation of the structural style for the Trapanese unit where pre-existing discontinuities (e.g. inherited Mesozoic normal faults) have a strong influence on the structural style and played an important role in the preferential occurrence of hinterland verging structures. In detail, backthrusts (N-verging) are dissected by tear faults along the Mt. Kumeta structure whereas an imbricate backthrust system evolves into thrust along the Mt. Rocca Busambra structure. Shortening estimate indicates low amount of internal deformation affecting the carbonate platform units (< 15%). The combined approach of three-dimensional geological modeling and restoration allowed us to: (i) discriminate the best structural interpretation for the subsurface architecture of the Apennine-Maghrebian chain, detecting issues or inconsistencies in previous seismic interpretations and (ii) propose a valuable tool for hydrocarbon exploration to be applied in other complex structural areas worldwide.