MARS IMAGE ANALYSIS ACTIVITY

Minimum materials required:

- 1 Internet-connected computer per team of students
    - Mars Image Analysis Activity materials: 1 set per team of students
    - One THEMIS visible image
    - The accompanying context image
    - An 11" X 17" MOLA elevation map of Mars
    - Erasable markers
    - Ruler
    - Calculator
- Set of Feature Identification Charts: 1 per student
- Mars Image Analysis Student Worksheets: 1 per student (optional)
- For Homework Reading: Question Mars Activity page 1 (Objective and Student Introduction background information sheet): 1 per student

The recommended format to facilitate this activity is as follows:

Prior to providing the materials to the student teams, first display each of the Mars Image Analysis activity materials in the front of the room and briefly explain each item:

1. Mars Orbiter Laser Altimeter (MOLA) Elevation Map of Mars: The colors on this map indicate different elevations on Mars. Review that blue and purple represent low elevations and brown, red and white represent high elevations. This map is showing the topography of Mars. Students will use the latitude and longitude provided for each image in order to see the approximate location of where the image was taken. This gives students a sense of global context. This global context will help students understand how the surrounding area may have influenced what features are seen in the THEMIS image.

2. Context Image: This provides latitude and longitude information (as well as some other information) about the THEMIS image and shows a more immediate context of where the image was taken on Mars. The small colored rectangle in the middle of the context image indicates the location of where the THEMIS image was taken. This image is a MOLA shaded relief image showing topography.

3. THEMIS Visible Image: This image provides a detailed look at the geologic features (the morphology) of the area that was imaged. It is important to know that the sun is illuminating from the left. This will allow students to determine whether they are looking at a depressed feature (shadow seen on the left of a feature) or a raised feature (sun lit side seen on the left). The image is 18 kilometers across. The length of images can vary.

4. Feature Identification Charts: These are thematically organized charts (each chart is entitled with a theme:
features associated with canyons, craters, volcanoes, water-related, and

wind-related processes). These charts will be used to help identify geologic features seen in the images.

5. Once you have previewed the materials students will use, demonstrate what the student teams will do once they have received their materials. This recommended procedure is as follows:

    a. Locate the general area of where the THEMIS image is located on the MOLA elevation map of Mars.

    b. Label and identify geologic features on the THEMIS visible image and the context image. Students should use the *Feature Identification Charts* for assistance in naming the geologic features.

    c. Think about and label information about the geologic history of the area using the relative age dating techniques learned in the *Mars Uncovered* activity.

    d. Allow students approximately 10-15 minutes to make observations of their image before having them make any measurements. This will allow them to focus on the geologic features. Once you are ready, explain how students can make measurements, which is as follows:

    e. To make measurements:

        i. Measure the width of the THEMIS image in centimeters (for example: 25.2 cm). Measurements will vary for each image.

        ii. The THEMIS image is 18 kilometers across. To figure out the scale factor of the image, they need to do some simple division: 18 km divided by the measured width in centimeters. In this case, you would compute 18 km divided by 25.2 cm, which would give you 0.71 km per cm. This means that every centimeter measured on the image is equivalent to 0.71 km on Mars. The 0.71 km per cm is the scale factor for that particular image (each image may vary).

        iii. To determine the measurement in kilometers on Mars of any feature on that image, you would need to do some simple multiplication. Measure any feature in centimeters and multiply that measurement by the scale factor of that image. For example, if a feature measures 1.5 cm on the image, multiply that measurement by the scale factor. In this case, it would be 1.5 cm X 0.71 km per cm. This measured feature is 1.07 km on Mars. You may want to play the *Mars Image Analysis* video clip to explain or demonstrate each part of the activity.

After students have had a chance to label features and make measurements on their initial image, allow them to get a chance to rotate and see other images student teams have been working with.

Rotate and make additional observations. For this, students simply do the following:

1. Rotate to a new image and look at where the image is located on the MOLA elevation map of Mars. It is always important to have a global context in mind.

2. Look at the context image and make any additional observations (identify additional geologic features). It is always important to think about how the immediate surrounding area may be affecting features seen in the THEMIS image.

3. Look at the THEMIS visible image and make any additional observations (identify additional geologic features or make additional measurements).

    a. For this option, make sure students complete all three steps. It is easy for students to focus only on the THEMIS image. It is also important that students do not erase other student team observations or write down inappropriate remarks if they disagree with another team's observations. As they learned in the *Mars Uncovered*activity, not all scientists agree with one another's observations and interpretations. Also students should keep their observations 'geologic'. Sometimes with this portion of the activity, images can get covered with student team observations causing creative imaginations to take over. Give your students strict guidelines on what is or is not appropriate.

Note: There may not be enough time for students to make observations of all images during Meeting 4 or Meeting 5. After the activity you can post images around the room for viewing by all the students.