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Modeling the Effect of Internal Pore Pressures Increases on Volcanic Edifice Instability

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Geotechnical engineers and geologists studying landslides are familiar with fluid pressurisation and its modifying effects on the shear strength of soils and rocks. Ordinarily, this pressurisation is by groundwater, and is rarely artesian. Being hydrostatic and related to a ground water level within the slope, favouring shallow landsliding and leading to a slope which is stable against deeper-seated modes of failure. This is the method of fluid pressurisation favoured in most volcanic stability studies. The effect of *internally* increasing the pore pressures is investigated with the use of true 3D numerical models using FLAC 3D. Based on derived rock mass strength data and deformability parameters (Thomas et al., 2004a), results illustrate the potential importance of internal pore fluid pressurisation to stability analysis of volcanic terrain. During gas pressurisation, the highest pressures will occur at the deepest levels of the edifice. We show that internal gas pressurisation is therefore likely to have a far greater effect on deep-seated failure mechanisms than surface water infiltration (Thomas et al., 2004b). If we consider de-gassing magma bodies and boiling of hydrothermal systems as a source for internal gas pore fluid pressurisation, there is no limit to the internal pressures that can build up other than the physical strength of the edifice. While the emission of volcanic gasses and their compositions are routinely monitored, the mechanical effects of the gas phase on the shear strength and structural integrity of the edifice have been mostly overlooked. Even small localised internal pore pressures of $\leq$ 1MPa are predicted to sufficiently stress the system, leading to lower magnitude trigger events required to initiate a large-scale collapse event.

Thomas M. E., Petford N., Bromhead E. N., 2004a. Volcanic rock-mass properties from Snowdonia and Tenerife: implications for volcanic edifice strength. *Journal of the Geological Society, London*, **161**, 939 – 946

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