Controls on hydrothermal system styles in submarine arc volcanoes

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Intra-oceanic volcanic arcs represent the boundaries between converging lithospheric plates where subduction-generated melts provide a steady supply of heat and magmatic fluids. Brothers volcano [1], situated along the active arc front of the Kermadec arc, northeast of New Zealand, provides insight into the style and composition of hydrothermal discharge at submarine arc volcanoes and acts as a natural reference system for our numerical study of subseafloor hydro- and thermodynamics.

Based on correlations describing phase stability relations in the binary salt-water system [2], and a realistic numerical transport simulation scheme, we present results of multi-phase fluid flow simulations in the subsurface of a submarine magmatic-hydrothermal system. Our results show that water depth and seafloor topography, crustal permeability, and the relative contributions of seawater and magmatic fluids are the first-order physical parameters controlling the development and style of hydrothermal venting.