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Inversion tectonics in the Neogene basins of Tuscany (Northern Apennines, Italy): Insights from the Pisa-Viareggio basin.

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Several sedimentary basins are located in the internal portion of the Northern Apennines, bordering the eastern side of the Northern Tyrrhenian sea. These basins trend almost parallel to the Apennine range and are filled by Neogene sediments with thickness ranging between few 100's m to few km (Martini et al., 2001). Sediments belonging to these basins crop out extensively in western Tuscany, often appearing heavily deformed. Although classically interpreted as extensional basins (e.g., Martini and Sagri, 1993 and references therein), some papers call for an initial thrust-related origin (Finetti et al., 2001; Bonini and Sani, 2002), and the long-lasting debate about the origin of the Neogene basins of Tuscany is still ongoing (cfr. Brogi 2011 and Sani et al., 2004).
This contribution aims at presenting the case of the Pisa-Viareggio basin, which is the northernmost one among the large basins of Tuscany (Pascucci et al., 2007). This basin straddles the coastline and has been investigated through the interpretation of a grid of industrial seismic profiles covering the Pisa plain and tied to exploration wells.
In the Pisa-Viareggio basin seismic profiles show a west-dipping listric extensional fault that bounds the basin to the east, supporting an extensional origin. The basin is filled with up to 3 seconds of upper Messinian to Quaternary sediments, and extension mostly occurred during late Messinian-early Pliocene, although continuing with reduced intensity till the Quaternary. The southern part of this basin shows a superimposed contractional deformation (tectonic inversion), that progressively increases to the south, where the basin appears completely overturned and eroded in the Livorno Mountains. The basin-boundary fault trends roughly NNW-SSE and is buried in the Quaternary sediments of the Pisa plain, but it turns rather abruptly to N-S and NNE-SSW in the south, near Livorno. Inspection of detailed geological maps (Lazzarotto et al., 1990) suggests that the fault plane have been uplifted and exposed in the Livorno Mountains, located just east of Livorno. The timing of the contractional deformation that affected the southern part of the Pisa-Viareggio basin can be roughly constrained within the Pleistocene.
We speculate on the possible causes of the intense deformation that affected the southern part of the Pisa-Viareggio basin and attempt to show that the tectonic history of this basin can possibly help to better understanding the evolution of the other Neogene basins, located further to the south, which suffered deformation and uplift to a larger extent.

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