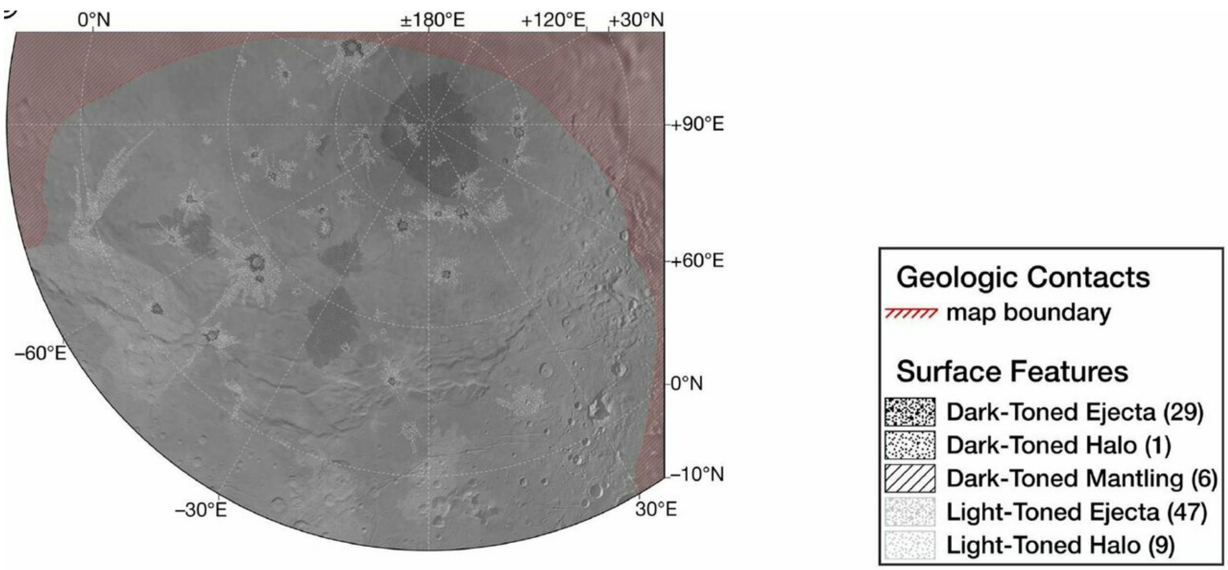
New map reveals geology and history of Pluto's moon Charon

February 27 2019, by Larry O'hanlon



Albedo-based map of Charon's encounter hemisphere Albedo is a measure of the amount of light reflecting off a surface. Credit: Robbins, et al., 2019

What a difference a planetary flyby makes. Pluto's moon Charon—once no more than a fuzzy blob of pixels beside a larger blob—now has its first geological map, published in AGU's *Journal of Geophysical Research*: *Planets*.

The new map was made with data and images collected by the 2015 flyby of the New Horizons spacecraft, which managed to gather enough data to map about a third of Charon's surface.

