GEOLOGY OF 103P/HARTLEY 2 AND NATURE OF SOURCE REGIONS FOR JET-LIKE OUTFLOWS.

P. H. Schultz[1], B. Hermalyn[1], M. Bruck[1], M. A'Hearn[2], T. Farnham[2], M.J.S. Belton[3], P. Thomas[4], J. Sunshine[2], S. Sebastian[2], and The DIXI Science Team, [1]Department of Geological Sciences, Box 1846, Brown University, Providence, RI 02912, (peter_schultz@brown.edu); [2]Department of Astronomy, University of Maryland, College Park, MD 20742; [3]Belton Space Exploration Initiatives, LLC, 430 S. Randolph Way, Tucson, AZ 85716; [4]Center for Radiophysics and Space Research, Cornell University, Ithaca, NY 14853.

Introduction: The EPOXI mission using the Deep Impact Flyby Spacecraft provided unprecedented high-resolution views of the nucleus of the small, active comet, 103P/Hartley 2. The general shape inferred from radar closely matched observations from the Deep Impact Spacecraft. A separate contribution at this meeting provides a more detailed description of the shape revealed [1]. Because of the ongoing processes that reshape the surface, geologic units are not yet being defined; rather, the surface is described here in terms of terrains and terrain units. This strategy avoids labels that may confuse interpretations, e.g., exhumed surfaces versus mantling deposits.

Terrain Types: The general terrain types visible on Hartley 2 can be divided into three general categories: surfaces covered by blocks (*Bt*), smooth terrains (*St*), and inter-blocky smooth regions (*IBSt*). Blocky terrains characterize both ends of the dumbbell-shaped nucleus, connected by a smooth "neck." Although described as smooth, slight variations in reflectivity and stippling within the neck indicate that the nature of the surface may be rougher at scales below the limits of resolution. Angular blocks (with different albedos) cover both ends of the nucleus, with observed sizes from <10m to 50 m.

As shown in Figure 1, one end of the nucleus is bulbous; the other, more elongate (nearest the DI spacecraft). *IBSt* covers the smaller bulbous end under direct sublight, whereas the more elongate end exhibits a mixed surface of *IBSt* and *St*. *St* regions are not randomly dispersed but occur in a concentric low surrounded by a blocky rim with a slightly elevated central region. Two poorly defined transverse bands (lower and higher relief) cross the bulbous end.

Source areas: Type IIa active areas [see 2] are characterized by collimated outflows (visible due to entrained fine dust) that emanate from specific regions on the nucleus, particularly on the bulbous end under low phase angles. Narrowest jets emerge from unresolved sources within a rough-appearing surface. On Hartley 2, jet-like regions also are observed to remain active, even on the night-side. Source regions on the surface range from less than 20m to more than 100m across. Obvious impact craters have not yet been identified, consistent with an evolving surface during successive perihelion passages.

The origin of the terrains, blocks, smooth terrains, and neck remains to be determined. Several working hypotheses are being considered for the blocks including sublimation relicts, plugs, and lag deposit. The *IBSt* terrains may be transported accumulations of dust. Jet-like outflows originate from a variety of features, from unresolved sources to broad depressions.

Conclusions: In some respects, Hartley 2 resembles 19P/Borrelly [3]: smooth areas, transverse ridges, and rough-textured surface. Deep Impact flew by comet 9P/Tempel 1 and revealed a very different surface, although localized active areas were also observed. High-resolution imaging along with the high-quality spectra [4] provided by the EPOXI mission, however, will contribute to a new understanding of the evolution of the nucleus and the source regions for jet-like outflows.

Acknowledgments: This work was supported through NASA's Discovery Program, which supported the EPOXI mission *via* contract NM071102 to the University of Maryland and task order NAS7-03001 between NASA and CalTech. We gratefully acknowledge the dedication and skill of the EPOXI flight team at JPL.

References Cited: [1] Thomas, P. *et al*. (2011), LPSC 42 (*this meeting*); 2] Belton, M. J. S. (2011), (2010), *Icarus* 210, 881-897**;** [3] Britt, D.T. et al. (2004), *Icarus 167*, 45-53; [4] Sunshine et al. (2011) (*this meeting*).

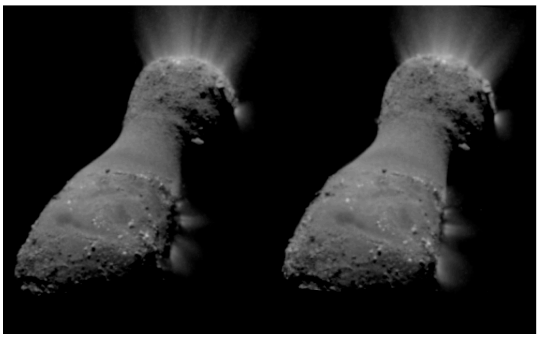

Figure 1: Stereo view of 103/PHartley 2 taken prior to closest approach. Blocks cover the two ends of the dumbbell-shaped nucleus. Narrow jet-like outflows extend from the sunlit end (top) while diffuse jets remain active, even beyond the terminator (lower right). This is a reverse stereo image (right eye focuses on left; left on right). Sun is at the top.