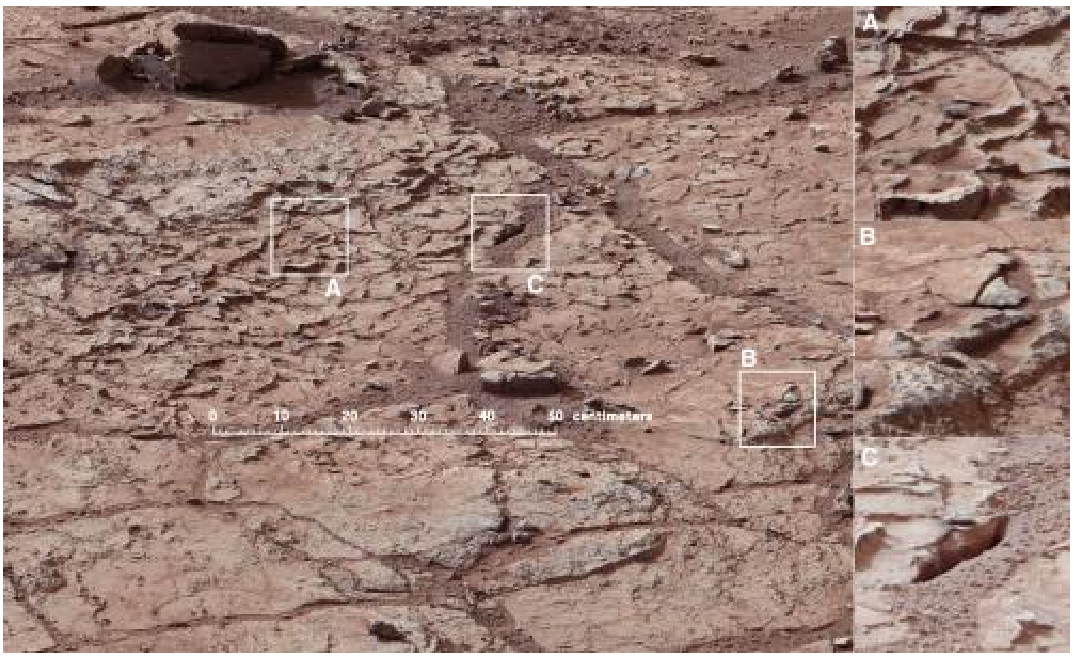
# Curiosity rover preparing to drill into first martian rock

January 15 2013




This view shows the patch of veined, flat-lying rock selected as the first drilling site for NASA's Mars rover Curiosity. The rover's right Mast Camera (Mastcam), equipped with a telephoto lens, was about 16 feet (5 meters) away from the site when it recorded this mosaic's component images, between 3:10 and 3:33 in the afternoon of the 153rd Martian day, or sol, of Curiosity's work on Mars (Jan. 10, 2013). The area is shot full of fractures and veins, with the intervening rock also containing concretions, which are small spherical concentrations of minerals. The scale bar on the left image is 19.7 inches (50 centimeters) long. On the annotated version, three boxes, each about 4 inches (10 centimeters) across, designate enlargements on the right that illustrate attributes of the area. Enlargement A shows a high concentration of ridge-like veins protruding above the surface. Some of the veins have two walls and an eroded interior. Enlargement B shows that in some portions of this feature, there is a horizontal discontinuity a few centimeters or inches beneath the surface. The discontinuity may be a bed, a fracture, or potentially a horizontal vein. Enlargement C shows a hole developed in the sand that overlies a fracture, implying infiltration of sand down into the fracture system. Credit: NASA/JPL-Caltech/MSSS

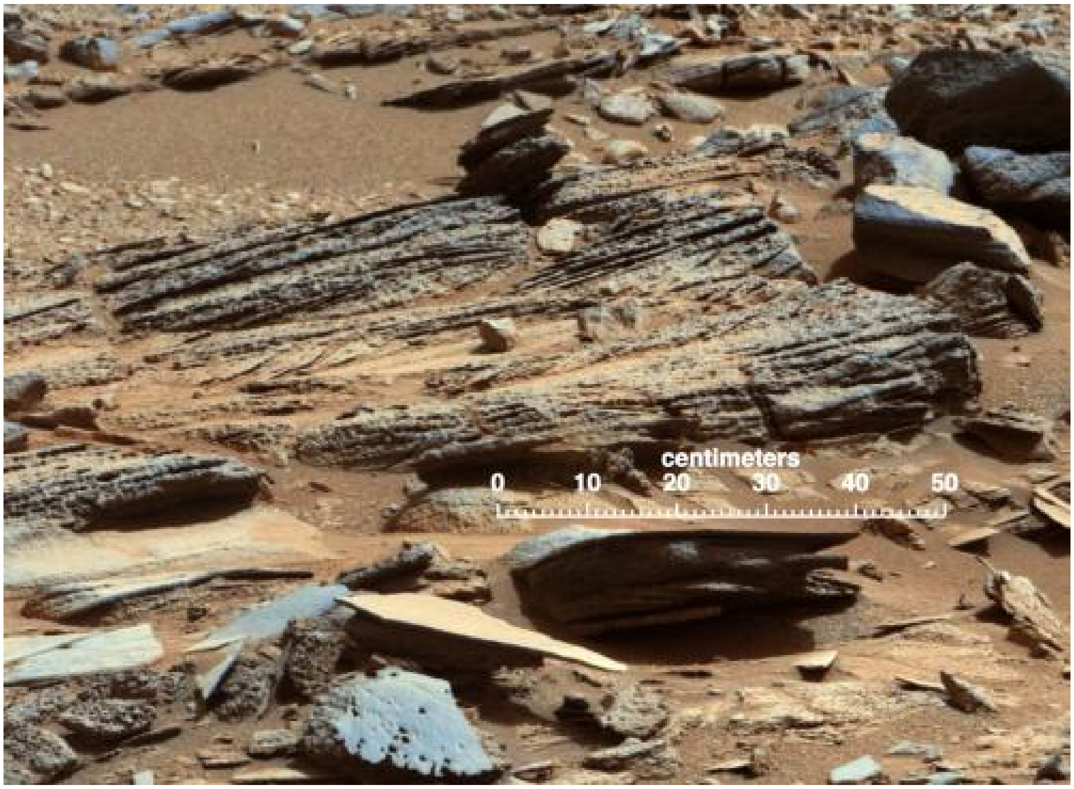
(Phys.org)—NASA's Mars rover Curiosity is driving toward a flat rock with pale veins that may hold clues to a wet history on the Red Planet. If the rock meets rover engineers' approval when Curiosity rolls up to it in coming days, it will become the first to be drilled for a sample during the Mars Science Laboratory mission.

