Abstract Submitted
for the SHOCK05 Meeting of
The American Physical Society

The Shock Hugoniot of Tuffistic Kimberlite Breccia and other Geological Materials below 10 GPa JOHN FIELD, Physics and Chemistry of Solids Group, Cavendish Laboratory, Madingley Road, Cambridge, CB3 0HE, UK, GEOFF WILLMOTT, WILLIAM PROUD, PCS GROUP TEAM — In recent experimental work, the shock response of Tuffistic Kimberlite Breccia (TKB) was determined in plate impact experiments. The shock Hugoniot was characterized between 0.3 and 8.4 GPa using embedded manganin gauges and VISAR. Lateral stresses were also measured using embedded manganin gauges and the shear response was derived between longitudinal stresses of 1.1 and 3.2 GPa. TKB has low shock impedance in comparison with similar investigations in the literature, consistent with its empirical reputation as a relatively weak rock. Although the shear stress data indicate a Hugoniot Elastic Limit (HEL) between 0.6 and 0.9 GPa, inelastic deformation probably occurs at compressive stresses less than 0.3 GPa due to processes such as porous compaction and pressure-induced liberation of water from aqueous crystals. This investigation of TKB (along with apparent inconsistencies in the literature) highlights the difficulties in applying simple hydrodynamic shock theory to inhomogeneous materials below 10 GPa. In this regime, which is important for application to blast mining, geological materials deform inelastically but not necessarily hydrodynamically. Multiple indicators from direct experimental measurements should be considered before making firm conclusions about the HEL, the presence of phase changes, or the onset of hydrodynamic shock waves.

William Proud
PCS Group

Date submitted: 07 Apr 2005 Electronic form version 1.4