EGU21-5083
https://doi.org/10.5194/egusphere-egu21-5083
EGU General Assembly 2021


# The Luco dei Marsi deep-seated gravitational deformation: first evidence of a basal shear zone in the central Apennine mountain belt (Italy)

**Emiliano Di Luzio**[1], Marco Emanuele Discenza[2], Maria Luisa Putignano[1], Mariacarmela Minnillo[2], Diego Di Martire[3], and Carlo Esposito[4]
[1]CNR - Consiglio Nazionale delle Ricerche, IGAG - Istituto di Geologia Ambientale e Geoingegneria. Area della Ricerca RM1, Via Salaria Km 29,3, Monterotondo Stazione - Roma, Italy (emiliano.diluzio@igag.cnr.it; marialuisa.putignano@igag.cnr.it)
[2]Geoservizi S.r.l. Via Luigi e Nicola Marinelli, 86025, Ripalimosani, Italy (discenza@geoservizisrl.net; minnillo@geoservizisrl.net)
[3]Università di Napoli "Federico II", Distar - Dipartimento di Scienze della Terra, dell'Ambiente e delle Risorse. Via Cinthia, 21, 80126, Napoli, Italy (diego.dimartire@unina.it)
[4]Università di Roma "Sapienza", Dipartimento di Scienze della Terra. Piazzale Aldo Moro, 5, 00185, Roma, Italy (carlo.esposito@uniroma1.it)

The nature of the boundary between deforming rock masses and stable bedrock is a significant issue in the scientific debate on Deep-Seated Gravitational Slope Deformations (DSGSDs). In many DSGSDs the deforming masses move on a continuous sliding surface or thick basal shear zone (BSZ) [1-3]. This last feature is due to viscous and plastic deformations and was observed (or inferred) in many worldwide sites [4]. However, no clear evidence has been documented in the geological context of the Apennine belt, despite the several cases of DSGSDs documented in this region [5-6].

This work describes a peculiar case of a BSZ found in the central part of the Apennine belt and observed at the bottom of a DSGSD which affects the Meso-Cenozoic carbonate ridge overhanging the Luco dei Marsi village (Abruzzi region). The NNW-SSE oriented mountain range is a thrust-related Miocene anticline, edged on the east by an intramountain tectonic depression originated by Plio-Quaternary normal faulting. The BSZ appears on the field as a several meters-thick cataclastic breccia with fine matrix developed into Upper Cretaceous, biodetritic limestone and featuring diffuse rock damage.

The gravity-driven process was investigated through field survey, aerial photo interpretation and remote sensing (SAR interferometry) and framed into a geological model which was reconstructed also basing on geophysical evidence from the CROP 11 deep seismic profile. The effects on slope deformation determined by progressive displacements along normal faults and consequent unconfinement at the toe of the slope was analysed by a multiple-step numerical modelling constrained to physical and mechanical properties of rock mass.

The model results outline the tectonic control on DSGSD development at the anticline axial zone

and confirm the gravitational origin of the rock mass damage within the BSZ. Gravity-driven deformations were coexistent with Quaternary tectonic processes and the westward (backward) migration of normal faulting from the basin margin to the inner zone of the deforming slope.

**References**

[1] Agliardi F., Crosta G.B., Zanchi A., (2001). Structural constraints on deep-seated slope deformation kinematics. Engineering Geology 59(1-2), 83-102. https://doi.org/10.1016/S0013-7952(00)00066-1.

[2] Madritsch H., Millen B.M.J., (2007). Hydrogeologic evidence for a continuous basal shear zone within a deep-seated gravitational slope deformation (Eastern Alps, Tyrol, Austria). Landslides 4(2), 149-162. https://doi.org/10.1007/s10346-006-0072-x.

[3] Zangerl C., Eberhardt E., Perzlmaier S., (2010). Kinematic behavior and velocity characteristics of a complex deep-seated crystalline rockslide system in relation to its interaction with a dam reservoir. Engineering Geology 112(1-4), 53-67. https://doi.org/10.1016/j.enggeo.2010.01.001.

[4] Crosta G.B., Frattini P., Agliardi F., (2013). Deep seated gravitational slope deformations in the European Alps. Tectonophysics 605, 13-33. https://doi.org/10.1016/j.tecto.2013.04.028.

[5] Discenza M.E., Esposito C., Martino S., Petitta M., Prestininzi A., Scarascia-Mugnozza G., (2011). The gravitational slope deformation of Mt. Rocchetta ridge (central Apennines, Italy): Geological-evolutionary model and numerical analysis. Bulletin of Engineering Geology and the Environment,70(4), 559-575. https://doi.org/10.1007/s10064-010-0342-7.

[6] Esposito C., Di Luzio E., Scarascia-Mugnozza G., Bianchi Fasani G., (2014). Mutual interactions between slope-scale gravitational processes and morpho-structural evolution of central Apennines (Italy): review of some selected case histories. Rendiconti Lincei. Scienze Fisiche e Naturali 25, 161-155. https://doi.org/10.1007/s12210-014-0348-3.