ASSESSING THE ROLE OF SEISMIC SHAKING ON CRATER MODIFICATION FOR 433 EROS.
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Introduction: The Near-Earth Asteroid Rendezvous (NEAR)-Shoemaker spacecraft observed asteroid 433 Eros from 2000-2001 using two instruments: the NEAR Multi-Spectral Imager (MSI) and the NEAR Laser Rangefinder (NLR). The surface of Eros was found to have regions of reduced crater density [1]. A recent study [2] proposes that the formation of the Shoemaker crater (16ºS, 30ºE), the youngest large crater on Eros [3], may have removed craters via seismic shaking, creating the observed deficiencies.

If the density of craters with diameters between 0.2 and 1.0 km is expressed as R and is plotted as a function of latitude and longitude on Eros, low values appear to be centered on and to surround Shoemaker crater (Fig. 1). In comparison to some possible factors that could explain the observed deficit, including surface elevation and slope (Fig. 1) as well as the expected distribution of ejecta from Shoemaker [3], the correlations are not as convincing. The areas of low crater density were found to correlate well with radial distance from the impact [2], confirming that the formation of this crater must be critical to the observed distribution. These observations strongly suggest that seismic shaking may be responsible for the observed crater deficit, but how does the crater destruction occur?

Crater Modification: To address this question, we want to determine whether the regions where seismic shaking is thought to have occurred are also those that possess the greatest reduction in 0.2 to 1.0 km craters. Regions of different R are investigated and various morphological aspects of craters are measured, including rim height (h), depth (d), diameter (D), and degradation state. We use co-registered high-resolution images (MSI) and lidar data (NLR) to make these measurements. The main goal is to understand the morphological signatures of seismic shaking using statistical approach whereby we separate out craters of different degradation states and observed systematic changes in their shape as a function of distance from the source crater.

If seismic shaking from the Shoemaker impact has brought about the deficit of small craters on the surface of Eros, an effect on crater degradation state should be observed: the degree of crater modification should depend on the distance from Shoemaker. If seismic shaking has acted to fill craters with regolith [e.g., 1,4,5] leading to the degradation of some craters and the destruction of others, this should be detectable in the observations. Data showing a decrease in d/D as a function of decreasing R as one approaches Shoemaker crater would confirm such an idea.

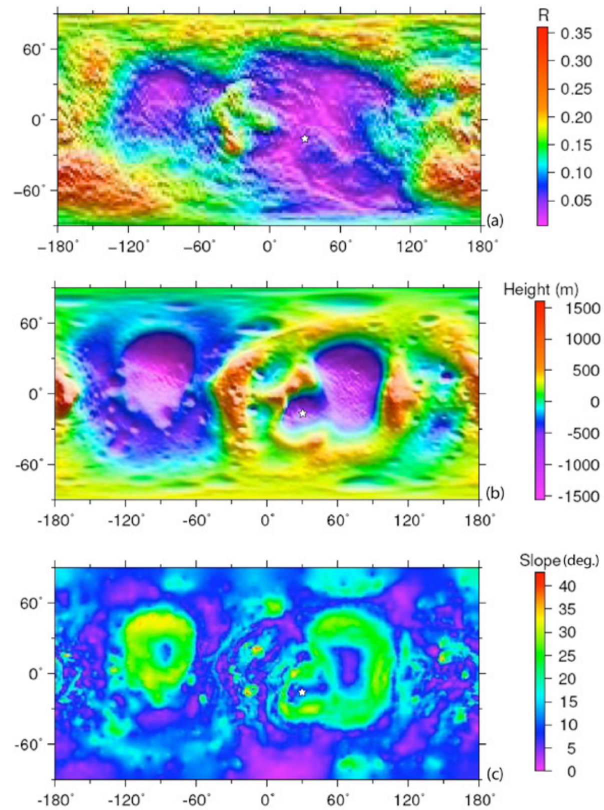

Figure 1. (a) Crater density (R) for diameters between 0.2 and 1.0 km, (b) surface elevation relative to geoid, and (c) slope on 433 Eros. The center of Shoemaker crater (16ºS, 30ºE) is indicated by a white star. The R data were provided by Dr. Peter Thomas of Cornell University. All other data were generated from NLR.

References: [1] Robinson, M. S. et al. (2002) *Meteoritics & Planet. Sci., 37,* 1651–1684. [2] Thomas, P. C. and Robinson, M. S. (2005) *Nature, 436,* 366–369. [3] Thomas, P. C. et al. (2001) *Nature, 413,* 394–396. [4] Cheng, A. F. et al. (2002) *Meteoritics & Planet. Sci., 37,* 1095–1105. [5] Richardson, J. E. et al. (2004), *Science, 306,* 1526–1529.