ICG2022-611
https://doi.org/10.5194/icg2022-611
10th International Conference on Geomorphology

Dismantling a volcanic edifice by deep-seated landslides: the case of the eastern Monte Amiata (Italy).

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The Monte Amiata is a volcano located in central Italy composed by trachytic to olivine latitic lava flows and domes emplaced between 305 and 231 ka (Pleistocene). These volcanic products, affected by saprolite alteration processes of spatially variable intensity, unconformably overlie Pliocene marine clayey sediments, as well as the Ligurian units stacked during the Northern Apennines orogeny. The Monte Amiata area has been attracting much attention from research and industry because of its economic importance in the field of geothermal energy, ore deposits and groundwater supply, hence a quite detailed geologic framework is available for this area. Instead, less efforts were made toward the understanding of the widespread gravitational processes affecting the eastern side of the volcanic edifice, often involving the transition between the volcanic rocks and the underlying sedimentary units, where many natural springs arise. The main urban agglomerations developed in this geologic setting, so buildings and infrastructures have been suffering damages caused by landslide processes over large areas. In this context, remote sensing imagery analysis, geomorphological surveys, engineering geology sub-surface investigations and ground displacement monitoring by integrating GNSS, robotic total station and geometric levelling allow us to map the main geomorphological features and infer the geometry and displacement rates of landslides occurring in the eastern side of the Monte Amiata volcano. The results suggest the occurrence of complex gravitational processes with different kinematic characteristics, state of activity and depth of the rupture surfaces. By cross-referencing the new quantitative data collected with the geomorphological evidences and the existing literature, we propose a model for the progressive dismantling of the eastern slopes of the Monte Amiata volcano caused by the interaction among complex gravitational movements affecting, at different structural levels, both the sedimentary units and the volcanic rocks. Moreover, detailed mapping of the saprolite derived by weathering of lava flows is provided and contextualised in the post-volcanic evolution of the Monte Amiata volcano.