

## ENG LAEG

## Defining the rock fall mechanisms through an integrated approach in the Conero Mt. coastal cliff area

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In the stretch of the coast near the Conero Mountain several rock fall phenomena causing significant damages to the infrastructures and human health have been documented. One reason to explain these frequent instability events has been individuated in the rock materials and in the poor quality of the Schlier formation [1].

This Fm. is considered an aquiclude because of its very low primary porosity and is also one of the most extended geological formation in the outcrop of this stretch of the Adriatic coast. The interesting fact is that after heavy rainfall events, consistent rock fall phenomena occur with a delay of few days. As assessed by the literature, the fracture pattern that drives the secondary permeability allows the water infiltration in the rock mass, significantly decreasing its strength [2]. For this reason, the quantification of the secondary permeability results very important for the understanding of the groundwater circulation role in the rock fall mechanisms of the area.

An insight through the infiltration process into the soil and the characteristics of the fracture system present in the site have been performed. The scanline method and the Discrete Fracture Network Modelling have been useful for the conduction of a fractured system detailed analysis. A further assessment is made considering the study made on a high fractured portion of the same sea cliff but located in an accessible nearby portion through the use of the Terrestrial Laser Scanner technique [3], stressing on the rock fracturing variability along the coastline. The whole study is characterized by a multi-level approach in which tracer hydrology, geomatics and geomechanics are involved. An innovation in this study is the coupling of the double ring infiltrometer test, permitting to estimate simultaneously the infiltration rate of the topsoil and to understand the role of fracturing on water infiltration in the rock mass. The non-negligible role of the fracturing network that characterizes the Schlier geological formation on the rock fall phenomena is highlighted in this research, stressing out the correlation present between rainfall and rock falls. At the end the discontinuities characterised by higher groundwater circulation and specific rock fall kinematics are detected with the analysis of the tracer test data.



ROCK MASS. CONSIDERING THE MECHANICAL APERTURE IS POSSIBLE ALSO TO CALCULATE THE AVERAGE PERMEABILITY VALUE OF THE MODEL EQUAL TO 1,2\*10^-3 cm/s.







## CONCLUSIONS

- THE SCHLIER FM. IF HIGHLY FRACTURED CANNOT BE CONSIDERED AN
  AQUICLUDE
- THE DOUBLE RING INFILTROMETER IS AN INNOVATIVE TRACER INJECTION
  METHOD WHERE WELLS OR ACTIVE CONDUITS ARE NOT PRESENT
- ONLY THE FRACTURES INVOLVED IN PLANAR SLIDING RISK ALLOW THE VERTICAL GROUNDWATER CIRCULATION, ACTING AS MAIN TRIGGERING FACTOR FOR ROCK SLOPE FALLS
- RAINFALL AND ROCKFALL ARE STRONGLY CORRELATED IN THE SHORT TERM





AlGeo

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[3] E. Mammoliti, F. Di Stefano, D. Fronzi, A. Mancini, E. S. Malinverni, e A. Tazioli (2022), «A



## Machine Learning Approach to Extract Rock Mass Discontinuity Orientation and Spacing, from

Laser Scanner Point Clouds», *Remote Sensing*, vol. 14, n. 10, pag. 2365.