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Evaluation of tectonics and landscape evolution as predisposing factor for a Mass Rock Creep deforming slope in the Zagros Belt (Iran)

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In the hillslope landscapes of tectonically active regions, the steep topography represents the most evident result of rock uplift, valley incision and landslide erosion. In response to rock uplift, relief and hillslope dip increase linearly in time mainly due to fluvial erosion processes in landscapes affected by low to moderate tectonic forcing. Nonetheless, such a linear increase in relief and hillslope dip is limited by the reaching of threshold slope conditions associated with the hillslope material strength, until the latter is exceeded by gravitational stress giving rise to bedrock landslides. In this regard, Mass Rock Creep (MRC) process may become a primary factor for damaging rock masses so leading to slope failures that generate huge rock avalanches. MRC acts on large time-space scale through a continuous and non-linear variation of stress-strain conditions of entire portions of slopes and the coupled role of tectonics and landscape evolution represents a predisposing factor for Deep Seated Gravitational Slope Deformations (DSGSD).

This research focused on the Loumar DSGSD that affects the NE slope of the Palganeh anticline in the Lorestan region (Zagros Mts., Iran), almost 90 km northwest of the Seymareh landslide which is more famous as it represents the largest landslide on Earth surface. The Loumar DSGSD evolution is strictly related to the vertical and lateral growth of the fold and to the evolution of the Seymareh river drainage system that kinematically released the slope at the bottom likely causing the initiation of the deformational process. We combined an inverse modelling of the river profiles linked to the fold uplift history and the analysis of a plano-altimetric distribution of geomorphic markers, correlated to the detectable knickpoints along the river longitudinal profiles, which allowed to constrain the main morpho-evolutionary stages of the valley. These data will be used to constrain a Landscape Evolution Model (LEM) and a stress-strain numerical model, to be performed under time-dependent creep conditions, that will be calibrated by a back analysing the slope evolution from the LEM. The final goal will be to discuss the possible role of impulsive triggers (earthquakes) in anticipating the time-to-failure of the MRC deformational process.

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