

Relation between deformation and cumulative seismicity as a possible tool for monitoring dike stability

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Volcanic edifices are characterised by intense fracturing. This arises from several processes connected to volcanic activity, as for instance degassing, chemical action of hydrothermal fluids and stress corrosion. Intense stress field produced by repeated dike injections also contributes to fracture host rocks. On the other hand, fracturing decreases rock resistance and lowers elastic stiffness, allowing magma dikes to open more and enhancing deformation.

A feedback process is then created between dike-induced deformation and dike-induced fracturing. This can be quantitatively described using the Effective Media Theory, which describes fractured media as homogeneous, with effective elastic parameters.

A linear relation is found to join the logarithmus of deformation and cumulative seismicity, when injected dikes are stable and do not propagate. A deviation from this behaviour could signify dike instability, and may be used for dike real-time monitoring. Some application to recent intrusions is shown and discussed.