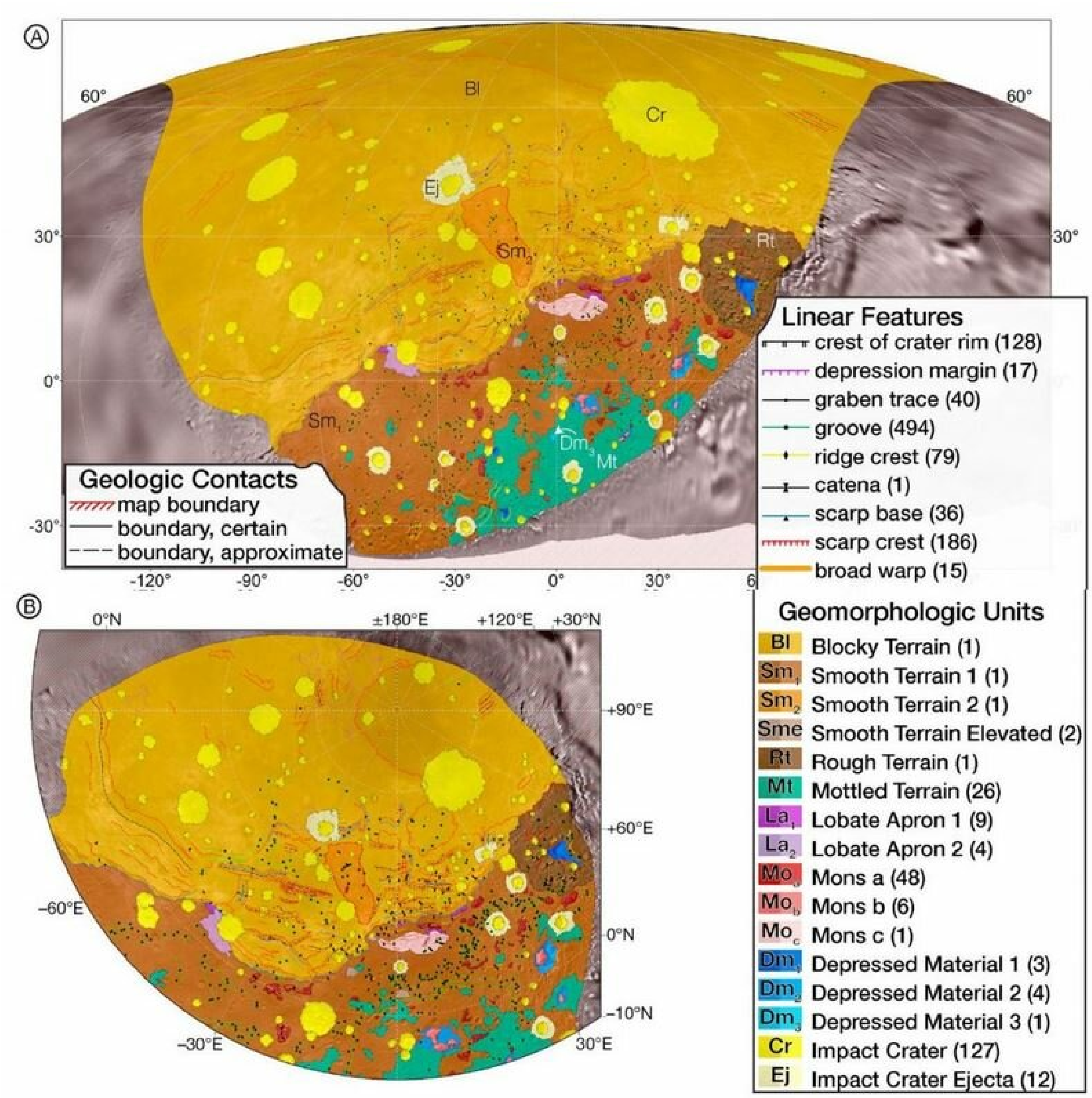
In that area, the scientists have identified 16 different kinds of geological units, or areas with similar landscapes, along with 10-kilometer-tall cliffs; more than a thousand grooves and other long, linear features; and a patchwork of light and dark ground.

To get the elevations of the cliffs, troughs, craters and other features, the team used multiple images of Charon taken as the spacecraft flew past to create stereo 3-D images. These images are taken from different positions, so they can be processed using the same principle that our own brain uses to take images from two eyes and give us depth perception.

The new map shows possible evidence of a world that may have once split open like a chapped lip, or a rising cake, then released icy materials from its interior to flood over large areas – what are called cryoflows. In fact, the researchers have found that Charon has perhaps one of the most convincing examples of large cryoflows found in the solar system so far.

Crater Enigma

The new map has revealed many puzzling features of Charon, including its craters.



