Abstract Submitted
for the SHOCK07 Meeting of
The American Physical Society

Heterogeneous Thermal Emission from Shocked Basalt SARAH STEWART, Harvard University, ACHIM SEIFTER, Los Alamos National Laboratory, GREGORY KENNEDY, Harvard University, MICHAEL FURLANETTO, ANDREW OBST, Los Alamos National Laboratory — Natural flaws in geologic materials result in heterogeneous pressure and temperature distributions upon shock compression. The effects of flaws are apparent in the thermal emission from shocked samples. We present emission temperature measurements from Columbia River Basalt using multi-band pyrometry (0.65 nm to 4.8 μm) and gated infrared imaging. After release from peak shock pressures between 9.5 and 45 GPa, free surface thermal emission temperatures range from 450 to >1250 K. The emission measurements show a departure from a quasi-single temperature surface between 10 and 14 GPa, where, at pressures well below that required for bulk melting of basalt, emission temperatures >1600 K are detected. In this pressure range, partial melting in fractures and pore spaces produce a bimodal temperature distribution comprised of a continuum and hot spots. The inferred hot spot distributions are in excellent agreement with petrographic studies of localized melting and generation of high pressure phases in basaltic meteorites from Mars shocked to similar pressures. However, the measured continuum temperatures in Columbia River basalts are 100 to 400 K higher than inferred for Martian meteorites.

Sarah Stewart
Harvard University

Date submitted: 23 Feb 2007 Electronic form version 1.4