Our Curiosity Intensifies

The question is no longer if Mars could have supported life, but if it still can.

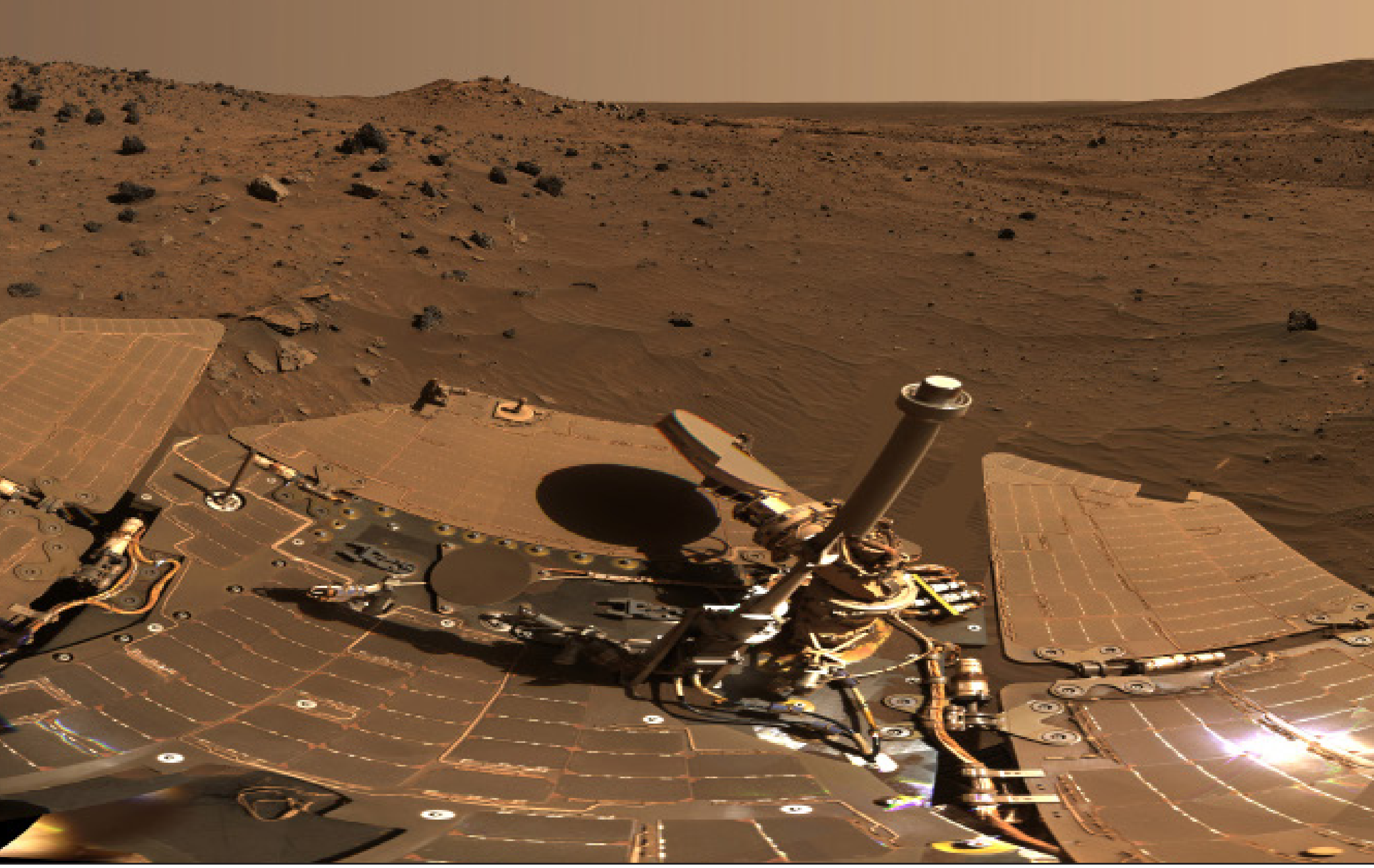
By Jacob Turner

Imagine a typical day on the surface of Mars. The temperature is somewhere between -200 and +100 degrees Fahrenheit, a few wispy clouds made of water-ice or carbon dioxide loom in sight. The surface is iron-red and rocky, resembling a large desert. Though the air is still and lifeless, there is movement. A robot the size of a car can be seen scanning the area, moving about on six wheels powered by the energy captured from the radioactive decay of plutonium dioxide. After stopping about 20 feet in front of a rock, the robot fires a laser and analyzes the chemical compounds from the resulting vapor. If it deems the rock worthy of further investigation, the robot will then drill into the rock for a more in-depth analysis of its chemical makeup. Such a scenario may sound like science fiction, but it is actually a description of everyday goings-on of Curiosity, an unmanned mobile laboratory and rover designed by NASA to better understand the history of Mars and whether or not it could sustain life. With each passing day, scientists are becoming more and more optimistic about such a possibility.

Curiosity is just the latest in a long line of Mars rovers painting an increasingly more detailed picture of what Mars is made of and how it has changed throughout its history. Understanding these two characteristics is crucial to concluding if Mars could be life sustaining. The implications of the data range from determining the safety and sustainability of a permanent Mars colony to answering the age-old questions of whether Earth is the only place in which life can exist or does exist. Previous rovers, such as the recent Spirit and Opportunity, discovered mineral compositions and rock formations that could only have formed in the presence of liquid water. However, the water would have been too acidic to drink. Regardless of that particular water's portability, the fact that there was evidence of liquid water at all was a huge step in understanding what Mars was like in its past and gave hope that liquid water may still exist on the planet's surface. Curiosity's mission is to expand on these discoveries.

Curiosity's landing spot was carefully chosen to ensure the highest likelihood that it would find valuable data. Using the Mars Orbiter, NASA decided to land Curiosity in Gale Crater, an area of Mars that probably once had water. Additionally, in the center of the crater there is a large buildup of rock layers known as Mount Sharp, which could be a remnant of a larger structure that existed on the site of the crater before it was hit with an asteroid between 3.5 and 3.8 billion years ago. Scientists believe that Mount Sharp could hold information about Mars' early history.