Geomorphologic unit map of Charon’s encounter hemisphere in (A) cropped Molleweide projection and (B) polar stereographic projection. Credit: Robbins, et al., 2019

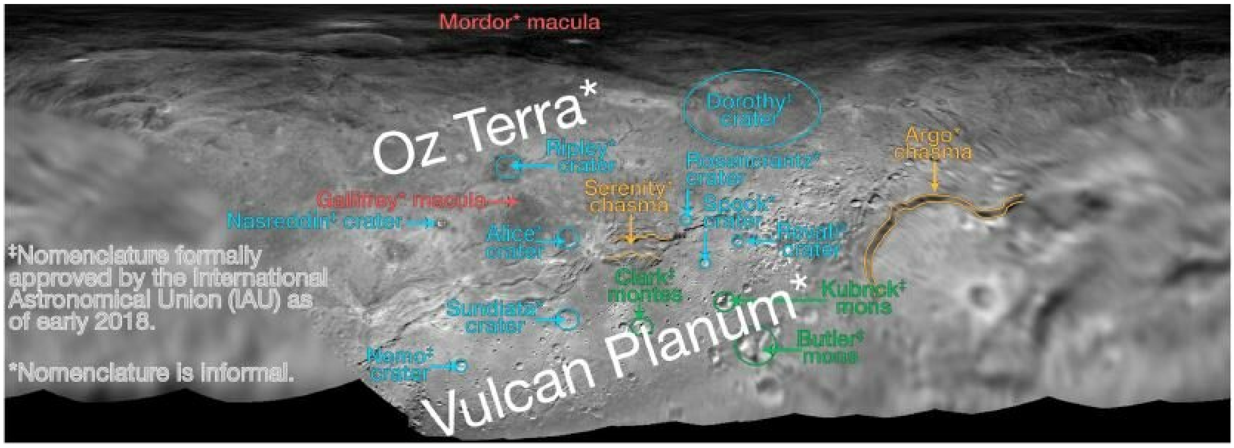
"Surprisingly we see very, very few degraded craters," said Stuart Robbins of the Southwest Research Institute and lead author of the new paper. "On Mars we see old (degraded) and new craters. On Charon pretty much every crater we see looks like it was created recently." Either that or the craters they see have been around a long time without anything changing them, he added.

One explanation for the lack of aged-looking craters might be that some process erased the older craters. That process might be ancient icy flows – cryoflows – that welled up through cracks in the surface of Charon and buried the older craters.

If so, then perhaps sometime in Charon's past its interior warmed up and underwent a chemical or physical change that caused it to expand slightly. That expansion cracked the surface – analogous to how the surface of a cake cracks as the cake rises while baking, Robbins explained. Then warmer materials from below oozed out over Charon's surface. That material would have hidden a lot of Charon's original surface, along with craters that were on that surface. This would also explain features that look like broken blocks of the moon's crust caught and surrounded by a flood of fresher material.

Oz, Vulcan and Spock

To organize Charon's features based on the cryoflows, the authors of the map described and named three major epochs in the history of Charon: Ozian, Vulcanian and Spockian.



Formal and informal nomenclature for regions and features of Charon used in the new map. Oz includes the mid to high latitudes. Vulcan includes the equatorial and near-equatorial regions.

The Ozian epoch was more than 4 billion years ago, when the informally named Oz Terra part of the crust of Charon was formed, shown in the upper part of the map.

The Vulcanian came next, perhaps starting more than 4 billion years ago as well, with cryoflows forming the Vulcan Planum in the lower part of the map, near Charon's equator. The Vulcanian probably continued for quite some time as different parts of Charon cooled.

The final epoch, the Spockian, represents the time after the Vulcan Palum solidified. That's the period of time when the same area got pockmarked with impact craters, up until the present day.

This is just one possible plot for Charon's story, Robbins points out.

"We could be entirely wrong," he said about the cryoflows.

It's a matter planetary scientists can puzzle over while they await more data from Charon, which could be a very long time coming since no follow up missions are currently in the works to that very remote part of the solar system.

More information: Stuart J. Robbins et al. Geologic Landforms and Chronostratigraphic History of Charon as Revealed by a Hemispheric Geologic Map, *Journal of Geophysical Research: Planets* (2019). DOI: 10.1029/2018JE005684

This story is republished courtesy of AGU Blogs (http://blogs.agu.org), a community of Earth and space science blogs, hosted by the American Geophysical Union. Read the original story here.

Provided by American Geophysical Union

Citation: New map reveals geology and history of Pluto's moon Charon (2019, February 27) retrieved 6 February 2023 from https://phys.org/news/2019-02-reveals-geology-history-pluto-moon.html