The size of a car, Curiosity is inside Mars' Gale Crater investigating whether the planet ever offered an environment favorable for microbial life. Curiosity landed in the crater five months ago to begin its two-year prime mission.

"Drilling into a rock to collect a sample will be this mission's most challenging activity since the landing. It has never been done on Mars," said Mars Science Laboratory project manager Richard Cook of NASA's Jet Propulsion Laboratory in Pasadena, Calif. "The drill hardware interacts energetically with Martian material we don't control. We won't be surprised if some steps in the process don't go exactly as planned the first time through."

Curiosity first will gather powdered samples from inside the rock and use those to scrub the drill. Then the rover will drill and ingest more samples from this rock, which it will analyze for information about its mineral and chemical composition.

The chosen rock is in an area where Curiosity's Mast Camera (Mastcam) and other cameras have revealed diverse unexpected features, including veins, nodules, cross-bedded layering, a lustrous pebble embedded in sandstone, and possibly some holes in the ground.




This image from the Mast Camera (Mastcam) on NASA's Mars rover Curiosity shows inclined layering known as cross-bedding in an outcrop called "Shaler" on a scale of a few tenths of meters, or decimeters (1 decimeter is nearly 4 inches). The superimposed scale bar is 50 centimeters (19.7 inches). Credit: NASA/JPL-Caltech/MSSS

The rock chosen for drilling is called "John Klein" in tribute to former Mars Science Laboratory deputy project manager John W. Klein, who died in 2011.

"John's leadership skill played a crucial role in making Curiosity a reality," said Cook.

The target is on flat-lying bedrock within a shallow depression called "Yellowknife Bay." The terrain in this area differs from that of the landing site, a dry streambed about a third of a mile (about 500 meters) to the west. Curiosity's science team decided to look there for a first drilling target because orbital observations showed fractured ground that cools more slowly each night than nearby terrain types do.

"The orbital signal drew us here, but what we found when we arrived has been a great surprise," said Mars Science Laboratory project scientist John Grotzinger, of the California Institute of Technology in Pasadena. "This area had a different type of wet environment than the streambed where we landed, maybe a few different types of wet environments."

One line of evidence comes from inspection of light-toned veins with Curiosity's laser-pulsing Chemistry and Camera (ChemCam) instrument, which found elevated levels of calcium, sulfur and hydrogen.

"These veins are likely composed of hydrated calcium sulfate, such as bassinite or gypsum," said ChemCam team member Nicolas Mangold of the Laboratoire de Planétologie et Géodynamique de Nantes in France. "On Earth, forming veins like these requires water circulating in fractures."


This image of an outcrop at the "Sheepbed" locality, taken by NASA's Curiosity Mars rover with its right Mast Camera (Mastcam), shows show well-defined veins filled with whitish minerals, interpreted as calcium sulfate. These veins form when water circulates through fractures, depositing minerals along the sides of the fracture, to form a vein. These veins are Curiosity's first look at minerals that formed within water that percolated within a subsurface environment. These vein fills are characteristic of the stratigraphically lowest unit in the "Yellowknife Bay" area -- known as the Sheepbed Unit. Credit: NASA/JPL-Caltech/MSSS

Researchers have used the rover's Mars Hand Lens Imager (MAHLI) to examine sedimentary rocks in the area. Some are sandstone, with grains up to about peppercorn size. One grain has an interesting gleam and bud-like shape that have brought it Internet buzz as a "Martian flower." Other rocks nearby are siltstone, with grains finer than powdered sugar. These differ significantly from pebbly conglomerate rocks in the landing area.

"All of these are sedimentary rocks, telling us Mars had environments actively depositing material here," said MAHLI deputy principal investigator Aileen Yingst of the Planetary Science Institute in Tucson, Ariz. "The different grain sizes tell us about different transport conditions."

JPL, a division of Caltech, manages the Mars Science Laboratory Project for NASA's Science Mission Directorate in Washington.

Provided by JPL/NASA