

**CONTINUING ANALYSES OF THE GLOBAL LINEAMENT MAP OF 433EROS.** D.L. Buczkowski, O.S. Barnouin-Jha and L.M. Prockter, Johns Hopkins University Applied Physics Laboratory, Laurel, MD 20723, Debra.Buczkowski@jhuapl.edu.

**Introduction:** The observed presence of grooves on Eros can be interpreted as being solely due to faulting resulting from the transmission of impact shock waves [1]. However, early studies found two large-scale lineations on Eros to be coplanar with a large flat region (the southern “facet”) on one end of the asteroid [2]. This was interpreted as indicative of a pre-existing structure throughout most of the asteroid, consistent with a fabric inherited from a parent body.

A global database of all Eros lineaments (Fig. 1) was recently constructed [3] to better understand the global distribution of these features and thus understand more about the interior structure of the asteroid. Over two thousand lineations, ranging up to tens of kilometers in length, were mapped on 180 high resolution (5-11 m/p) NEAR Multi-Spectral Imager images of Eros [3]. The mapped lineations have been grouped into sets according to location and orientation; many different sets of lineaments were identified [3].

**Radial Lineation Sets:** Some of the lineations are clearly related to specific impact craters; at the time of writing lineations have been identified radial to 13 craters [3]. Given their proximity and orientation relative to the craters it seems most likely that these lineaments were formed as a direct result of the impact event.

**Other Lineation Sets of Impact Formation:** The most distinct set of lineations on Eros (Fig. 2) is found aligned roughly with the prime meridian of the asteroid [3]. Several of these lineations are up to 10’s of kilometers long. The orientation of these lineaments is consistent with the pattern expected from fragmentation due to impact on the long side of an ellipsoid target [4]. We infer that these lineations were formed as a result of the Psyche and/or Himeros impacts.

**Lineation Sets of Non-Impact Formation:** Another set of lineations is identified encircling the “tail” of Eros, from  $\sim 170^\circ$  to  $240^\circ$  longitude [3]. The preferred orientation of these lineaments does not obviously follow any predictions of models of lineation formation by impact. We therefore suspect that these lineations represent a pre-existing internal structure.

**Implications:** The bulk density of Eros ( $\sim 2.7 \text{ g/cm}^3$ ) is lower than the measured density of comparable ordinary chondrite meteorites ( $\sim 3.3 \text{ g/cm}^3$ ), indicating a high porosity [5]. However, the presence of long structural features on the surface, including the thousands of lineations mapped by [3], are indicative of a significant internal strength. Thus Eros is generally classified as a ‘heavily fractured’ asteroid [6]. How-

ever, interpretation of the global lineation map introduces the possibility that Eros is a contact binary [3].

**References:** [1] Prockter L. et al. (2002) *Icarus*, 155, 75-93 [2] Thomas P.C. et al. (2002) *GRL*, 10.1029/2001GL014599 [3] Buczkowski et al. (2008) *Icarus* 193, 39-52 [4] Asphaug E. et al. (1996) *Icarus*, 120, 158-184 [5] Yeomans et al. (2000) *Science*, 289, 2085-88 [6] Wilkison et al. (2002) *Icarus*, 155, 94-103

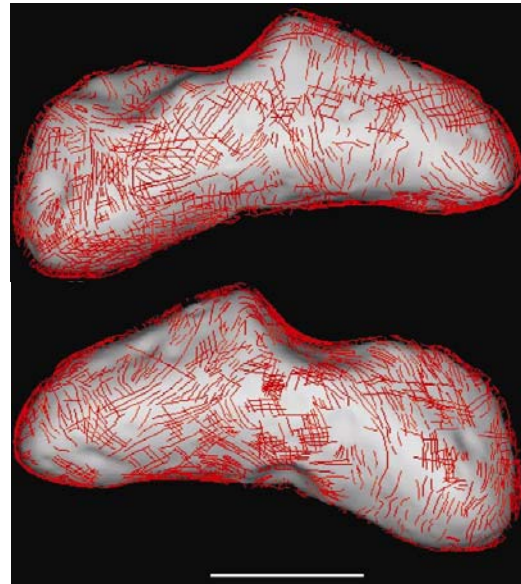


Figure 1. Southern (top) and northern (bottom) hemispheres of the Eros lineation map.

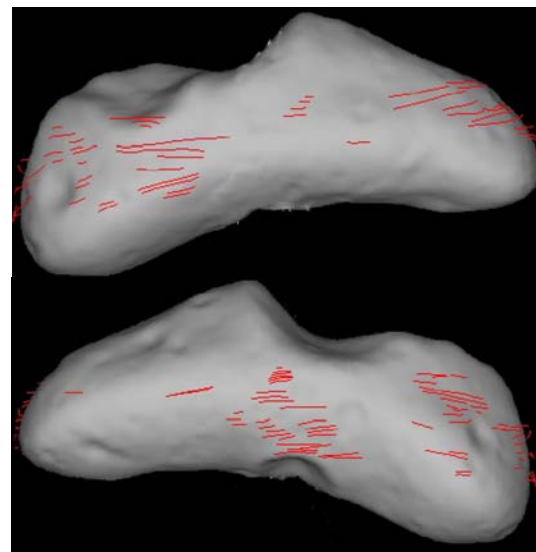


Figure 2. Example of a lineation set on the southern (top) and northern hemispheres of Eros.