Abstract Submitted for the DFD07 Meeting of The American Physical Society

Length of a lava tube MIRANDA HOLMES, Courant Institute of Mathematical Sciences, NYU, JOHN WHITEHEAD, Woods Hole Oceanographic Instituion — Motivated by the existence of long lava tubes in certain types of volcanic flows, we study the question of a viscous melted substance flowing in a cold circular tube. As the fluid flows it cools and solidifies at the tube radius and we investigate the question "how far can the fluid flow and remain liquid?" A theoretical solution is derived for the liquid radius and the temperature profiles in liquid and solid. It is shown that if fluid is maintained at constant flux the distance can be infinite, but if the fluid is maintained at constant pressure difference across the length of the tube, then a there is a maximum length which depends on the Peclet number and a dimensionless temperature. Conditions are derived for which the radius is unstable. These predictions are investigated with numerical and laboratory experiments.

> John Whitehead Woods Hole Oceanographic Institution

Date submitted: 03 Aug 2007

Electronic form version 1.4