



Seismic interpretation and 3D geological reconstruction of the foredeep Laga basin (Central Italy): relationships between compressive structures and extensional faults

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The area interested by the 2016-2017 seismic sequence is located in a tectonically complex region Central Italy. Here, the compressional structures show a very complex pattern: both Umbria-Marche and Gran Sasso Domains overthrust the synorogenic Messinian Laga Domain, through arc-shaped major thrusts, namely the M. Sibillini thrust and the Gran Sasso thrust. The Laga basin is filled by turbiditic sedimentary sequences, mostly included into the Laga Formation, classically considered the fill of a deep marine foredeep basin connected to the flexure of the Adriatic lithosphere. The relationships between the old inherited tectonic structures and the more recent normal faults of the basin is still not constrained at depth due to lacking of clear subsurface images.

In this work, we present the results obtained by seismic interpretation of a set of seismic profiles in the area of the Laga basin between the M. Sibillini and the Gran Sasso thrusts. We have reconstructed the top of Carbonate sequence, below the Messinian Laga sequence, and the top of Triassic evaporites. This latter was useful also to reconstruct the trajectory and the geometry of the main basal thrust of the study area (Acquasanta thrust). The 3D geometry of the main normal faults has been also reconstructed and the relationship with the main thrust has been investigated through several geological sections, parallel and orthogonal to the tectonic transport.

The seismic data allowed a detailed reconstruction of the Acquasanta anticline geometry. In the northern sector, the anticline is a typical box-fold, ENE-verging, characterized by forelimb dips higher than the backlimb ones, and a N-S trending fold axis. The geometry and the wavelength of the anticline is strongly controlled by the basal thrust located within the Triassic evaporites. The anticline is interrupted by a E-W trending fault, probably formed during the compressive tectonic transport. The results of the seismic interpretation confirm a structural disharmony of the clastic succession with respect to the deeper folds involving the Mesozoic carbonates, due to the occurrence of a shallow detachments. In the southern sector, i.e. the seismogenic part of the Laga basin (close to Amatrice and Camposto villages), the geometry of the deep geological structures is complicated by occurrence of important NNW-trending, WSW-dipping normal faults. We have defined the geometry of the normal fault systems in the Laga basin, responsible of recent and historical seismicity respectively. These normal faults cut the previous compressive tectonic systems without any evidence of negative inversion of the inherited structures.

The results of this study demonstrate that interpretation of seismic profiles is an essential approach for the reconstruction of the 3D geometry of deep geological structures in such complex tectonic setting of the Apennines.