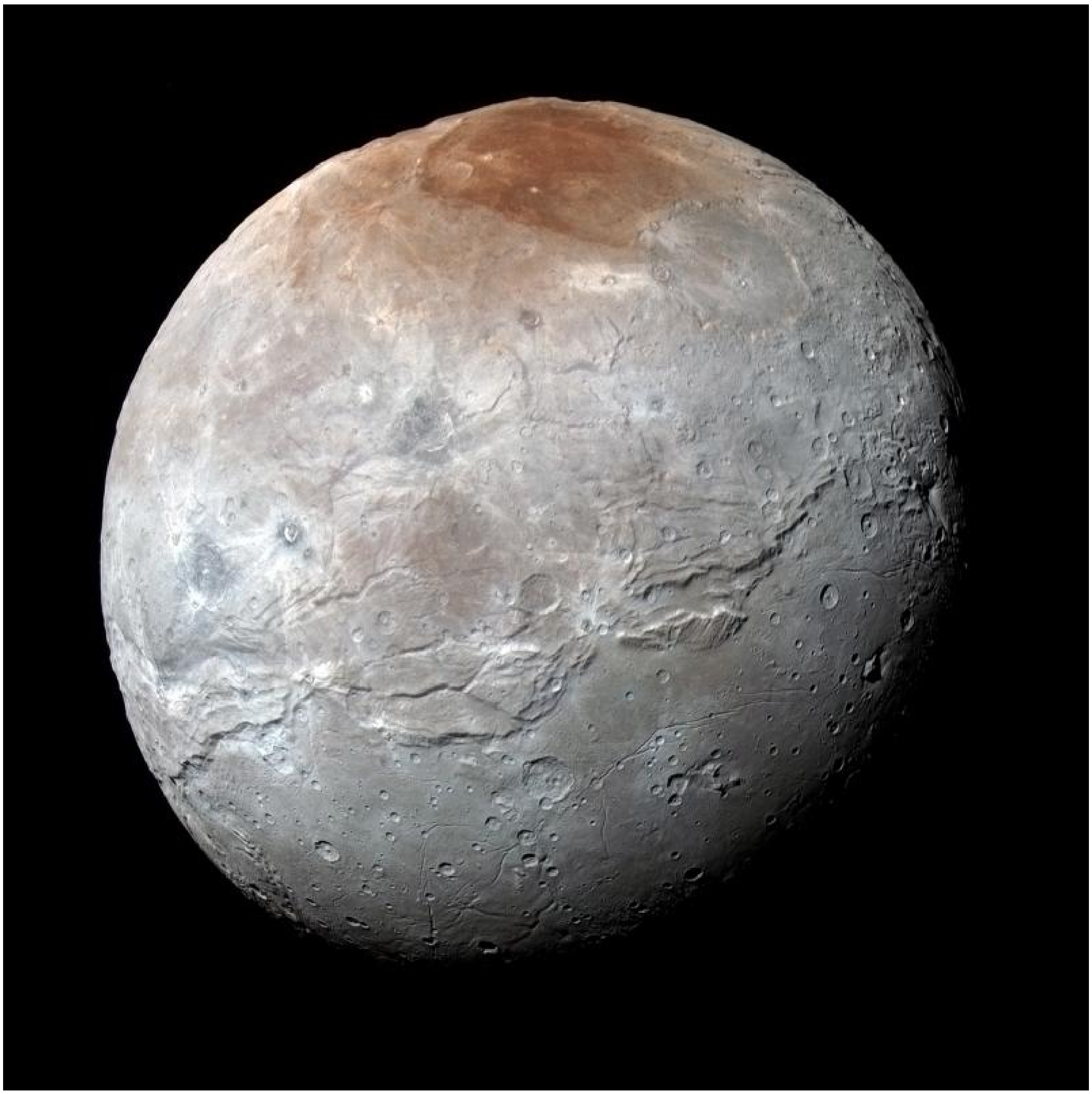
Images of Pluto's moon Charon show huge fractures and hints of icy 'lava flows'

October 6 2015, by David Rothery



Charon has a huge fracture system, unlike anything seen on Pluto. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute

Since the New Horizons probe flew through the Pluto system on July 14, most of the attention has been on Pluto itself. But it also has a comparatively large and – as we now know – fascinating moon called Charon.

The vast haul of data from New Horizons is now being transmitted to Earth at a slow rate because the signal is so weak. Yet some amazingly detailed images have been released, helping researchers trace the moon's violent history through its ridges and craters.

Charon is usually pronounced "Shairon" or even "Sharon", though "Kairon" would be a more faithful rendering of the name of the ferryman of the classical underworld after whom it is named. Charon and Pluto are locked in a tidal embrace that matches their rotation rates to their orbital period about each other, so that the same side of Charon always faces Pluto, and vice versa.

Our prior understanding is that Charon's surface is mostly water-ice, tainted by ammonia and lacking the more exotic methane, carbon monoxide and nitrogen ices that so spectacularly coat parts of Pluto. Charon is a darker, drabber world than Pluto when you see an identically processed image of each (below).

