Curiosity rover: No big surprise in first soil test

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This is a view of the third (left) and fourth (right) trenches made by the 1.6-inch-wide (4-centimeter-wide) scoop on NASA's Mars rover Curiosity in October 2012. The image was acquired by the Mars Hand Lens Imager (MAHLI) on Sol 84 (Oct. 31, 2012) and shows some of the details regarding the properties of the "Rocknest" wind drift sand. The upper surface of the drift is covered by coarse sand grains approximately 0.02 to 0.06 inches (0.5 to 1.5 millimeters) in size. These coarse grains are mantled with fine dust, giving the drift surface a light brownish red color. The coarse sand is somewhat cemented to form a thin crust about 0.2 inches (0.5 centimeters) thick. Evidence for the crusting is seen by the presence of angular clods in and around the troughs and in the sharp, jagged indentations and overhangs on one wall of each trench (the walls closest to the top of this figure). Beneath the crust surface, as revealed in the scoop troughs and the piles of sediment on the right side of each, is finer sand, which is darker brown as compared with the dust on the surface. The left end of each trough wall shows alternating light and dark bands, indicating that the sand inside the drift is not completely uniform. This banding might result from different amounts of infiltrated dust, chemical alteration or deposition of sands of slightly different color. Image credit: NASA/JPL-Caltech/MSSS

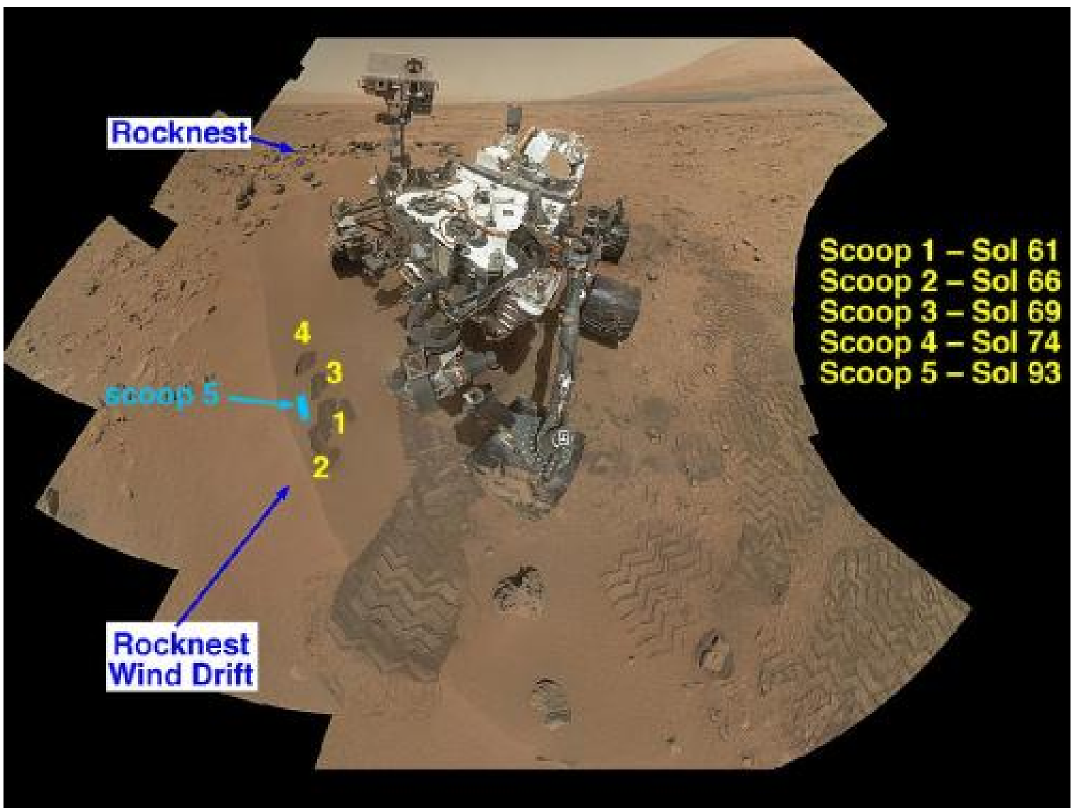
(Phys.org)—NASA's Mars Curiosity rover has used its full array of instruments to analyze Martian soil for the first time, and found a complex chemistry within the Martian soil. Water and sulfur and chlorine-containing substances, among other ingredients, showed up in samples Curiosity's arm delivered to an analytical laboratory inside the rover.

Detection of the substances during this early phase of the mission demonstrates the laboratory's capability to analyze diverse soil and rock samples over the next two years. Scientists also have been verifying the capabilities of the rover's instruments.

Curiosity is the first Mars rover able to scoop soil into analytical instruments. The specific soil sample came from a drift of windblown dust and sand called "Rocknest." The site lies in a relatively flat part of Gale Crater still miles away from the rover's main destination on the slope of a mountain called Mount Sharp. The rover's laboratory includes the Sample Analysis at Mars (SAM) suite and the Chemistry and Mineralogy (CheMin) instrument. SAM used three methods to analyze gases given off from the dusty sand when it was heated in a tiny oven. One class of substances SAM checks for is organic compounds—carbon-containing chemicals that can be ingredients for life.

"We have no definitive detection of Martian organics at this point, but we will keep looking in the diverse environments of Gale Crater," said SAM Principal Investigator Paul Mahaffy of NASA's Goddard Space Flight Center in Greenbelt, Md.

Curiosity's APXS instrument and the Mars Hand Lens Imager (MAHLI) camera on the rover's arm confirmed Rocknest has chemical-element composition and textural appearance similar to sites visited by earlier NASA Mars rovers Pathfinder, Spirit and Opportunity.

