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Subsurface geology of the Lusi region: preliminary results from a comprehensive seismic-stratigraphic study.

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We investigate the subsurface data of a large sector in the Sidoarjo district (East Java, Indonesia) where the sudden catastrophic Lusi eruption started the 26th May 2006. Our goal is to understand the stratigraphic and structural features which can be genetically related to the surface manifestations of deep hydrothermal fluids and thus allow us to predict possible future similar phenomena in the region.
In the framework of the Lusi Lab project (ERC grant n° 308126) we examined a series of densely spaced 2D reflection commercial seismic lines This allowed the reconstruction of the lateral variability of key stratigraphic horizons as well as the main tectonic features.
In particular, we shed light on the deep structure of the Watukosek fault system and the associated fracture corridors crossing the entire stratigraphic successions.

To the South-West, when approaching the volcanic complex, we could identify a clear contrast in seismic facies between chaotic volcanoclastic wedges and clastic-prone sedimentary successions as well as between the deeper stratigraphic units consisting of carbonates and lateral shales units. The latter show possible ductile deformation associated to fault-controlled diapirism which control in turns deformation of overlying stratigraphic units and deep geo-fluids circulation. Large collapse structures recognized in the study area (e.g. well PRG-1) are interpreted as the results of shale movement at depth. Similarly to Lusi, vertical deformation zones (“pipes”), likely associated with deeply rooted strike-slip systems seem to be often located at the interface between harder carbonate rocks forming isolated build ups and the laterally nearby clastic (shale-prone)-units.
The mechanisms of deformation of structural features (strike vs dip slip systems) which may affect either the basement rock or the overlying deeper stratigraphic rocks is also being investigated to understand the relationship between deep and shallower (i.e. meteoric) fluid circulation.
Seismic stratigraphic study of the basin margin (closer to volcanic accumulations) will also allow reconstructing the relationships between present and past volcanic activity recorded in the deep subsurface with the genesis of piercement structures and development of vertical deformation zones