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Pluto's Icy Heart Is Still Beating

Strange shapes inside the region known as Sputnik Planum suggest that the tiny world is constantly repaving its surface with churning ice.

By **Nadia Drake**

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Pluto at Its Finest The New Horizons spacecraft captured the highest resolution images ever of a swath of Pluto, stitched together here in a mosaic image. Use the scrollbar below the image or swipe to see the complete picture.

NASA/JHUAPL/SWRI



Pluto's most recognizable feature—its bright, shiny heart—is alive. Geologically speaking, that is.



From beneath the western half of that seemingly placid plain, warm nitrogen ice is continually rising upward. As it reaches Pluto's surface and spreads sideways, that fresh ice erases craters and other signs of planetary age, keeping the region known as Sputnik Planum looking perpetually youthful.

The rejuvenating ice treatment also produces telltale polygonal patterns on the surface, shapes that will keep shifting as the Sputnik Planum ice sheet continues churning.



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"Not only is it the heart of Pluto, it's the beating heart," says Bill McKinnon of Washington University in St. Louis. "There are actually things happening. If we were to come back in 100,000 years, the pattern would be markedly altered."

Two papers, published today in *Nature*, present the finding that subsurface convection is continually repaving the face of Sputnik Planum and producing the polygonal features.

The studies differ in the details of how that all works—including how deep the layer of convecting nitrogen ice is—but the basic story is the same.

"I'm more excited about the similarities between the two papers," says one study coauthor, Alexander Trowbridge of Purdue University. "Our results are very similar, which is what you want to see in science."

Bubbling Ice

Last July, when scientists sent the New Horizons spacecraft zooming by Pluto, they were in for a surprise. The tiny world's motley assortment of terrains, colors, and ices looked way too dramatic to have been sculpted by the icy hand of the outer, outer solar system, where heat is scarce, stuff tends to freeze in place, and cratered, dead relics from the beginning of the solar system orbit the sun in a great disc of debris.

Among Pluto's peculiar features is Sputnik Planum, which measures about 745 miles (1,200 kilometers) across. Its smooth, softly pitted face appeared to be much too young, devoid of the craters that accumulate on older planetary surfaces, and it looked as though glaciers flowing down from the surrounding mountains were feeding into the icefield.



Pluto's Extreme Close-Up This video shows how astronomers created a mosaic of the highest-resolution images of Pluto from NASA's New Horizons spacecraft.



A closer look revealed the network of polygonal shapes, which all rise ever so slightly in their centers. At the time, McKinnon suggested the polygons could be the work of convection beneath Sputnik Planum, a region that is essentially a huge reservoir of soft, malleable nitrogen ice.

Think of that convective process like a sort of slow motion bubbling, the kind of thing you see in lava lamps or a pot of oatmeal warming on the stove.

"You will see that the surface will separate into polygonal terrain," Trowbridge says of the oatmeal. "If the stove is on, the centers of the polygons will be raised, but if you turn the stove off, the centers of the polygons collapse."

Decaying radioactive elements in Pluto's interior are still powering its planetary stove, and that heat is enough to cook up polygonal cells between 6 and 25 miles (10 and 40 kilometers) across.

"They're unique features that really, on this scale, we haven't seen anywhere else in the solar system," Trowbridge says.

Rapid Repaving

Based on the new work, the teams calculate that Sputnik Planum's face could be completely repaved every 500,000 to 1 million years or so, meaning the region looked completely different when saber-toothed cats prowled the Earth. It's a geologically rapid process that scientists didn't exactly expect to see on a small, freezing world that lives, on average, 40 times farther from the sun than Earth.

"At the far outer edges of the solar system, in a deeply alien environment, are features that would not look out of place on Earth or Mars," write Paul Schenk and Francis Nimmo in a commentary that appears in *Nature Geoscience*.

The two teams reporting convection disagree somewhat about the thickness of that layer of nitrogen ice, and the exact answer could say something about how Pluto's beating heart came to be.

"The cool thing is that you can use an understanding of the process to interrogate what's going on inside Pluto," McKinnon says. "It's one thing to say, 'Oh look, the surface of Sputnik Planum looks like it's covered in these convective wells.' But then what?"

For now, it seems likely that Sputnik Planum is a flat-bottomed impact basin that has become a sort of planetary nitrogen dump. But it's not clear whether all that nitrogen concentrated there primarily because of climate or glacial activity, note Andrew Dombard and Sean O'Hara in another commentary accompanying the papers.

More work will be needed to solve these mysteries of Pluto's heart and determine whether it's really one of a kind. Perhaps, McKinnon says, some of the other large worlds in Pluto's neighborhood, such as Eris and Makemake, have similar features.

"Pluto is much more active than anyone hoped for," he says. "It stands to reason that the other bodies are at least comparable because they're running on their own power."

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