Incredible video shows Hayabusa2 pogo-bouncing off asteroid

Enlarge / The surface of Ryugu as Hayabusa2 made its approach.

reader comments

39 with 34 posters participating

Share this story

The following series of events is not fiction: fly a probe to an asteroid, bounce off that asteroid while grabbing a piece of it, and fling that sample back to Earth. This series of activities is exactly what JAXA's Hayabusa2 mission is in the middle of doing. (And by the way, NASA's OSIRIS-REx mission is working on the exact same thing, just on a timeline a year behind Hayabusa2.)

Hayabusa2 grabbed its first sample from the surface of a near-Earth asteroid named Ryugu in February 2019. (A second sample was collected in July after it blasted a small crater to expose sub-surface material.) A new study published by the team this week details what the probe saw at the sampling site—including remarkable video of the touchdown itself.

We have touchdown

As the probe touched Ryugu's surface, it fired a small projectile into it, catching some of the debris in an open "sampling horn" before bouncing away and re-establishing its orbit. These samples will return to the Earth later this year,

but for now, the scientists are establishing what we know about the areas they came from.

Ryugu has a somewhat angular shape and is a little less than a kilometer across, and its equator bulges out in a distinctive ridge that makes the asteroid resemble a spinning top. Up close, it looks like a rubble pile. But there are some interesting color patterns within that jumble.

A video of the touchdown. Be patient, the screen will eventually fill with the view from different cameras.
A video of the touchdown. Be patient, the screen will eventually fill with the view from different cameras.
Ryugu's surface is a mix of dark material with slightly reddish or bluish tinges. The blue dominates the poles and equator, and the red dominates the mid-latitude regions in between. But zoom in close and you'll see that both are represented.

Boulders are primarily bluish—including where you see one cracked open—with reddish patches on the surface. And the spot that Hayabusa2 sampled was initially bluish but was coated in red after the dust settled. Putting everything together, the reddish color seems to be the mark of alteration or weathering—like rust forming on the surface of steel.

Seeing red

Oxidizing isn't a thing in the vacuum of space, but there are other processes that can create this appearance. Interactions with the charged particles of the solar wind can drive chemical reactions on the surface of a body, for example, but that tends to form a microscopic skin—Ryugu's layer appears thicker. So the conclusion the researchers draw is that this is actually the product of a closer pass with the Sun earlier in Ryugu's life. That heat metamorphosed a surface layer of the asteroid, which was then pulverized and redistributed by small impact events. And given that the poles and the equator

are topographic highs, that material would tend to settle into the mid-latitude lowlands

Enlarge / This illustration shows the researchers’ proposed timeline for Ryugu’s evolution.

The team can actually guess at the timing of Ryugu’s flirtation with the Sun by examining its impact craters. By looking at how craters and their ejected debris overlap, you can work out which are older and which are newer. The inside of the older craters are reddish, but there are younger craters that still appear bluish (more evidence that the reddening was a past episode rather than an ongoing and recent process).

Based on established estimates for the average rates of impact collisions over time, the researchers calculate that the reddening episode occurred somewhere between 300,000 years and 8 million years ago (depending on when Ryugu left the asteroid belt for its near-Earth orbit). They also calculate that Ryugu probably formed (from the breakup of some larger body) around 9 million years before that. That’s quite recent compared to some well-studied breakups of major asteroids, which implies

Ryugu is a grandchild, at least—the product of progressively smaller breakups.

The team is hopeful that Hayabusa2 caught some of the reddened material as well as the bluer rock in its sample grab, so we'll hopefully get a much closer look at this stuff when the shipment comes in later this year.

If you simply can't wait that long for another asteroid sampling fix, NASA's OSIRIS-Rex probe is currently eyeballing its target on the asteroid Bennu. Its touch-and-go sampling lunge is set for August of this year.

Science, 2020. DOI: 10.1126/science.aaz6306 (About DOIs).

https://arstechnica.com/?p=1674228