Surface secrets

But there is still plenty of variety across the face of Charon if you look for it. The image below is an enhanced colour view of Charon's Plutofacing hemisphere, brightened up relative to the previous dark view, showing details as small as 2.9 km. The brown smudge over its north pole might be discoloured by tiny particles of tar that have somehow drifted across from the top of Pluto's atmosphere, though if so we can't yet explain their concentration around Charon's pole.

Pluto (lower right) and Charon (upper left) identically processed. Credit:

NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute

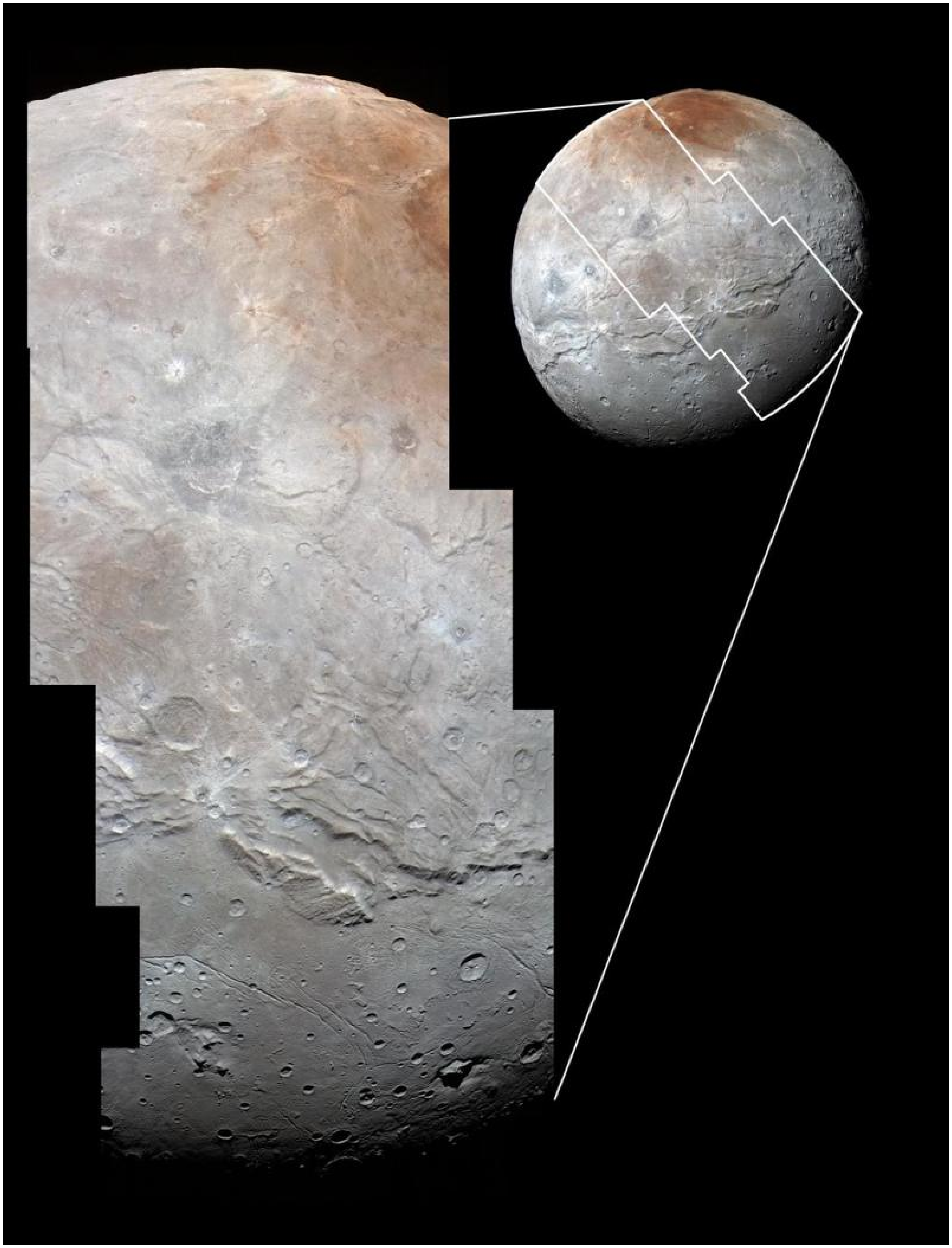
As a geologist, what interests me most is Charon's surface history. The north is more heavily cratered than the south, which tells us that the terrain in the north is older, whereas the south has been subjected to some kind of resurfacing process that has either erased or buried the older craters. While we can tell that Charon has been resurfaced more recently than parts of Pluto, we don't know the exact mechanism for this. It could have to do with the tidal-heating interaction between Pluto and Charon, but few people expected such apparently recent tidal heating.

If this were our own moon, we could use density of craters to work out a surface age in billions of years, because we know the rate at which impacts have occurred to form those craters. But because we don't know the rate of crater formation on Pluto, all we can say is that Charon's more densely cratered surfaces are older than the less densely cratered areas.

