AAS Division of Planetary Science (DPS) Abstract 2009
Submitted: 7/8/2009 2:21:29 PM EDT

Edgett, K. S. (2009) MRO CTX and MGS MOC Observations Regarding Small Impact Craters and Substrate Resistance to Erosion on Mars, 41st American Astronomical Society Division for Planetary Sciences Meeting, Abstract 58.06, *Bulletin of the American Astronomical Society 41*(3), p. 1116.

MRO CTX and MGS MOC Observations Regarding Small Impact Craters and Substrate Resistance to Erosion on Mars.

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A basic concept taught to beginning planetary scientists is that, on a planetary body, a surface that has been heavily cratered by primary impacts consists of material that is older than that of a surface with fewer such craters. On Mars, this is not always true. For the smallest impact craters (less than 1 km diameter), the resistance of the cratered substrate to erosion is critical. The hardest rocks, such as a basalt lava flow, are more resistant to erosion than the softest rocks, such as the bedrock beneath Meridiani Planum examined using the rover Opportunity. Softer, still, are surfaces consisting of unconsolidated or weakly indurated material, such as dust mantles and sand dunes. The substrates more resistant to erosion retain small craters longer. This observation provides a tool for interpretation of the relative hardness of different geologic units on the martian surface. Key examples (in which superposition relations show that the material most heavily dotted with small impact craters is the younger of two adjacent surfaces) are seen in Mars Global Surveyor (MGS) Mars Orbiter Camera (MOC) and Mars Reconnaissance Orbiter (MRO) Context Camera (CTX) images. One example is a lava flow west of Sinus Meridiani near 1.4°N, 10.5°W, that overlies a much less cratered, softer substrate. Another occurs in Galdakao Crater (13.5°S, 183.5°W), wherein the eastern two-thirds of the crater floor consist of heavily cratered lavas which embay older, but less cratered, yardang-forming materials. The observation also presents some interesting puzzles. For example, a dune field at 12.8°S, 181.9°W, is peppered with small craters. The dunes are lithified and might have been buried and then exhumed from beneath adjacent yardang-forming material. Why are the small craters on this apparent sandstone preserved? What cemented these particular sands so well that the rock is nearly as hard as basalt?