Low Velocity Impacts on Phobos. Heather D. Smith[1] Pascal Lee[1, 2] and Doug Hamilton[3], [1]Planetary Systems Branch, NASA Ames Research Center, Moffett Field, CA . E-mail: Heather.D.Smith@NASA.Gov 2. SETI Institute and Mars Institute Mountian View, CA E-mail: pascal.lee@marsinstitute.net 3. Department of Astronomy, University of Maryland, College Park, MD. dphamil@astro.umd.edu.

Introduction: We present evidence for low velocity impacts on Phobos resulting from material transfer from Deimos to Phobos and/ or recaputure of Phobos ejecta.

Mars's inner moon, Phobos, is located deep in the planet's gravity well and orbits far below the planet's synchronous orbit. Images of the surface of Phobos, in particular from Viking Orbiters, MGS, MRO, and MEX, reveal a spectral heteogenity, rich collisional history, including fresh-looking impact craters and subdued older structures, very large impact structures (compared to the size of Phobos), such as Stickney, and much smaller ones [1, 2, 3, 4].

Sources of impactors colliding with Phobos include *a priori:* A) Impactors from outside the martian system (asteroids, comets, and fragments thereof); B) Impactors from Mars itself (ejecta from large impacts on Mars); and C) Impactors from Mars orbit, including impact ejecta launched from Deimos and ejecta launched from, and reintercepted by, Phobos. In addition to individual craters on Phobos, the networks of grooves on this moon have also been attributed in part or in whole to impactors from some of these sources[5,6 7} as shown in Figure 1.

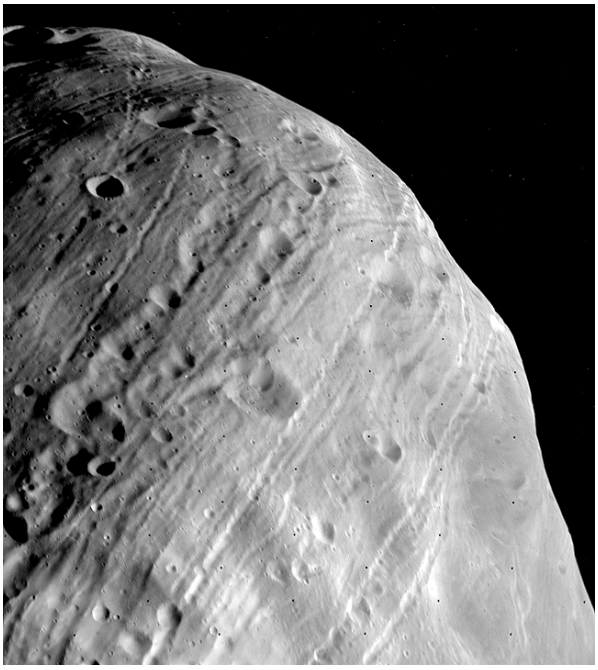

Figure 1. Grooves and crater chains on Phobos. Image taken by the Viking 1 Orbiter

Method: We report the preliminary results of a systematic survey of the distribution, morphology, albedo, and color characteristics of fresh impact craters and associated ejecta deposits on Phobos. Considering that the different potential impactor sources listed above are expected to display distinct dominant compositions and different characteristic impact velocity regimes, we identify specific craters on Phobos that are more likely the result of *low velocity impacts by impactors derived from Mars orbit* than from any alternative sources. Our finding supports the hypothesis that the spectrally "Redder Unit" on Phobos may be a superficial veneer of accreted ejecta from Deimos, and that Phobos's bulk might be distinct in composition from Deimos[8,9].

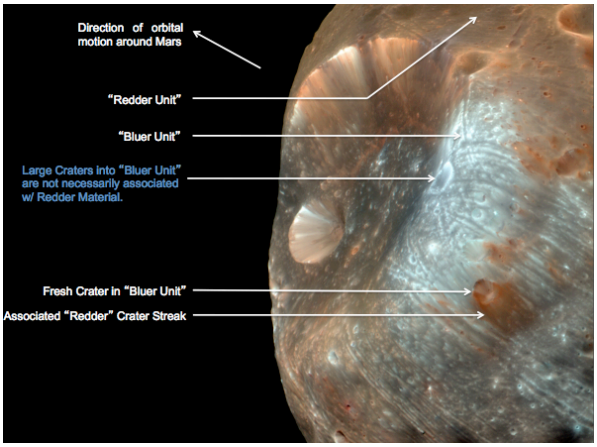

Figure 2. MRO image of Phobos showing the spectral units, orbital direction, and surface features supporting the transfer of material from Deimos to Phobos.

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