Georgia Tech

Research News

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VOLCANOES ON VENUS? NEW MEASUREMENTS APPEAR TO SHOW CHANGES IN ATMOSPHERE; SUPPORT THEORIES OF VOLCANIC ACTIVITY

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New measurements taken by radio telescope appear to show a dramatic ten-year decline in the amount of sulfur dioxide in the atmosphere of the planet Venus. The measurements, corroborating other data, give new support to theories which suggest the existence of volcanic activity on the cloud-enshrouded planet.

Sulfur dioxide absorbs certain frequencies of microwave energy at known rates, allowing researchers at the Georgia Institute of Technology to calculate from the radio measurements the amount of the chemical present in the Venus atmosphere. The microwave energy measured is part of natural emissions from the planet.

"We have evidence for the first time that levels of sulfur dioxide have been dropping off in the atmosphere below the clouds," said Dr. Paul Steffes, associate professor in Tech's School of Electrical Engineering. 3128/662-8429

The Georgia Tech scientists believe the Venus atmosphere now contains approximately 40 to 50 parts per million of sulfur dioxide -- compared to 150 to 185 parts per million reported by independent U.S. and Soviet probes dropped into the atmosphere in 1978.

Though other changes in atmospheric chemistry could explain the decline in sulfur dioxide, Steffes says the measurements support theories which suggest substantial volcanic activity occurred on Venus not long before the 1978 probes arrived.

"What we are seeing is consistent with the argument that there was a large injection of sulfur dioxide into the atmosphere of Venus," he said. "It doesn't necessarily prove the existence of volcanic activity, though it is suggestive of it."

Over the past ten years, an ultraviolet spectrometer aboard Pioneer Venus has reported a decline in levels of sulfur dioxide in the atmosphere above the planet's thick cloud layer. The sensor, however, cannot penetrate the cloud layer to measure sulfur dioxide in the lower atmosphere.

In addition, a Soviet probe in 1985 also reported declines in the level of sulfur dioxide.

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Steffes and graduate student Jon Jenkins, along with Dr. Michael J. Klein of the Jet Propulsion Laboratory, made the measurements from the 140-foot NRAO radio telescope at Green Bank, West Virginia, and at the 70-meter NASA DSS-14 telescope at Goldstone, California. The data was presented October 31 to the 21st Annual Meeting of the Division for Planetary Sciences of the American Astronomical Society in Providence, R.I.

Sulfur dioxide levels can be calculated by measuring the emission of 1.3 centimeter radio waves from Venus. Because of the atmospheric absorption, larger amounts of microwave radiation received correspond to lesser quantities of the gas in the atmosphere.

Because the radio signals must pass through a large portion of the Venus atmosphere, they tend to produce an "averaging" effect. Radio observation therefore may provide more representative data than probes dropped into the atmosphere at isolated locations, Steffes said. The radio telescope observations can also be repeated over time.

"The combination of U. S. and Soviet probes, plus the radio telescope measurements made by us, suggest that the amount of sulfur dioxide in the lower atmosphere of Venus has dropped by a factor of three over the past ten years," he concluded.

Preliminary measurements also suggest a similar decline in the level of sulfuric acid vapor, though Steffes warns that more study is needed to confirm that data. The sulfuric acid data also appears to show significant variations in atmospheric chemistry at different areas of Venus.

"We have data sets which show the microwave absorption from sulfuric acid vapor in the upper latitudes near the poles is different than it is at the equatorial zones," Steffes reported. "It suggests that the structure of the atmosphere is different from place to place."

The sulfuric acid data was obtained by measuring the absorption rate of microwave radio beams sent through the Venus atmosphere to Earth from the Pioneer Venus spacecraft, which has been orbiting the planet for the past decade.

The Magellan spacecraft now on its way to Venus may provide confirmation of volcanic activity with its surface-mapping radar. The radar should be able to detect new surface features such as lava flows, telling scientists for sure if volcanic activity exists on the planet.

With its more powerful radio and larger antenna, Magellan "will give us the opportunity to probe more deeply and more accurately into the Venus atmosphere," Steffes predicted.

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