Mars Today, Europa Tomorrow!

On the morning of August 6, 2012 (Eastern Daylight Time), the National Aeronautics and Space Administration and Jet Propulsion Lab successfully landed the Mars Science Laboratory *Curiosity Rover* at the location known as Gale Crater on Mars. At 899 kg and equipped with some of the most advanced interplanetary science payload to date, the rover is set to begin its primary mission to last 98 Earth weeks (one Martian year).

Destination Mount Sharp, Credit: NASA/JPL-Caltech/MSSS

Curiosity will explore the area near Gale Crater where multiple layers of rock have been exposed to search for clues that may indicate habitability of Mars in the past. This mission has four primary science objectives to meet this goal:

• Assess the biological potential of at least one target environment by determining the nature and inventory of organic carbon compounds, searching for the chemical building blocks of life, and identifying features that may record the actions of biologically relevant processes.

• Characterize the geology of the rover's field site by investigating the chemical, isotopic and mineralogical composition of surface and near-surface materials and interpreting the processes that have formed rocks and soils.

• Investigate planetary processes of relevance to past habitability (including the role of water) by assessing the long-time-scale atmospheric evolution and determining the present state, distribution and cycling of water and carbon dioxide.

• Characterize the broad spectrum of surface radiation, including galactic cosmic radiation, solar proton events and secondary neutrons.

Previous research from the Mars Reconnaissance Orbiter has revealed the presence of clay minerals and others that form in liquid water. Given that every environment on Earth where there is liquid water sustains life, this mission will investigate further traces of organic compounds and possible energy sources for life with ten main scientific instruments. Among them the first use of x-ray diffraction on Mars for mineral analysis (CheMin), and Alpha Particle X-Ray Spectrometer, and Chemistry and Camera suite (ChemCam). While the details of this mission are active and ongoing, it should be noted that the landing site for this rover was not stimulated by evidence indicating habitability in the present day. It should go without saying that there is much to understand about Mars as it is today, and that such a crater landing might

be one of the best opportunities to find any possible historical records of life, if it ever existed on Mars.

And, this is where Europa comes into light. Europa has been imaged by missions including *Pioneer* 10 and 11, *Galileo,* and *New Horizons.* There is strong evidence of an ocean much more voluminous than all of Earth's below the surface of this icy satellite; tidal heating, as discussed in a separate module, is hypothesized to be the dominant source of energy for an ecosystem that may exist below the surface. Studies of extreme ecosystems on Earth such as those in Lake Vostok, Antarctica and deep sea hydrothermal vents point to Europa as one of the best candidates for habitability *in the present day.* The subsequent lesson plans all are based on this theme.

Sources and Resources

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