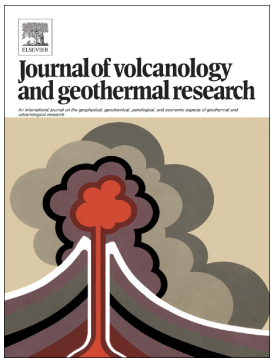

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G.M. Marmoni, S. Martino, M.J. Heap, T. Reuschlé

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Gravitational slope-deformation of a resurgent caldera: new insights from the mechanical behaviour of Mt. Nuovo tuffs (Ischia Island, Italy)

G.M. Marmoni*[1], S. Martino[1], M.J. Heap[2], and T. Reuschlé[2]

[1]*Earth Science Department - Sapienza University of Rome, Piazzale Aldo Moro 5, 00185, Rome, Italy*

[2]*Géophysique Expérimentale, IPG Strasbourg (CNRS UMR 7516), Strasbourg, France*

*Corresponding author: Gian Marco Marmoni (gianmarco.marmoni@uniroma1.it)

Abstract

Ischia Island (Italy) is an impressive exemple of the rare phenomenon of caldera resurgence. The emplacement and replenishment of magmas at shallow depth resulted in a vertical uplift of about 900 m, concentrated in the western portion of Mt. Epomeo (789 m a.s.l.). As a consequence of this uplift, the island has experienced several slope instabilities at different scales since the Holocene, from shallow mass movements to large rock and debris avalanches. These mass wasting events, which mobilised large volumes of greenish alkali-trachytic tuff (the Mt. Epomeo Green Tuff, MEGT), were strictly related to volcano-tectonic activity and the interaction between the volcanic slopes and the hydrothermal system beneath the island. Deep-seated gravitational slope deformation (DSGSD) at Mt. Nuovo, located adjacent to densely populated coastal villages, is an ongoing process that covers an area of 1.6 km^2. The Mt. Nuovo DSGSD involves a rock mass volume of 190 Mm^3 and is accommodated by a main shear zone and a series of sub-vertical fault zones associated with high-angle joint sets. To improve our understanding of this gravity-induced process, we performed a physical (porosity and permeability) and mechanical (uniaxial and triaxial deformation experiments) characterisation of two ignimbrite deposits - both from the MEGT - that form a significant component of the NW sector of Mt. Epomeo. The main conclusions drawn from our experiments are twofold. First, the presence of water dramatically reduces the strength of the tuffs, suggesting that the movement of fluids within the hydrothermal system could greatly impact slope stability. Second, the