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Multi-methodological stability analysis of the slope beneath the "Magna Mater" temple in the Palatino archaeological area (Rome, Italy)

Emiliano Di Luzio (1), Gianluca Bianchi Fasani (2), and Bretschneider Alberto (2)

(1) CNR-ITABC, Istituto per le Tecnologie Applicate ai Beni Culturali, Area della Ricerca di Roma RM 1 - Montelibretti, Via Salaria km 29.300, C.P. 10 - 00016 Monterotondo Stazione, Rome (Italy), (2) Università di Roma “La Sapienza”, Dipartimento di Scienze della Terra, Piazzale Aldo Moro, 5, 00185, Rome (Italy)

The Palatino Hill is among the main archeological sites of the roman antiquity as it was inhabited since the foundation (VIII sec a.C), hosted several religious buildings of the Republican age and became the main headquarters location during the imperial time. This archaeological site, belonging to the wider Fori Romani-Colosseo-Palatino archaeological area, nowadays needs continuous care and application for its preservation and valorization. Among the main problems, geo-hazard linked to slope instability seriously affects in particular the SW slope of the Palatino Hill, because of the local geomorphological conditions.
The CNR-ITABC (Istituto per le Tecnologie Applicate ai Beni Culturali, i.e. Institute for Technologies Applied to the Cultural Heritage) of the CNR (Consiglio Nazionale delle Ricerche, i.e. National Research Council) completed a multi-methodological slope stability analysis of the rock slope underlying the temple of the Magna Mater, a religious building built between the 294 and 191 BC. Evidence of local instability are documented in historical times and can still be observed in middle slope, tuff rock faces.
Starting from the reconstruction of the geological bedrock around the investigate slope, different methodologies were used in a multiple-step analysis. Discrete field criteria were used to evaluate stability conditions along single discontinuities within the tufitic rock masses, including: i) analysis of fracture systems and slope attitude for the evaluation of kinematic compatibility to failures through the application of the Markland criteria; ii) geomechanical RMR classification for the determination of rock mass quality and rock mass equivalent parameters; iii) geomechanical SMR classification for a preliminary planning of site remediation. Moreover, a limit-equilibrium slope stability analysis was performed using different calculation methods to determine safety factor values (Fs) for sliding surfaces supposed throughout the volcano-sedimentary multilayer featuring the slope. Finally, an advanced 2D continuum modeling was realized through a FLAC (Fast Lagrangian Analysis of Continua) analysis using a finite difference calculation method in order to model the behavior of the slope system and to analyze the stress/strain conditions.
Result of such multi-methodological approach allowed to understand the real causes of local instability within the tuff rock masses and, at the same time, to exclude an overall slope instability; the same results were used by the Roman Archaelogical Board to define a plane for geohazard reduction and site remediation for a possible future fruition of the site