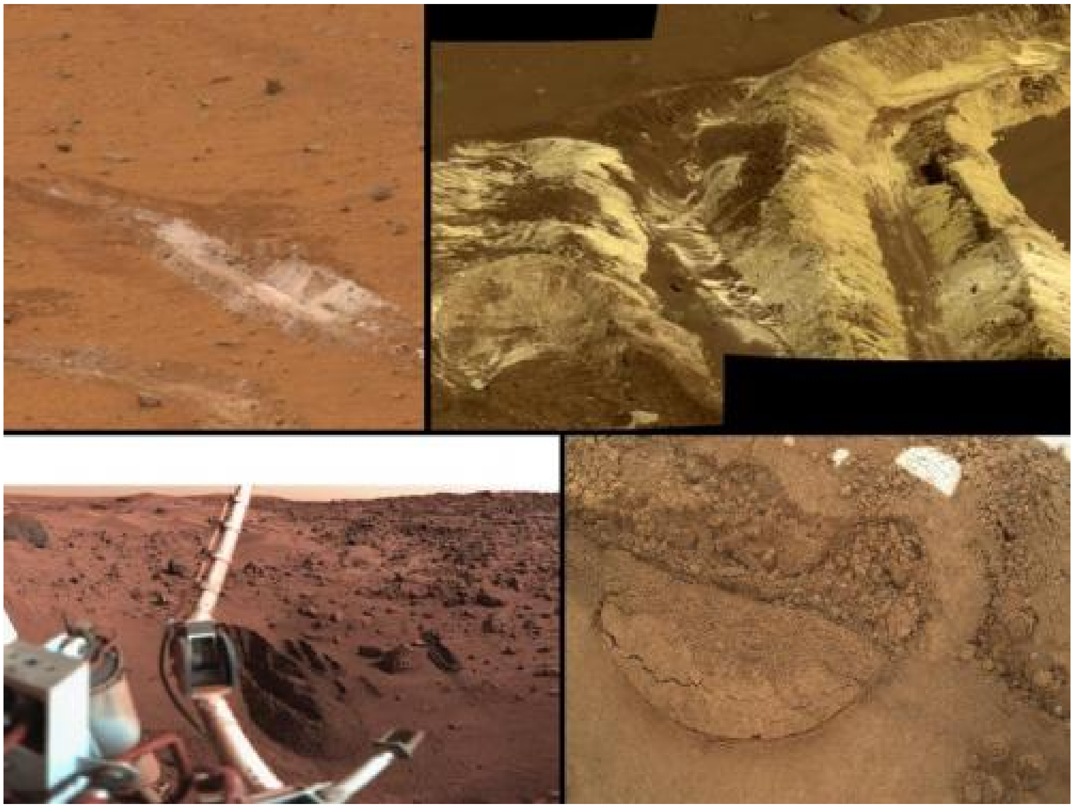


NASA's Curiosity Mars rover documented itself in the context of its work site, an area called "Rocknest Wind Drift," on the 84th Martian day, or sol, of its mission (Oct. 31, 2012). The rover worked at this location from Sol 56 (Oct. 2, 2012) to Sol 100 (Nov. 16, 2012). Credit: NASA

Curiosity's team selected Rocknest as the first scooping site because it has fine sand particles suited for scrubbing interior surfaces of the arm's sample-handling chambers. Sand was vibrated inside the chambers to remove residue from Earth. MAHLI close-up images of Rocknest show a dust-coated crust one or two sand grains thick, covering dark, finer sand.

"Active drifts on Mars look darker on the surface," said MAHLI Principal Investigator Ken Edgett, of Malin Space Science Systems in San Diego. "This is an older drift that has had time to be inactive, letting the crust form and dust accumulate on it."

CheMin's examination of Rocknest samples found the composition is about half common volcanic minerals and half non-crystalline materials such as glass. SAM added information about ingredients present in much lower concentrations and about ratios of isotopes. Isotopes are different forms of the same element and can provide clues about environmental changes. The water seen by SAM does not mean the drift was wet. Water molecules bound to grains of sand or dust are not unusual, but the quantity seen was higher than anticipated.



This collage shows the variety of soils found at landing sites on Mars. The elemental composition of the typical, reddish soils were investigated by NASA's Viking, Pathfinder and Mars Exploration Rover missions, and now with the Curiosity rover, using X-ray spectroscopy. The investigations found similar soil at all landing sites. In addition, the soil was usually unchanged over the traverse across the Martian terrain made by both Mars Exploration Rovers. The Mars Exploration Rover Spirit's landing region in Gusev Crater is seen in both pictures at top; Viking's landing site is shown at lower left; and a close-up of Curiosity's Gale Crater soil target called "Portage" is at lower right. In Gusev Crater, several white subsurface deposits were excavated with Spirit’s wheels and found to be either silica-rich or hydrated ferric sulfates. Image credit: NASA/JPL-Caltech

SAM tentatively identified the oxygen and chlorine compound perchlorate. This is a reactive chemical previously found in arctic Martian soil by NASA's Phoenix Lander. Reactions with other chemicals heated in SAM formed chlorinated methane compounds—one-carbon organics that were detected by the instrument. The chlorine is of Martian origin, but it is possible the carbon may be of Earth origin, carried by Curiosity and detected by SAM's high sensitivity design.

"We used almost every part of our science payload examining this drift," said Curiosity Project Scientist John Grotzinger of the California Institute of Technology in Pasadena. "The synergies of the instruments and richness of the data sets give us great promise for using them at the mission's main science destination on Mount Sharp."

Provided by NASA