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# *Epitome*

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owing to its influence on mountain villages in the past and, at present, on the penstocks of the Ceresole-Rosone hydroelectric plant, which have been suffering constant deformations since their construction, completed in 1930. The sliding affects the orthogneisses of the Gran Paradiso unit, and is located at the step between two NW-SE trending major faults. Three main joint sets affect the rock mass, facilitating its generalized dislocation. Outcrops of silvery micaschists, thought by some authors to be the relicts of high-pressure mylonites, are found in the upper part of the landslide, trending parallel to the slope, as most of the gneissic schistosity.
Since 1960 numerous boreholes and investigation campaigns have been concerning the eastern, mostly detritic sector, where the penstocks are located; an integrated monitoring system including GPS stations is presently working, recording movements of up to 15 mm/year in periods of heavy rain. Up to date, apart from field data, little information was available concerning the rest of the landslide, where large dislocated basement outcrops occur.
New investigations, whose results are presented in this work, were carried out in 2006 including field surveys, deep boreholes and seismic tomography, aiming to define the slide geometry with respect to the existing hydroelectric tunnels, especially in its poorly known uppermost part.
The base of the slide lies at a maximum depth of 160-170 m from the surface, much deeper than previously known from investigations in the eastern area, where the penstocks lie and where an average depth of about 40 m is reported.
Boreholes show a gradual transition to the sound basement rock, by progressive disappearing of voids and crushed zones, still present at depth, anyway, even where no active sliding is supposable any more. Seismic tomographies confirm this gradual transition within the landslide body.
It is not possible to identify a single sliding plane; movements occur at different depths and ssem to be mostly related to micaschist levels; local sliding along the regional schistosity cannot be excluded as well.
Crushing of the rock mass and erasing of the schistose levels are frequent along the sliding surfaces; friction products include gravelly to clayey incoherent material, often characterized by a chloritic composition. Saturation of such levels facilitates the movement onset.
The dislocation of the rock mass determine an overall high permeability, which explains the absence of groundwater during drilling. However, signs of infiltrating water are clearly visible over the entire sliding mass and even in the sound basement rock, which in normal conditions appears to be drained as well.
The sliding surfaces are connected by sub-vertical steps relatable to the main structural discontinuity sets, as most of the trenches in the ridge zone. The basal sliding surface rises from the central sector eastward, reaching the surface where the penstocks start; westwards it goes up more gradually, keeping a few tens of meters depth, up to its morphologically poorly defined western edge.

## T35-16 Poster Falcucci, Emanuela

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**DETECTION AND ANALYSIS OF DEEP SEATED GRAVITATIONAL SLOPE DEFORMATION IN THE CENTRAL AND SOUTHERN APENNINES**

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*Key terms: deep seated gravitational deformations; parametric inventory; central and southern Apennines*

Modern geomorphological investigations have been properly focused on the definition of the major factors conditioning the landscape evolution. The interaction of some of these factors as the litho-structural setting, the local relief, the tectonic activity, the climatic conditions and the seismicity plays a key-role in determining large scale slope instability phenomena which displays the general morphological features of deep seated gravitational deformations (DSGD).
The present work aims to detect the large scale gravitational deformation affecting the central and southern Apennines and to provide an accurate description of the morphologic features of the deformations by means of aerial photograph interpretation and geological/geomorphological field surveys. In particular, our goal is the detection of all the DSGD affecting this part of the Italian Peninsula and to make a parametric inventory scheduling a series of parameters: the geographic localization; the geological-structural features of the slope affected by the DSGD; the tectonic framework of the sector in which the DSGD is located; the morphologic and morphometric features of the slope; the topographic profile of the slope; the definition of the DSGD activity. Hence, these parameters allow to provide a qualitative and quantitative description of the DSGD and information useful for a better definition of the deformation mechanism.
The fact that, according to the present literature, i) the DSGD may evolve in rapid, catastrophic mass movements (e.g. Vajont, Val Pola) and ii) this paroxistic evolution of the deformations may be triggered by high magnitude seismic events, permits to better understand the necessity to map in detail these large scale slope instability phenomena, defining their geometrical and kinematical characteristics, in a perspective of land-use planning of a part of the Italian territory, such as the central and southern Apennines, characterized by a high magnitude historical seismicity.

