Moon's escaping gasses expose fresh surface

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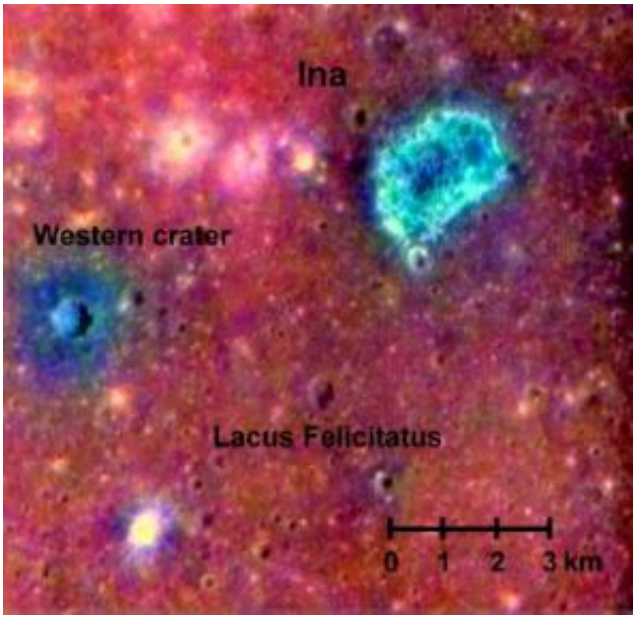


False color composite indicates age and composition of lunar surface features. Titanium basalts (blue) are exposed on the floor of Ina structure and in the "fresh" impact crate at left. Less mature soils (based on spectral ratios) appear in green. Credit: NASA

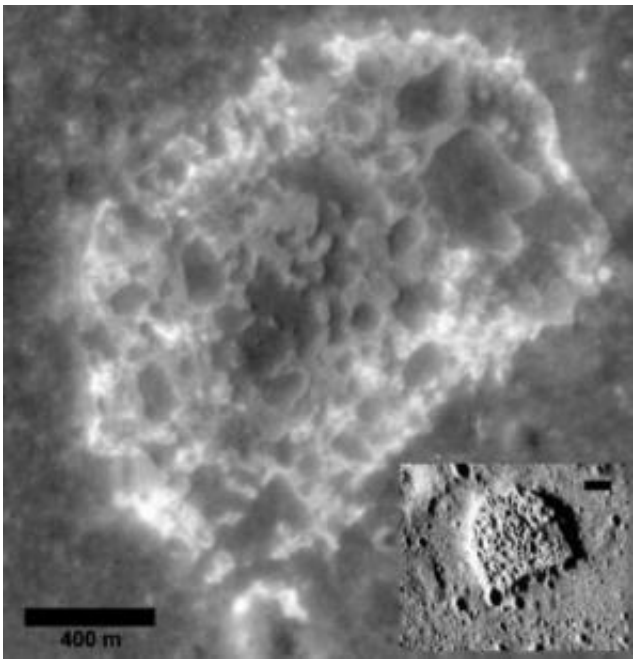
Conventional wisdom suggests that the moon has seen no widespread volcanic activity for at least the last three billion years. Now, a fresh look at existing data points to much more recent release of lunar gasses.

The study, published in the journal *Nature* by geologists Peter Schulz and Carlé Pieters of Brown University and Matthew Staid of the Planetary Science Institute, uses three distinct lines of evi-dence to

support the assertion that volcanic gas has been released from the moon's surface within the last one to ten million years. The researchers focus on a D-shaped area called the Ina struc-ture that was first recognized in images from Apollo missions.

The unusual sharpness of the features first called Schultz's attention to the area. "Something that razor sharp shouldn't stay around long. It ought to be destroyed within 50 million years," said Schulz. On Earth, wind and water quickly wear down freshly exposed surface features. On the airless moon, constant bombardment with tiny space debris accomplishes a similar result. By comparing the fine-scale surface features within the Ina structure to other areas on the moon with known ages, the team was able to place its age at closer two million years.

The scarcity of asteroid impact craters on the surface within Ina provided a second line of evi-dence for the feature's relative youth. The researchers identified only two clear impact craters larger than 30 meters on the 8 square kilometers of the structure's floor. This frequency is about the same as at South Ray Crater, near the Apollo 16 landing site. The surface material ejected from South Ray Crater has long been used as a benchmark for dating other features on the moon's surface and most lunar scientists studying these rocks agree on a date of approximately two million years, based on cosmic ray exposure.



Apollo images of D-shaped Ina structure, where gas releases may have exposed fresh surfaces. Main image shows very few craters within the depression. Low-angle illumination (inset) reveals sharp features with little weathering. Credit: NASA

The third piece of support for the authors' hypothesis comes from comparing the spectral signa-tures of deposits in the Ina depression to those from very fresh craters. As lunar surface deposits weather, the wavelengths of light they reflect change in predictable ways. Overall reflectance, or albedo, gets less bright and the ratio of light at 1000 nm wavelengths to 750 nm wavelengths in-creases. Based on these color ratios, the deposits on Ina's floor are exceptionally young – and possibly even newly exposed.

The appearance of the surface at Ina does not indicate an explosive release of magma, which would result in visible rays of ejecta surrounding a central crater. Rather, it suggests a rapid re-lease of gasses, which would have blown off the surface deposits, exposing less

weathered mate-rials. This interpretation is particularly appealing because Ina is located at the intersection of two linear valleys or rilles -- like many geologically active areas on Earth.

Ina also does not appear to be alone. The authors identify at least four similar features associated with the same system of rilles, as well as others in neighboring rille systems. Although several kinds of evidence support the authors' conclusion that the moon is more geologically active than previously thought, the only sure way to resolve the question would be to collect samples at such sites. "Ina and other similar features are great targets for future exploration, by people or robots, said G. Jeffrey Taylor, a lunar researcher at the University of Hawaii. "They might be the best place to get a good look at the interface between the powdery regolith and the consolidated rock beneath."

Over the years, says Schultz, amateur astronomers have seen puffs or flashes of light coming from the moon's surface. Although most professional observers have upheld the conclusion that the moon was inactive, such sightings have kept open a window of doubt. A coordinated obser-vation campaign, including both professional and amateur astronomers, would be one way to build additional evidence for activity, says Schultz. A gas release itself would not be visible for more than a second or so, but the dust it kicked up might stay suspended for up to 30 seconds. With modern alert networks, that's long enough to move a professional telescope into position to see what's happening.

Source: Brown University