Mars Study

Heavily cratered terrain on Mars was created between 4.2 to 3.8 billion years ago during the period of "heavy bombardment" (i.e. impacts of asteroids, proto-planets, and comets). Since then the surface of Mars has not been extensively modified. Surfaces on airless bodies such as Mars that have not been subsequently modified by volcanism are "saturated" in craters.

Craters appear across the entire surface of Mars, and they are vital to understanding its crustal properties as well as surface ages and modification events. They allow inferences into the ancient climate and hydrologic history, and they add a key data point for the understanding of impact physics.

This study, created by Stuart Robbins, presents a new global database for Mars that contains 378,540 craters statistically complete for diameters D ≥ 1 km.

Unique Identifier: **CRATER_ID**

More information is available at:
http://about.sjrdesign.net/files/thesis/RobbinsThesis_LargeMB.pdf

Mars Crater Variables

Variable Names

CRATER_ID, LATITUDE_CIRCLE_IMAGE, LONGITUDE_CIRCLE_IMAGE, DIAM_CIRCLE_IMAGE, DEPTH_RIMFLOOR_TOPOG, MORPHOLOGY_EJECTA_1, MORPHOLOGY_EJECTA_2, MORPHOLOGY_EJECTA_3, NUMBER_LAYERS

Variables with Descriptions

- CRATER_ID – crater ID for internal sue, based upon the region of the planet (1/16ths), the "pass" under which the crate was identified, ad the order in which it was identified

- LATITUDE_CIRCLE_IMAGE – latitude from the derived center of a non-linear least-squares circle fit to the vertices selected to manually identify the crater rim (units are decimal degrees North)

- LONGITUDE_CIRCLE_IMAGE – longitude from the derived center of a non-linear least-squares circle fit to the vertices selected to manually identify the crater rim (units are decimal degrees East)

- DIAM_CIRCLE_IMAGE – diameter from a non-linear least squares circle fit to the vertices selected to manually identify the crater rim (units are km)

- DEPTH_RIMFLOOR_TOPOG – average elevation of each of the manually determined N points along (or inside) the crater rim(units are km)

    - Depth Rim - Points are selected as relative topographic highs under the assumption they are the least eroded so most original points along the rim
    - Depth Floor – Points were chosen as the lowest elevation that did not include visible embedded craters

- MORPHOLOGY_EJECTA_1 – ejecta morphology classified. Examples below.
    - If there are multiple values, separated by a "/", then the order is the inner-most ejecta through the outer-most, or the top-most through the bottom-most

- MORPHOLOGY_EJECTA_2 – the morphology of the layer(s) itself/themselves. This classification system is unique to this work. Examples below.

- MORPHOLOGY_EJECTA_3 – overall texture and/pr shape of some of the layer(s)/ejecta that are generally unique and deserve separate morphological classification. Examples below.

- NUMBER_LAYERS – the maximum number of cohesive layers in any azimuthal direction that could be reliably identified

Archetypal Examples of All Crater Ejecta Morphologies[1]

