(1) Craters show that terrains on planets have different properties and (2) different ages, and (3) they can be used to refine our models and understanding of the physics that governs the impact process. Bringing the application closer to home in terms of planetary hazards, knowing more about craters can impact our survival because they inform the population and frequency of extraplanetary impactors. The scaling laws derived from observations, models, and experiments allow for an informed assessment of risk from an approaching bolide. From a military standpoint, understanding craters formed by bombs and missiles is the same as that from an extraplanetary impactor and, historically, those on the forefront of studying craters were employed by the U.S. Department of Defense (i.e., Eugene Shoemaker and David Roddy) and studied bomb detonation sites. Beyond this, though, studying impact craters furthers our knowledge of planetary surface properties under different regimes and criteria, whereby a greater understanding of their characteristics under different environments and circumstances constrains our knowledge of how they form, what they inform us about the surface, and other questions of basic science intrigue.

An initial null hypothesis is that crater diameter and depth do not have a direct correlation to each other. While H1 does posit a direct correlation.

Variables:

* CRATER\_ID – crater ID for internal sue, based upon the region of the planet (1/16ths), the “pass” under which the crate was identified, and the order in which it was identified (Unique Identifier)
* 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

The crater study conducted by Stuart J. Robbins

Abstract

Impact craters are arguably the primary exogenic planetary process contributing to the surface evolution of solid bodies in the solar system. 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. Previously available databases of Mars impact craters were created from now antiquated datasets, automated algorithms with biases and inaccuracies, were limited in scope, and/or complete only to multikilometer diameters. This work presents a new global database for Mars that contains 378,540 craters statistically complete for diameters D ! 1 km. This detailed database includes location and size, ejecta morphology and morphometry, interior morphology and degradation state, and whether the crater is a secondary impact. This database allowed exploration of global crater type distributions, depth, and morphologies in unprecedented detail that were used to re-examine basic crater scaling laws for the planet. The inclusion of hundreds of thousands of small, approximately kilometer-sized impacts facilitated a detailed study of the properties of nearby fields of secondary craters in relation to their primary crater. It also allowed the discovery of vast distant clusters of secondary craters over 5000 km from their primary crater, Lyot. Finally, significantly smaller craters were used to age-date volcanic calderas on the planet to re-construct the timeline of the last primary eruption events from 20 of the major Martian volcanoes.

Study link: <http://about.sjrdesign.net/files/thesis/RobbinsThesis_LargeMB.pdf>