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Slope instabilities of the Larzac Plateau: the Pégairolles-de-l'Escalette rotational landslide

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Keywords: landslides, rotational, Larzac, slope instabilities

ABSTRACT IN FRENCH:

Le plateau du Larzac est affecté par plusieurs mouvements de terrain, allant du basculement à des grands mouvements de versant rotationnels, évoluant dans la série sédimentaire allant des argiles à évaporites du Trias au carbonates de l'Hettangien. Ce travail se concentre sur le glissement rotationnel de Pégairolles-de-l'Escalette, afin d'identifier des scénarios de rupture permettant d'expliquer son activité actuelle. Les observations de terrain montrent que le massif est découpé par deux familles de discontinuités en plus de la stratigraphie. Le Rock Mass Rating (Bieniawski, 1993) est utilisé in-situ afin d'obtenir des paramètres mécaniques pour le massif carbonaté. Les modélisations à l'équilibre limite montrent que c'est essentiellement le niveau piézométrique et les niveaux de faiblesses mécaniques qui gouvernent ces instabilités.

INTRODUCTION

The Larzac carbonate plateau extending from Millau (Aveyron) to Lodève (Hérault) is subjected to various slope instabilities, from rock toppling, to large rotational landslides. Our study focusses on the deep-seated landslide located on the right bank of the Lergue river, close to Pégairolles-de-l'Escalette village and the A75 highway (Fig. 1). Its activity, with a low slip rate of 3 mm/year, has been characterized through in situ (borehole) geophysical monitoring (Denchick et al., 2019).

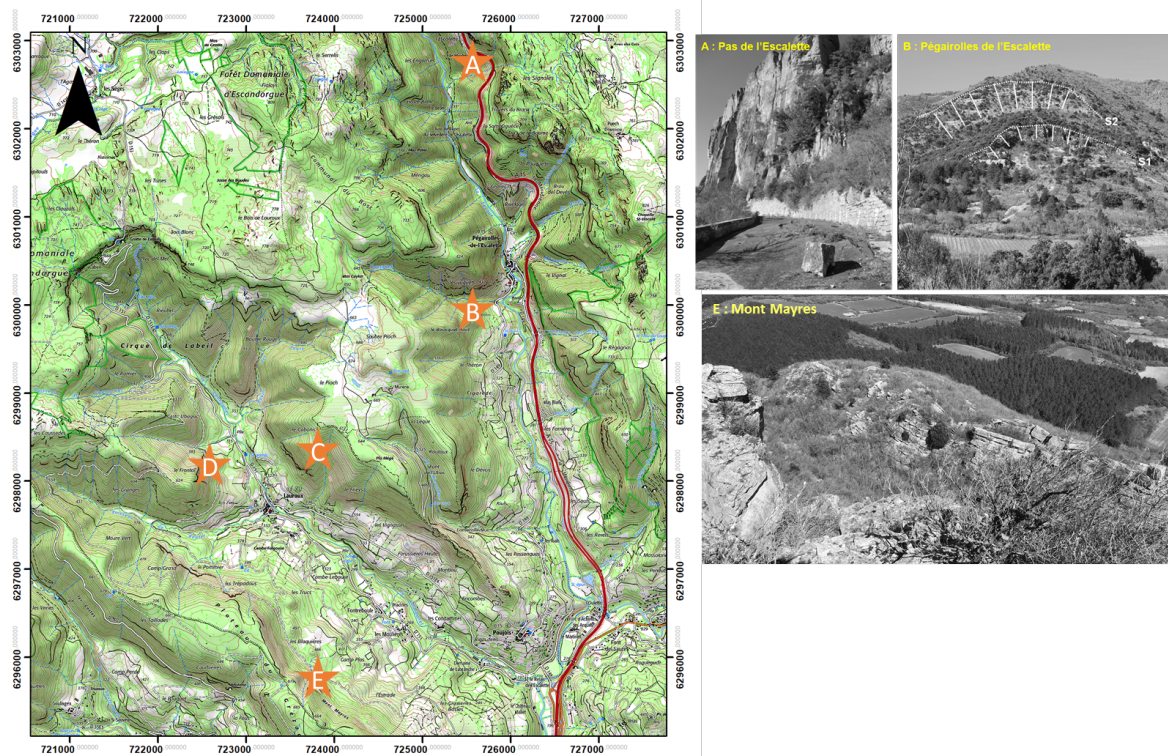


Figure 1: geological mapping illustrating the location of the different landslides or rocks toppling, A: Pas de l'Escalette, B: Pégairolles-de-l'Escalette, C: Le Cabanis, D: Le Frontal and E: Mont Mayres

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The geologic model of the landslide is given in Fig. 2. The rotational slide involves sedimentary rocks from Norian (Triassic) claystones and evaporites to Hettangian carbonates and includes several slides surfaces. The presence of similar landslides in the area (Fig. 1), suggest a common (causal) factor.

