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The Late Miocene-Early Pliocene out-of-sequence thrusting event: new insights into the tectonic evolution of the southern Apennines (Italy)

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We present a structural study on late Miocene-early Pliocene out-of-sequence thrusts affecting the southern Apennine chain. The analyzed structures are exposed in the Campania region (southern Italy). Here, leading thrusts bound the N-NE side of the carbonate ridges that form the regional mountain backbone. In several outcrops, the Mesozoic carbonates are superposed onto the unconformable wedge-top basin deposits of the upper Miocene Castelvetero Group, providing constraints to the age of the activity of this thrusting event. We further analyzed the tectonic windows of Giffoni and Campagna, located on the rear of the leading thrust. We reconstructed the orogenic evolution of this part of the orogen. The first was related to the in-sequence thrusting with minor thrusts and folds, widespread both in the footwall and in the hanging wall. A subsequent extension has formed normal faults crosscutting the early thrusts and folds. All structures were subsequently affected by two shortening stages, which also deformed the upper Miocene wedge top basin deposits of the Castelvetero Group. We interpreted these late structures as related to an out-of-sequence thrust system defined by a main frontal E-verging thrust and lateral ramps characterized by N and S vergences. Associated with these thrusting events, LANFs were formed in the hanging wall of the major thrusts. Such out-of-sequence thrusts are observed in the whole southern Apennines and record a thrusting event that occurred in the late Messinian-early Pliocene. We related this tectonic episode to the positive inversion of inherited normal faults located in the Paleozoic basement. These envelopments thrust upward crosscut the allochthonous wedge, including, in the western zone of the chain, the upper Miocene wedge-top basin deposits. Finally, we suggest that the two tectonic windows are the result of the formation of an E-W trending regional antiform, associated with a late S-verging back-thrust, that has been eroded and crosscut by Early Pleistocene normal faults.