REVISITING THE NEAR-SHOEMAKER LANDING SITE. O.S. Barnouin[1], R.W. Gaskell[2], C.M. Ernst[1]. [1]The Johns Hopkins University Applied Physics Laboratory (Johns Hopkins Road, Laurel, MD 20723, Olivier.Barnouin@jhuapl.edu; Carolyn.Ernst@jhuapl.edu), [2]Planetary Science Institute (rgaskell@psi.edu).

Introduction: The NEAR-Shoemaker spacecraft landed on the surface of 433 Eros on Feb 12, 2001. In a recent study [1], the location of the final landing site was updated to 41.626 S, 80.421 E (x = 0.82 ±0.01, y = 4.85 ± 0.01, z = -4.37 ± 0.01), in a crater about 200 m south (Fig. 1) of the previous estimate [2]. This new solution was obtained using a sophisticated optical navigation approach that included NEAR Laser Rangefinder (NLR) data and estimates for the change in velocity associated with each one of the five final burns that brought the spacecraft safely to the surface. In this study, we use new high-resolution topography from imaging [3], and improvements in the NLR data [4, 5] to revisit and re-evaluate current interpretations of the geology observed in the final images collected by the NEAR-Shoemaker spacecraft.

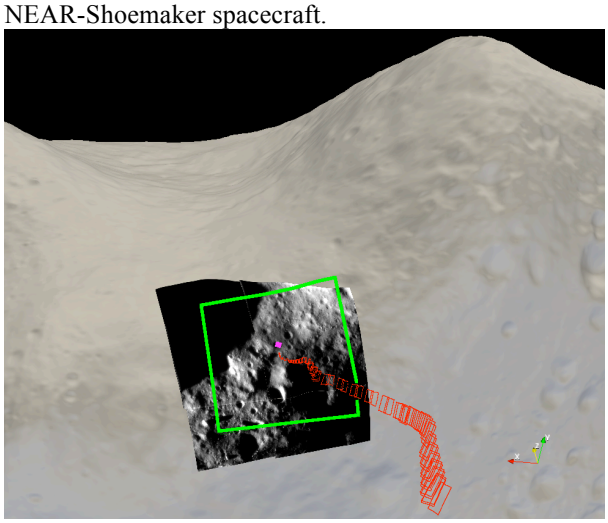

Figure 1: Location (red) of the final images collected by the NEAR-Shoemaker spacecraft ending in the crater where the spacecraft landed. Magenta point indicates earlier best estimate [1] of the final landing site.

Results: At a regional scale, the new and more accurate landing solution for the NEAR-Sheomaker spacecraft is not substantially different from the one reported in previous studies [2]. This new site is located a little further south relative to the earlier one, up the southern rim of the Himeros crater (Fig. 1). The high-resolution topography (Fig. 2) shows that the slopes to the SE of the new site are <15°. To the NE, these slopes increase (>20°) as the elevation decreases down into Himeros crater. This high-resolution topography indicates that the "ponds" observed in the last descent images [2] are the result of regolith trapped in a local elevation minima defined by a small crater that appears to be fed by a small valley-like depression made up of highly degraded craters. Further away from the landing site, the approach images follow the general elevation change that occurs from SE to the NW. The noted paucity of small craters identified in these data [2] is probably a result of seismic shaking from Shoemaker crater [6]. The observed decrease in the depth-to-diameter ratio of many larger craters in this region is consisting with such a process [7]. This shaking might have activated large lineaments that span across the region from the NE to the SW that might have destroyed and flattened the craters. The close-up images show the presence of another finer-scale linear texture, where small rocks and gravel seem to align often following local slopes. Considering observations made by the Hayabusa spacecraft at 25143 Itokawa, these fine scale features resemble structures seen at the edge of Muses-C regio [8] that are interpreted to be the result of granular surface flow from seismic shaking. These observed displacements of regolith are probably how many craters on Eros were destroyed.

References: [1] Gaskell (2011), AAS-11-220e. [2] Veverka et al., (2001), Nature, 413, 390-393. [3] Gaskell et al. (2008) MAPS 43, 1049-1061. [4] Cheng et al. (2002), Icarus 155, 51-74. [5] Mazarico et al. (2012), ACM this issue. [6] Thomas and Robinson (2005), Nature 436, 366-369. [7] Ernst et al. (2012), LPSC 43, 4393. [8] Abe et al., Science 316, 1011-1014.

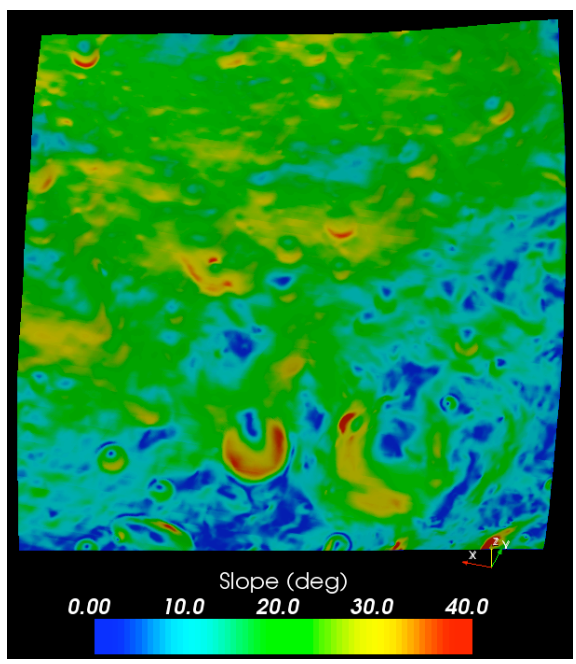

Figure 2. Slope distribution in the region of the NEAR-Shoemaker landing site (green outline in Fig. 1). The low-sloped blue region at the center of the image is where NEAR-Shoemaker landed.