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Remaining Mars Atmosphere Still Dynamic

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Mars
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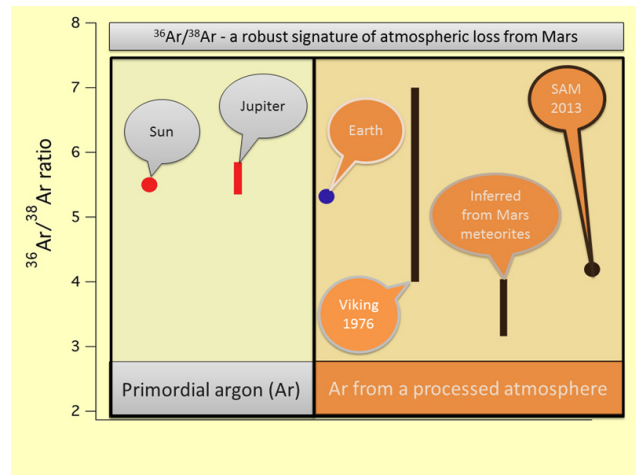
Summary: New data from the Curiosity rover indicates that much of Mars' original atmosphere has been lost, but what remains is still quite active.

Mars has lost much of its original atmosphere, but what's left remains quite active, recent findings from NASA's Mars rover Curiosity indicate. Rover team members reported diverse findings at the European Geosciences Union 2013 General Assembly, in Vienna. Evidence has strengthened this month that Mars lost much of its original atmosphere by a process of gas escaping from the top of the atmosphere. Understanding the history and evolution of the martian atmosphere is important in determining [life's potential](#) on ancient Mars.

Curiosity's Sample Analysis at Mars (SAM) instrument analyzed an atmosphere sample last week using a process that concentrates selected gases. The results provided the most precise measurements ever made of isotopes of argon in the Martian atmosphere. Isotopes are variants of the same element with different atomic weights.

"We found arguably the clearest and most robust signature of atmospheric loss on Mars," said Sushil Atreya, a SAM co-investigator at the University of Michigan, Ann Arbor.

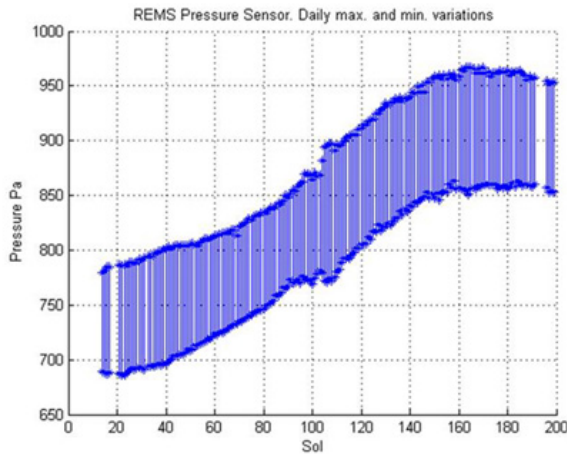
SAM found that the Martian atmosphere has about four times as much of a lighter stable isotope (argon-36) compared to a heavier one (argon-38). This removes previous uncertainty about the ratio in the Martian atmosphere from 1976 measurements from NASA's [Viking](#) project and from small volumes of argon extracted from Martian meteorites. The ratio is much lower than the solar system's original ratio, as estimated from argon-isotope measurements of the Sun and Jupiter. This points to a process at Mars that favored preferential loss of the lighter isotope over the heavier one.



This image shows the ratio of the argon isotope argon-36 to the heavier argon isotope argon-38, in various measurements. The point farthest to the left designates a new (2013) measurement of the ratio in the atmosphere of Mars, made by the quadrupole mass spectrometer in the Sample Analysis at Mars (SAM) suite of instruments in NASA's Curiosity Mars rover. For comparison, the previous measurement at Mars by the Mars Viking project in 1976 is shown also. The SAM result is at the lower end of the range of uncertainty of the Viking data, but compares well with ratios of argon isotopes from some Mars meteorites. The value determined by SAM is significantly lower than the value in the sun, Jupiter and Earth, which implies loss of the lighter isotope compared to the heavier isotope over geologic time. The argon isotope fractionation provides clear evidence of the loss of

Curiosity measures several variables in today's Martian atmosphere from Mars. Credit: NASA/JPL-Caltech atmosphere with the Rover Environmental Monitoring Station (REMS), provided by Spain. While daily air temperature has climbed steadily since the measurements began eight months ago and is not strongly tied to the rover's location, humidity has differed significantly at different places along the rover's route. These are the first systematic measurements of humidity on Mars.

Trails of dust devils have not been seen inside Gale Crater, but REMS sensors detected many whirlwind patterns during the first hundred Martian days of the mission, though not as many as detected in the same length of time by earlier missions. "A whirlwind is a very quick event that happens in a few seconds and should be verified by a combination of pressure, temperature and wind oscillations and, in some cases, a decrease in ultraviolet radiation," said REMS Principal Investigator Javier Gómez-Elvira of the Centro de Astrobiología, Madrid.



This graph shows about one-fourth of a Martian year's pattern atmospheric pressure at the surface of Mars, as measured by the Rover Environmental Monitoring Station on NASA's Curiosity rover. Image Credit: NASA/JPL-Caltech/CAB(CSIC-INTA)/FMI/Ashima Research

are being sent during a four-week period while Mars is passing nearly behind the Sun, from Earth's perspective. This geometry occurs about every 26 months and is called Mars solar conjunction.

"After conjunction, Curiosity will be drilling into another rock where the rover is now, but that target has not yet been selected. The science team will discuss this over the conjunction period." said Mars Science Laboratory Project Scientist John Grotzinger, of the California Institute of Technology, Pasadena.

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