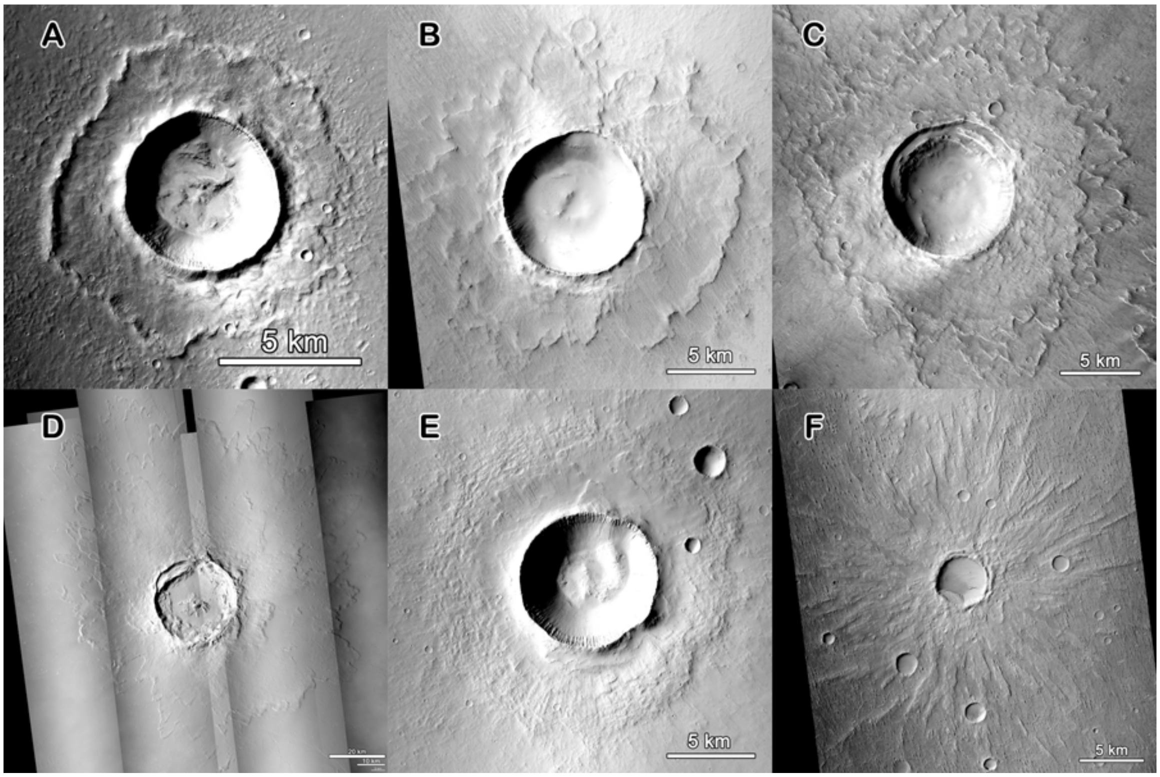

Figure 63: Select ejecta morphologies; scale bar is 5 km in all cases except (D), where the largest bar is 20 km. (A) is an example of the SLERC type in the first morphology column and HuSL (hummocky, short lobes) for the second (CTX image P21_009439_1850_XN_05N221W). (B) is an SLERS, SmSL (smooth, short lobes) (CTX image P19_008619_1840_XI_04N152W). (C) is a DLERS, HuSL type (CTX image B03_010694_1868_XI_06N285W). (D) is the MLERS, HuBL type (CTX mosaic from many images). (E) is an example of the "Pin-Cushion" morphology (also SLEPC, Hu) which, at the higher CTX resolution, has a strong radial ejecta component overlying the cohesive layer (CTX image P21_009381_2010_XN_21N080W). (F) is a good example of the SLEPS, HuSp type (CTX image P17_007606_1808_XI_00N210W).

[1] Everything in this section has been copied directly from *Robbins, S.J. (2011) "Planetary Surface Properties, Cratering Physics, and the Volcanic History of Mars from a New Global Martian Crater Database" Ph.D. Thesis, University of Colorado at Boulder.*

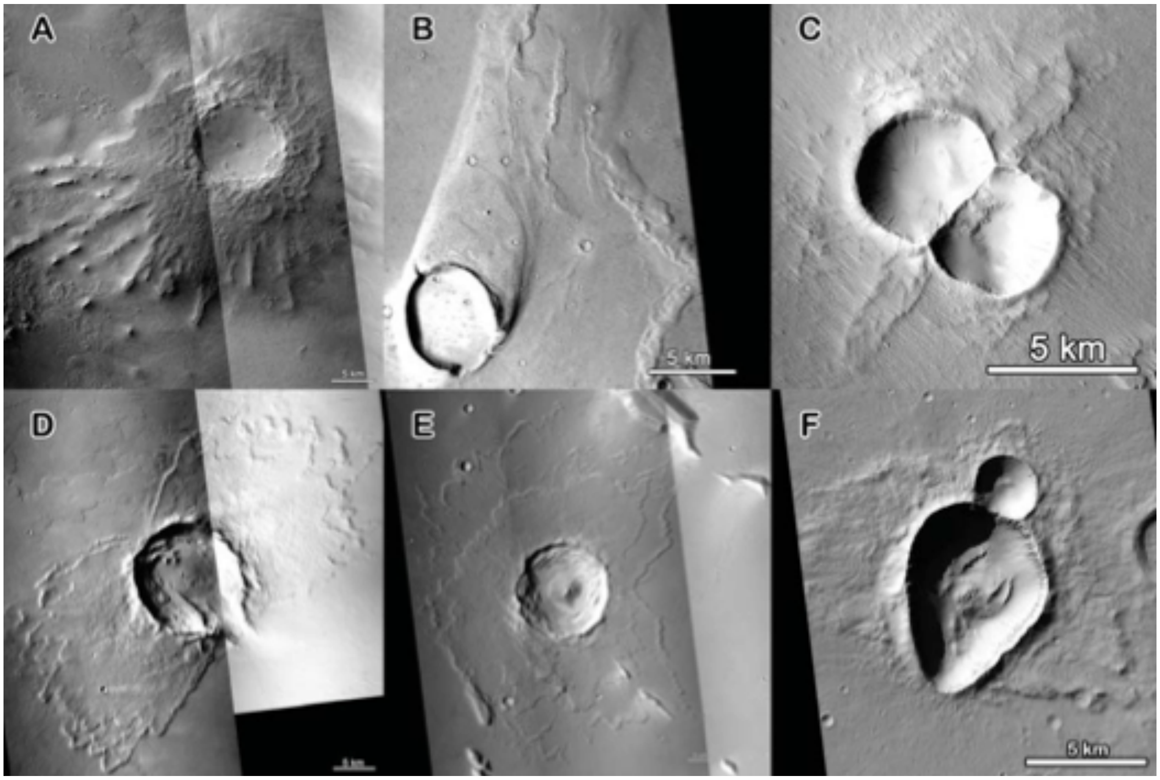

Figure 64: Select ejecta morphologies; scale bar is 5 km in all examples. (A) is both an SLEPd (pedestal crater), an example of the HuSp (hummocky, splash) type, and "Splash" in the third ejecta morphology column (CTX mosaic from P13_005942_1816_XI_01N135W , P21_009304_1806_XN_00N136W , P22_009515_1806_XI_00N136W.IMG). While not actually ejecta, "Sandbar" was indicated in the third ejecta morphology column for craters such as (B) (CTX image P03_002392_1948_XN_14N058W). (C) is the bumblebee ejecta type from a binary impact (CTX image P15_006971_1842_XN_04N151W). (D) is a DLERS, SmBL type with "Butterfly" in the third ejecta morphology column (CTX mosaic from P12_005874_1916_XN_11N080W and P20_008880_1915_XN_11N080W). (E) is the "pseudo- butterfly" type (also DLERS, SmBL) because, while it has the zone of avoidance to the east and some of the larger ejecta mobility immediately beyond the zone of avoidance, it continues around to the west as the normal DLE ejecta type and does not come back to the crater rim as with (D) (CTX mosaic from P02_001962_1967_XN_16N199W , P13_006142_1964_XN_16N198W , P20_008792_1980_XN_ 18N199W). (F) is an example of the "Rectangular" type which, while likely a progression from "Butterfly," has a ~180° zone of avoidance at the ends of the major axis. (CTX image B18_016578_ 1475_XI_32S359W).