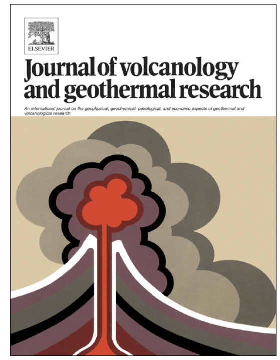
Accepted Manuscript



Causes of distal volcano-tectonic (dVT) seismicity inferred from hydrothermal modeling

C.A. Coulon, P.A. Hsieh, R. White, J.B. Lowenstern, S.E. Ingebritsen

PII: S0377-0273(17)30302-5
DOI: doi: 10.1016/j.jvolgeores.2017.07.011
Reference: VOLGEO 6159

To appear in: *Journal of Volcanology and Geothermal Research*

Received date: 16 May 2017
Revised date: 14 July 2017
Accepted date: 16 July 2017

Please cite this article as: C.A. Coulon, P.A. Hsieh, R. White, J.B. Lowenstern, S.E. Ingebritsen , Causes of distal volcano-tectonic (dVT) seismicity inferred from hydrothermal modeling, *Journal of Volcanology and Geothermal Research* (2017), doi: 10.1016/j.jvolgeores.2017.07.011

Causes of distal volcano-tectonic (dVT) seismicity inferred from hydrothermal modeling

C.A. Coulon[1, 2], P.A. Hsieh[1], R. White[1], J.B. Lowenstern[1], and S.E. Ingebritsen[1]

[1]*U.S. Geological Survey, Menlo Park, California USA*

[2]*Dept. of Geosciences, Ecole Normale Supérieure, Paris FRANCE*

Corresponding author's email: seingebr@usgs.gov

Abstract Distal volcano-tectonic (dVT) seismicity typically precedes eruption at long-dormant volcanoes by days to years. Precursory dVT seismicity may reflect magma-induced fluid-pressure pulses that intersect critically stressed faults. We explored this hypothesis using an open-source magmatic-hydrothermal code that simulates multiphase fluid and heat transport over the temperature range 0 to 1200°C. We calculated fluid-pressure changes caused by a small (0.04 km^3) intrusion and explored the effects of flow geometry (channelized *vs*. radial flow), magma devolatilization rates (0-15 kg/s), and intrusion depths (5 and 7.5 km, above and below the brittle-ductile transition). Magma and host-rock permeabilities were key controlling parameters and we tested a wide range of permeability (k) and permeability anisotropies (k_h/k_v), including k constant, $k(z)$, $k(T)$, and $k(z, T, P)$ distributions, examining a total of ~1600 realizations to explore the relevant parameter space. Propagation of potentially causal pressure changes ($\Delta P \geq 0.1$ bars) to the mean dVT location (6 km lateral distance, 6 km depth) was favored by channelized fluid flow, high devolatilization rates, and permeabilities similar to those found in geothermal reservoirs (k ~10^{-16} to 10^{-13} m^2). For channelized flow, magma-induced thermal pressurization alone can generate cases of $\Delta P \geq 0.1$ bars for all permeabilities in the range 10^{-16} to 10^{-13} m^2, whereas in radial flow regimes thermal pressurization causes $\Delta P < 0.1$