The tricky part was landing the rover. Older rovers entered the atmosphere in a capsule, which then opened a parachute to slow the descent. The rovers were then suspended from the capsule by wire and completely surrounded by air bags. After being released a few meters



above their destination, the rovers safely landed on the ground. The first part was doable, but Curiosity was simply too large and too delicate for the airbag technique to work. Instead it was deployed using what is called a sky crane. The rover entered the atmosphere the same way, but it was folded up inside what is called a descent stage. While hovering around 25 feet above the ground, the descent stage lowered Curiosity while the rover slowly unfolded all of its parts. Once Curiosity landed, the cords connecting the stage to the rover were cut and the stage flew away to crash land a safe distance from the rover. To make matters worse, the entire landing sequence had to automated, because the signal from the rover to Earth would have taken too long for a safe, manual landing.

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Since landing in Gale Crater back in August of 2012, Curiosity has made some incredible discoveries providing evidence of a Mars that could have been a much more Earth-like place. Within the first few days of its mission, Curiosity, using a tool called the Sample Analysis at Mars, or (SAM), determined that Mars' early atmosphere may have been very similar to present-day Earth. Due to bombardment by high-energy, charged particles ejected from the sun called "solar winds," however, this atmosphere has slowly eroded over time. Curiosity has also found evidence of ancient riverbeds, evidenced by rock formations, smoothed stones, and sediment deposits that only form in the presence of flowing water. The mineral composition of these rocks indicates that the water would have been much more pH-neutral than earlier samples from other locations. After drilling into nearby rocks, Curiosity found that they contained what are considered the six most important elements for life: oxygen, hydrogen, carbon, sulfur, phosphorus, and nitrogen. Using the collected data, scientists at NASA have concluded that this area would have been suitable for microbial life to thrive. Such conditions have also been found in the remains of a 3.5 billion year old lake on Mars. However, in what may be the most exciting discovery yet, Curiosity has determined that Martian soil is uniformly 2% water. Such a discovery strengthens the current hypotheses that Mars still has underground water sources, where microbial life could still exist. The answers to these speculations may become the goals of future Mars missions.

Today, Curiosity is still going strong and currently heading towards the base of Mount Sharp, where it hopes to find clues to the different chapters of Mars' history. With all of the amazing information already uncovered, it is exciting to think of what Curiosity may discover in the years to come.