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Lava flow dynamics driven by temperature-dependent viscosity variations SERINA DINIEGA, Jet Propulsion Laboratory, California Institute of Technology, SUZANNE SMREKAR, Jet Propulsion Laboratory, STEVEN ANDERSON, University of Northern Colorado, ELLEN STOFAN, Proxemy Research
— As lava viscosity can change 1-2 orders of magnitude due to small changes in temperature, several studies have predicted the formation of low-viscosity/high-speed "fingers" (similar to a Saffman-Taylor type instability). Through the use of numerical simulation and steady-state analysis of model equations, we identify solutions that provide pahoehoe lava flows with a natural mechanism for the formation of channels within a sheet flow. We assume Hele-shaw-type geometry, Newtonian/laminar fluid flow, a Nahme's exponential law relating temperature and viscosity, and radiative heat-loss. Preliminary results indicate that flow-focusing occurs rapidly, but that the system settles into a new steady-state and does not create perpetually-lengthening hot-fingers. This suggests that additional physical processes are needed for the continued growth of preferred flow zones. This work has application to both Earth and planetary volcanology studies as the emplacement mechanics that yield long lava flows are not yet well understood.

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