1 AIM OF THE STUDY

The goal of our work is to find the failure scenario accounting for the current activity of the sliding mechanism. For this purpose, several failure scenarios are proposed from field data and evaluated through 2D slope stability simulation based on through 2D slope stability simulation based on the strength reduction analysis approach (implemented in OPTUM G2 software).

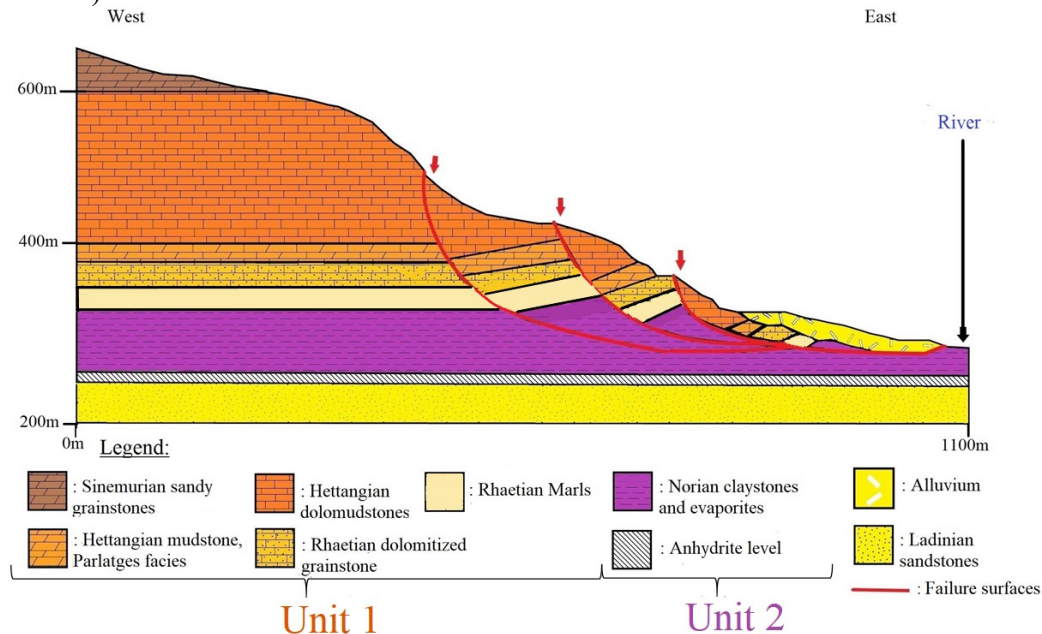


Figure 2: Geological cross-section of the Pégairolles-de-l'Escalette landslide. This geological model has been simplified for the numerical simulations into two lithological units (Unit1: Late Triassic sandstones and Jurassic carbonates and Unit 2: Triassic clays). Location of the deep-seated failure surfaces are given after Denchick et al. (2019).

2 RESULTS

Field data, that include geomorphological mapping, measurements of the fractures network, and Rockschmidt (Unconfined Compressive Strength, UCS) measurements of the geological units, show that upper units are cut by a dense network of discontinuities. Three families are present: bedding planes, subvertical NNW-SSE joints and subvertical WSW-ESE joints. Using these data we applied a Rock Mass Rating (Bieniawski, 1993) analysis to propose failure scenarios based on the Hoek-Brown and Mohr-Coulomb failure criterion for the carbonates rocks. Due to the lack of outcrops of Norian clays, UCS values were obtained from literature (Hoek, 1990). Borehole information available informs about anhydrite intercalated in Norian clays (Denchik *et al.*, 2019). The five failure scenarios tested were based on a bilayer geological model: carbonates overlying claystones. These scenarios illustrate the role of joints, anhydrite levels and water table on the slope stability.

CONCLUSION

These numerical simulations demonstrate the importance of considering both joints and weak mechanical levels like anhydrite bed, but also the main role of water table as key parameters governing slope instabilities in heterogeneous rock medium like sedimentary rocks.

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