Looking for Water on Mars

By Brian Grigsby

> "Our team believes that this region was a channel that emptied into the crater and formed an alluvial fan. Our team was looking for features that would have formed in aqueous environments. This particular area is important because it closely resembles alluvial fans on Earth and would prove the presence of water at one time."

If this quote sounds like a statement from a seasoned planetary scientist, think again. A high school student made this analysis after she examined data collected from the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM), an instrument on board the orbiting spacecraft Mars Reconnaissance Orbiter (MRO). She and her team of high school students, along with other teams from around the United States, were participating in the Mars Exploration Student Data Teams (MESDT). CRISM MESDT is part of Arizona State University's Mars Education Program and was created to give students the opportunity to work with scientists, mission planners, and educators on the collection and analysis of data downloaded from CRISM.

MESDT focuses on immersing teams of high school students in an authentic, research-based science, technology, engineering, and mathematics (STEM) experience. The program allows students to be participants in the scientific process and works within the infrastructure of any planetary science curriculum, while providing a valuable resource for actual mission scientists as they analyze an increasing amount of data. The high school students work with real data from CRISM, which is managed by Johns Hopkins University's Applied Physics Laboratory (APL) in Maryland. CRISM's primary mission is to search for mineral traces of ancient water as it images the planet in up to 544 wavelengths of light.

Each team has a school adviser and a mentor from the CRISM science team. Student teams train and connect with scientists through desktop videoconferencing, teleconferences, and electronic bulletin boards. The students use the same software as the researchers—CRISM Map—which enables students and science team members to view the latest releases from the CRISM instrument. The data allow teams to search for specific minerals that could indicate past geologic processes, such as volcanic activity, or features that may have formed in the presence of water.

Student teams are not required to have knowledge of geology or even Mars to participate in the MESDT program. They receive general information about the program, and CRISM scientists provide enough background for the students to understand Mars exploration within the context of a science mission. Once students have been introduced to the program and learn about how MESDT functions, they are trained to use data

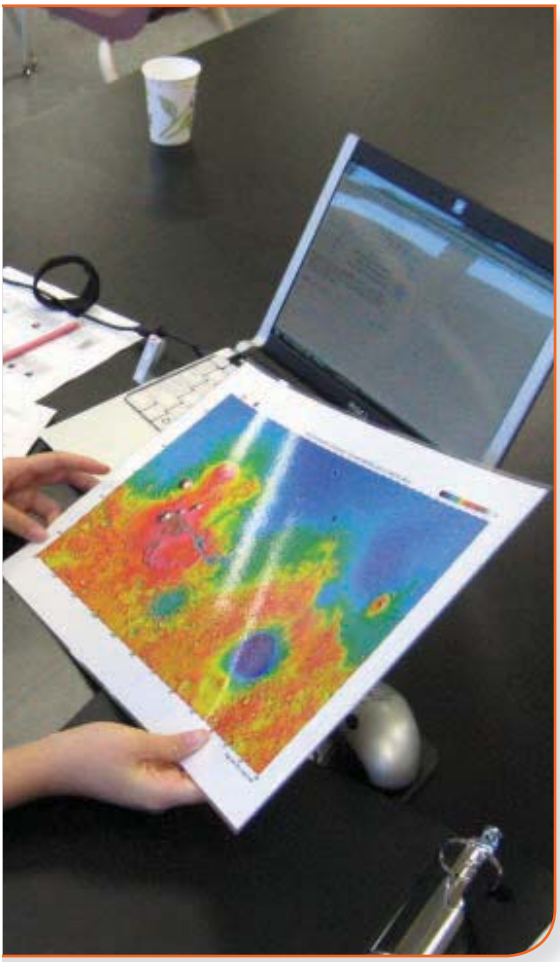
sets and discover how scientists analyze data.

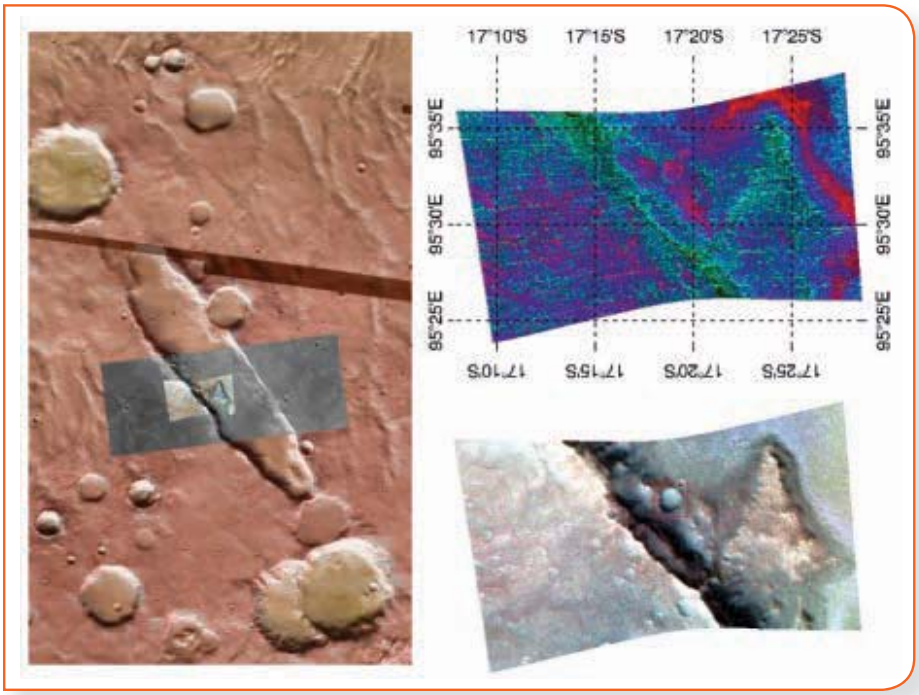
Throughout the year, teams use password-protected online forums to post questions, list data analysis plans, and discuss their findings. All participants learn from each other, making MESDT a truly student-driven program.

During the beta test in 2007–09, students from four high school teams analyzed data focusing on a region of ancient rocks in Mars' southern highlands that CRISM collected in its low-resolution mapping mode. They identified various mineral deposits

Science

A high school student studies an image taken by the Compact Reconnaissance Imaging Spectrometer for Mars.





Students took, downloaded, and processed images of Mars and created presentations.

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and developed hypotheses to explain how the deposits might have formed. The students then planned targeted observations 10 times the spatial resolution of the initial images. They took, downloaded, and processed images from their first observations in February 2008. The teams then worked with science team mentors to analyze the results. During the process, teams selected two additional sites and added them to CRISM's observation schedule.

In 2009–10, more than 100 students participated, including several high school teams and a college team. These teams learned how scientists choose landing sites for rovers on Mars and how their own research could help determine future landing sites.

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To a certain degree, the success of the MESDT program is measured by the number of students who choose a STEM career path. For example:

- MESDT mentor Bill Lewis, of Livonia High School in New York, said that the program helped one of his students realize astronomy was the field he wanted to pursue. The student will be majoring in astronomy and physics.
- Another MESDT student is studying planetary geology at Arizona State University.
- Another is a computer technology major at Georgia Tech because of his experience with MESDT.
- One student entered a regional science competition with her research, titled "Thermokarst Environments on Mars: Where Did the Water Go?" She has earned several awards and continues her pursuit of the geological sciences.

These are just a few of the team members who have chosen STEM fields. But student success is also measured through the submission of abstracts to the Lunar Planetary Science Conference (LPSC) that takes place