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Large-scale gravitational deformations and quaternary faulting: the case of the south-western side of the Mt. Morrone (central Apennines, Italy)

S. Gori (1), M. Coltorti (2), F. Dramis (6), F. Galadini (1), P. Galli (3), B. Giaccio (4), P. Messina (4), A. Pizzi (5), A. Sposato (4)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italy (galadini@ingv.it), (2) Dipartimento di Scienze della Terra, Università di Siena, Siena, Italy (coltorti@unisi.it), (3) Dipartimento della Protezione Civile, U. Servizio Sismico Nazionale, Roma, Italy (Paolo.Galli@protezionecivile.it), (4) Istituto di Geologia Ambientale e Geoingegneria, CNR, Roma, Italy (paolo.messina@igag.cnr.it), (5) Dipartimento di Scienza della Terra, Campus Universitario, Università "G. D'Annunzio", Chieti, Italy (pizzi@unich.it), (6) Dipartimento di Scienze Geologiche, Università degli Studi "Roma Tre", Roma, Italy (dramis@uniroma3.it).

The present work aims to add new data to improve the comprehension of the relationship between tectonics and large-scale gravitational deformations. According to the present literature, tectonics may play an active or passive role in the gravitational evolution of mountain slopes. The passive role is related to the structural setting inherited by previous, no more active, tectonic phases. Rock movements may occur along faults planes, being just triggered by erosional processes and/or seismic shaking. The role of active tectonics, instead, is represented by the morphological modifications that surface faulting produce on slopes, determining an increase of relief energy and (of) rocks stress.

The present paper deals with the case of the Morrone ridge, a Neogene thrust front located in the outer sector of the central Apennine foreland fold and thrust belt (Abruzzi Apennines), in order to define the relationship between an active fault system potentially responsible for high-magnitude seismic events and the occurrence of large-scale gravitational movements.

The Mt. Morrone relief delimits the eastern border of the Sulmona basin, a tectonic depression the formation of which is due to the activity of two parallel normal fault segments affecting the $\sim$20 km long Mt. Morrone western slope. The Late Pleistocene-Holocene activity of these normal fault branches has been already documented in the past. Along the same slope, landforms and structures, such as trenches and small depressions, representing the surficial expression of Deep Seated Gravitational Movement (DSGM), have been detected at different elevations a.s.l.. The highest trench is very long and almost continuous, bounding the higher part of the slope for over 20 km from the Pescara river valley to the Pacentro village. A series of relatively shorter trenches, in the order of 1-2 km long, affects the middle-lower part of the slope.

Geological, structural and geomorphological surveys have been carried out along this mountain slope in order to achieve information about the kinematic history and behaviour of these DSGM and to define their relationship with the fault system activity. Moreover, paleoseismological trenches have been dug across two of the gravitational trenches, in order to detect possible evidences and chronological constraints for the DSGM formation and evolution.

All the data indicate that the DSGM affecting the SW slope of the Mt. Morrone took place after the Early-Middle Pleistocene, since slope-derived breccias, related to this chronological interval, have been displaced by the opening of a gravitational trench. Small displacements of colluvial units which fill the trenches (dated at 10660-10540 cal. b.C./ 10430-9910 cal. b.C. and 21440$\pm$120 BP) might represent the effects of the gravitational deformation. This probably represents the secondary effect of the fault system activation, and indicates that the Mt. Morrone normal fault system played an active role in the evolution of the large-scale gravitational deformation.