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Crustal Rock: Recorder of Oblique Impactor Meteoroid Trajectories THOMAS J. AHRENS, H. ANITA AI, Caltech — Oblique impact experiments in which 2g lead bullets strike samples of San Marcos granite and Bedford limestone at 1.2 km/s induce zones of increased crack density (termed shocked damage) which result in local decreases in bulk and shear moduli that results in maximum decreases of 30-40% in compressional and shear wave velocity (Budianski and O'Connell). Initial computer simulation of oblique impacts of meteorites (Pierazzo and Melosh) demonstrate the congruence of peak shock stress trajectory with the pre-impact meteoroid trajectory. We measure (Ai and Ahrens) via multi-beam ($\sim$ 300) tomographic inversion, the sub-impact surface distribution of damage from the decreases in compressional wave velocity in the 20 $\times$ 20 $\times$ 15 cm rock target. The damage profiles for oblique impacts are markedly asymmetric (in plane of pre-impact meteoroid pre-impact trajectory) beneath the nearly round excavated craters. Thus, meteorite trajectory information can be recorded in planetary surfaces. Asymmetric sub-surface seismic velocity profiles beneath the Manson (Iowa) and Ries (Germany) impact craters demonstrate that pre-impact meteoroid trajectories records remain accessible for at least $\sim 10^8$ years.

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