## T35-17 Poster Galvani, Alessandro

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**GEODETIC AND GEOMORPHOLOGIC INVESTIGATIONS ACROSS THE CENTRAL APENNINES (ITALY)**

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*Key terms: GPS; Active tectonics; large scale gravitational deformations*

Insights about active deformation in the Central Apennines are derived from the distribution of the historical and instrumental seismicity and from geometry and kinematics of active fault systems. GPS data represent a powerful tool to understand the present active deformation of the area. In order to cast light on the complex regional kinematic pattern, characterised by faults inherited from the pre - Quaternary tectonic regime, but responsible for the formation of Pleistocene intramontane basin, the geodetic GPS network, "CA_GeoNet (Central Apennine Geodetic Network), was set up and monitored by the Istituto Nazionale di Geofisica e Vulcanologia since 1999, with the aim to estimate the active strain rate of the area. The network is distribuited across the Apennine regions of Umbria , Abruzzo, Marche and Lazio covering an area of ~ 180x130 km. from the Tyrrhenian to the Adriatic sea, across the main seismogenic faults. In this study we show the new GPS velocity field obtained from GPS data collected since 1999. Data analysis performed with Bernese 5.0 software, shows strain at ~ 10 nanostrain and identify areas with different velocity patterns. In the Fucino area three vertices were located on areas involved on large scale gravitational movements. The residual GPS signal obtained after the removal of the signal related to surficial gravitational movements due to large scale deep seated slides, show results which are consistent with the present tectonic regime.
The geological and geomorphological analysis, allowed to define the kinematics of gravitational displacements and their relationships with tectonically - controlled modifications of the landscape. The GPS data provide a new quantitative analysis of horizontal and vertical displacements and, linked with the detecting of the geomorphic features of large scale deep seated slides, has implications for the displacements evolution and the hazard of this region.

## T35-18 Poster Giardino, Marco

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**THE QUART-CROCE DI FANA DEEP-SEATED GRAVITATIONAL SLOPE DEFORMATION (AOSTA VALLEY): GEOMORPHOLOGICAL AND TECTONIC FACTORS IN THE STABILITY OF LARGE VALLEY SLOPES**

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*Key terms: Deep-seated Gravitational Slope Deformation (DGSD); Neotectonics; Dissolution phenomena*

The Quart-Croce di Fana Deep-seated Gravitational Slope Deformation (DGSD) affects a portion of the Aosta Valley characterized by an extremely complex and articulated recent geological and geomorphological history. It is located on the left hydrographical side of the middle Aosta Valley, a multi-km, E-W segment of this wide alpine valley system. Here structures and landforms are strongly conditioned by the Aosta-Ranzola fault zone, one of the more important neotectonic lineament in the NW-Alps, whose deformational history range from Oligocene to Present.
Detailed geomorphological mapping and morphostructural studies of the Quart-Croce di Fana DGSD, evidenced very distinctive associations and patterns of erosional and depositional landforms (rochees moutonnees, spill-ways, erratics, till deposits at various elevation) and deep-seated phenomena (dissolutions and collapses) and superficial slope deformations (trenches, closed and lengthen depressions, counter-slope scarps) often involving and displacing glacial landforms.
Complexity of structural and geomorphological settings derived by the contemporary action of several processes, whose importance and mutual interaction may change during the time. The principal processes are:
- the Neotectonic activity of the Aosta-Ranzola shear zone, in relationship to the pre-existing geo-structural setting and to the evolutionary stages of the valley side;
- the deep dissolution phenomena evidenced by high sulphates contents of the deep waters sampled in the hydroelectrical tunnel
- the glacial and fluvial-glacial modelling, progressive overdeepening of the valley and later release of glacial pressure, at the withdrawal phases;
- Gravity, either causing "deep-seated" movements or shallow instabilities.
Analyses of the role of these different "instability factors" lead to the proposal of an interpretative model for Quart-Croce di Fana DGSD evolutionary stages. The glacial dynamics and the contemporary- to post-glacial hydrogeological processes follows important climate-related variations, affecting both the surface drainage and the underground water circulation. The Quart-Croce di Fana DGSD represents a good example of this articulate evolution trend. Also, the role of the Aosta-Ranzola shear zone seems to be confirmed: its important tectonic activity causes a notable state of fracturing on the basement. The induced secondary permeability allowed the superficial waters to reach the evaporite layers located in specific tectonic positions: dissolution and collapses process activated, and propagated causing the slope deformation. Traces of this dissolution are clearly visible and affect different portions of the rock masses, being formed in different periods. This events succession seems to be related to the successive thalweg settings during the erosional deepening of the Aosta Valley.
All the above mentioned processes, combined in space and time, and with a mutual varying grade of importance, gave origin to the present day aspect of the Quart-Croce di Fana DGSD and still have a role in conditioning natural instability. Evidences based on the analysis of recent deformations on buildings and other recent man-made structures and on levelling and GPS measures confirm that the gravitational phenomenon is still active. Also the interaction between the slope dynamics and one important underground infrastructure indicated the importance of a general deformational model to be associated to preliminary quantifications of the present-day deformational rates.

## T35-19 Poster Guerricchio, Alessandro

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**THE WIDE DSGSD (OR GRAVITATIVE TERRITORIAL DEFORMATION-) IN SERRA STELLA, SPEZZANO DELLA SILA, TRIGGERED BY THE METAMORPHITES OF THE BAGNI UNIT (COSENZA PRESILA)**