Perhaps the most impressive aspect of Charon is the system of fractures that stretch right across the globe. The broad fracture in the right-centre of the globe in the previous view has been provisionally named Serenity Chasma, and is seen in more detail in the view below, which includes a mosaic of high-resolution images showing features as small as 0.8 km.

There's a clue here as to what might have gone on. The ground surface on the south of Serenity Chasma has been heaved up and tilted away from the rift, and the old tilted surface disappears below a smooth younger surface with fewer craters than the northern terrain. So, maybe, the original surface was arched up over the rift and became split as the rift opened, and something smooth came flooding out. That could easily be "lava flows" made of an ammonia-water mixture erupted from Charon's interior, in a process called "cryovolcanism" to distinguish it from the much hotter volcanism on Earth. Some much narrower cracks crossing those plains also demonstrate a later phase of fracturing.

Charon - the movie



Part of Charon in the highest resolution yet available. Credit: NASA/Johns

Hopkins University Applied Physics Laboratory/Southwest Research Institute

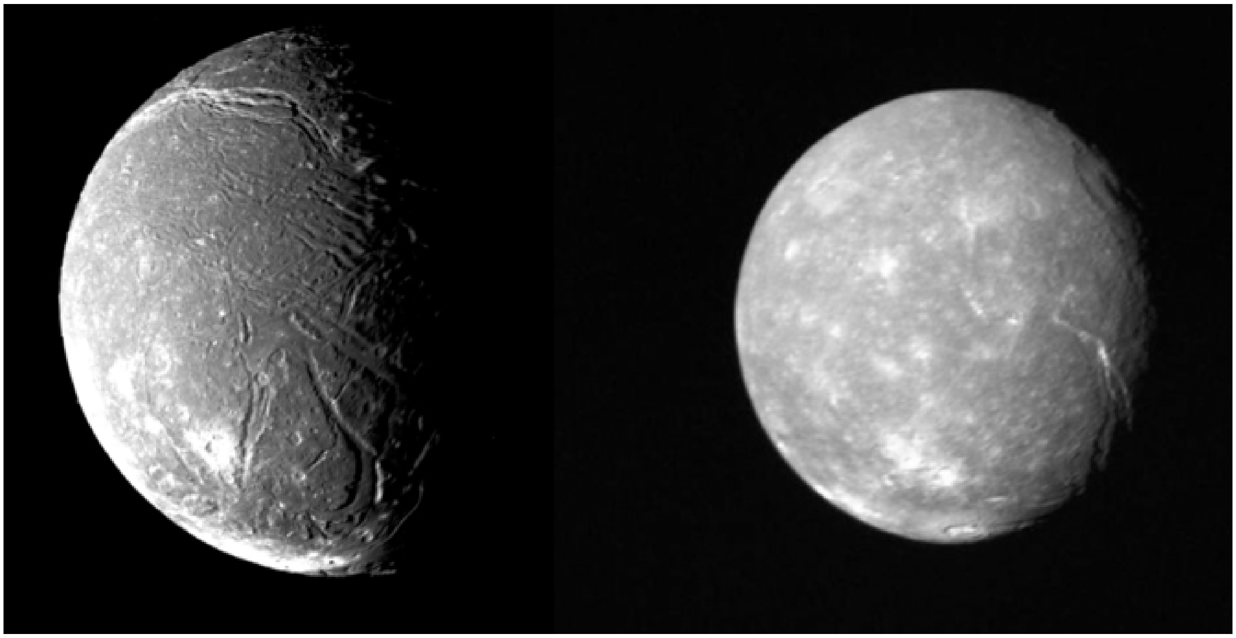
The New Horizons team has used images obtained from different viewpoints to make a stereoscopic model of parts of Charon's surface, from which they constructed the artificial fly-over video below. It starts high above the north pole, swoops down to fly along the length of Serenity Chasma, and ends with a view across the cryovolcanic plains towards a moated mountain in the distance.

Cousin moons

Are there other worlds out there like Charon? Well, maybe some of the moons of Uranus, which have ammonia mixed with their water-ice too. At 1207km in diameter, Charon is a little larger than Ariel but considerably smaller than Titania. All three have about 1.6 to 1.7 times the density of water, so they must contain about the same proportion of rock in their interiors.

During the only fly-by of Uranus (by Voyager 2 in 1986) we found that the globes of both Ariel and Titania are crossed by giant fracture systems and there are signs of cryovolcanic resurfacing on Ariel. The trouble is that we saw Uranus's moons much less well than we have now seen Charon, and the Voyager images, which seemed staggeringly detailed 30 years ago, are now frustratingly limited.

But Charon shows us that Ariel and Titania are likely to be more complicated than they seem. Maybe it's time for another probe to explore the wonders around Uranus.



Voyager 2 views of two icy fractured moons of Uranus that are most similar to Charon. Left: Ariel, 1155 km diameter. Right: Titania, 1576 km diameter. Credit: NASA/JPL

Source: The Conversation

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