

Phobos: Low Velocity Impacts

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 Orbiter 1, MGS, MRO, and MEX, reveal a rich collisional history, including fresh-looking impact craters and subdued older ones, very large impact structures (compared to the size of Phobos), such as Stickney, and much smaller ones.

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, particularly B.

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.