Geophysical Research Abstracts
Vol. 20, EGU2018-4551, 2018
EGU General Assembly 2018

Deformed stratigraphic markers in the shallow subsurface of the Po Plain: possible indicators of recent tectonic activity

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The Po Basin is a wedge-top basin developed atop a system of blind thrusts that represent the most external structures of the Apenninic chain. These structures were originally considered to be inactive. Geomorphological and geophysical studies have supported the hypothesis of a recent activation of several blind thrusts. This hypothesis has been confirmed for some areas (e.g., the “Mirandola anticline”) by two M=6 earthquakes that struck Emilia-Romagna in 2012.
This research program aims at understanding the extent to which recent tectonics may affect Quaternary stratigraphy on short (millennial to centennial) temporal scales. In order to detect tectonically-induced deformation of Late Pleistocene and Holocene deposits, distinct types of stratigraphic markers were used. These include:
(i) Paleosols. Pedogenically modified horizons on flat floodplain surfaces represent key markers for high-resolution stratigraphic analysis, because of their high correlation potential. Two weakly developed paleosols were mapped in the Po Plain: the paleosol formed at the onset of the Last Glacial Maximum (29-24 ka) and the paleosol related to the Yonger Dryas cooling event (12.9-11.7 ka).
(ii) Peat layers (swamp deposits) and lagoonal horizons (9-6 ka). Brackish deposits, in particular, are the most reliable stratigraphic markers, as they represent horizontal layers at time of deposition.
(iii) Fluvial channel-belts. These thick sand bodies have complex internal architecture. Individual channel bodies have very reduced correlation potential, owing to their lenticular geometry. In contrast, laterally extensive, sheet-like, channel-belt sand bodies can be used to detect major dislocations.
Geological cross-sections across key stratigraphic areas and 3D mapping outline remarkable deformation of late Quaternary deposits above the main buried tectonic structures, with dislocations of several meters. The deformation of stratigraphic markers is interpreted to reflect the combined effect of recent tectonic activity and differential subsidence due to sediment compaction.