Acoustic velocity and elastic moduli profiles and corresponding fracture density and orientation patterns in artificially shocked granite: preliminary results

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Impact events can be simulated at a small scale in the laboratory and the subsequent crater can be examined to learn more about cratering processes. This work investigates subsurface fracture patterns beneath craters and the relationships between fracture density and orientation and acoustic velocity anomalies. Previous research in the laboratory and larger scale seismic surveys across impact craters on the Earth's surface show that shock damage reduces the compressional wave velocities in the rock. Shear wave velocities measured as a part of this study complement the compressional wave velocities reported in the literature. The collection of a more complete data set allows calculation of Vp/Vs ratios and the derived elastic moduli profiles across an artificial crater produced by the Lindhurst Laboratory of Experimental Geophysics at the California Institute of Technology, Pasadena, California. Preliminary results show that shear wave velocities are more sensitive to the presence of fractures and resolve more widespread damage than compressional wave velocities, thus shear wave velocities or Vp/Vs ratios can be used to map a more complete picture of impact induced damage. Shear wave velocity measurements in three directions show anisotropy which has been attributed to the presence of different fracture populations and orientations. Future work will compare crack orientation in more detail with acoustic velocity and elastic moduli profiles; thin section observations will allow better characterization of fracture populations. Results from this study have implications for understanding cratering effects on solid surfaces throughout the solar system.

Atlantic Geology, 2008, Volume 44, Number 1