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# Quantitative examination of the effect of magma degassing on the electrical conductivity structure of a volcano

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Magmatic volatiles released from magmas dissipate through volcanic edifices. Relatively insoluble materials, such as CO2 and SO2, are generally discharged from a crator and through soil to air. On the other hand, soluble materials, such as Cl, are considered to dissolve into interstitial water and increase steeply electrical conductivity of volcanic aquifer. Discharge rate of volcanic volatiles is now estimated by the direct observation of CO2 and SO2 gases from a crator and a fumarole, such as COSPEC and DOAS, and by the geochemical method. Electrical conductivity structure can be also a helpful information for the estimation of volcanic volatiles. Kagiyama(1998) found that the electrical conductivity of volcanic aquifer decreases with distance from a volcanic center at Kirishima-Iwoyama. This suggests that soluble materials dissolving into volcanic aquifer are transported and dissipated outward from a volcanic center. The decrease of the electrical conductivity above is found in the other volcanoes(e.g. Keller and Rapolla, 1974, Srigutomo, 2008, Komori and Kagiyama, 2008); however, to date, the reason of the decrease has not been considered quantitatively.
For the quantitative consideration of the dissipation of volcanic volatiles, the numerical simulation is used. Previously, the authors found that the decrease of electrical conductivity is due to addition of meteoric water to aquifer transporting volcanic volatiles, and that the degree of decrease depends on the ratio of flux of volcanic volatiles to addition of meteoric water (Komori and Kagiyama,2008,2009).
The objective of this presentation is to examine the effect of heat transportation on electrical conductivity distribution by means of numerical simulation, which has not been considered in our study previouly. This numerical simulation is run under some assumptions: a)input of heat and soluble materials are only from a volcanic center; b)steady state; c)thickness and physical properties of volcanic aquifer are uniform. Governing equations are continuity equation, darcy's law, and advection-diffusion equations of heat and materials. These equations are non-dimensionalized and discretized by implicit method of Patankar(1980).
Discretized equations are solved under the appropriate boundary conditions and controlled values of heat and material fluxes. Grids used for the numerical simulation are 100 grids in vertical direction and 50 grids in horizontal direction. Initial conditions are nondimensional temperature = 0 and nodimensional concentration = 0. This calculation regarded as steady state when the residuals of temperature and concentration between calculations are negligibly-small.
In this presentation, the results of numerical simulation will be shown, and the effect of heat transport on the relation between electrical conductivity distribution of volcanic aquifer and dissipation of volcanic volatiles will be examined.

Keywords: magmatic volatiles, magma degassing, electrical conductivity