TEACHER'S GUIDE

Mars Geologic Mapping

Background

What does the top of your desk look like? Are there random piles of papers or is everything precisely filed away in a tidy fashion? How far back in your history can you go by just looking at the top of the desk? In a way, we can tell a lot about a person's personality and habits and even history by looking at the top of his or her desk. In the same way, we can tell a lot about a planet, such as Mars, by mapping out its surface.

Studying "superposition" allows scientists to study the layers on the surface of Mars to help determine which events occurred in what order and which areas are older than others. Most of the time younger geologic features are on top of older geologic features. Scientists called photogeologists study surface images of planets to find out the age and geologic history of a planet.

By studying other planets, we can learn more about our own planet. Each world is unique with its own weather patterns, atmosphere, and surface conditions, yet all the different characteristics arise from the same laws of nature. Since all of the planets were formed at the same time, studying their characteristics is like looking at a scrap book of the family of planets to which Earth belongs.

Topics

Geologic History of Mars
Feature Mapping
Comparative Planetary Geology

Objectives

Students will:

- Interpret photographic details of a Martian surface image.
- Design and create a simple features map.
- Interpret the geologic history of a part of Mars' surface.
- Analyze and discuss the sequencing of Mars' geologic history.

Overview

Students will approach studying the surface of Mars in the same way as photogeologists. After drawing a simple features map, they will have the tools to state the general geologic history of a part of Mars' surface. Students focus on the evidence showing river channels that once flowed and caused erosion.

Key Question

How can we determine the geologic history of Mars?

Key Concepts

- By studying features in relation to one another, the relative geologic age can be inferred.
- Comparing features on Earth to similar features on Mars, we can infer the origins of the feature and the geologic history of the area.

Materials & Preparation

- Photo of Mars' surface showing outflow channels emptying into northern plains of Chryse Planitia. Photo also available on the World Wide Web at: http://cass.jsc.nasa.gov/expmars/channels.html (provide enough photos for each pair of students)
- Transparencies, one per group
- Clear tape
- Map of Mississippi River Delta or a local river delta
- Color overhead markers (red, green, and blue needed for each group)

Procedures

1. Secure a transparency to the top of the Mars photo with transparent tape.
2. Tell students that this is a spacecraft photograph of an area on Mars around 20 N latitude and 55 W longitude, at the northern edge of Chryse Planitia. The image shows

impact craters and river channels. The area is about 200 kilometers across.

3. Show students an example of a crater with a continuous, sharp-edged, unbroken rim. Note that they should draw the rim and not the fairly flat interior. See drawing on student sheet.
4. Have students carefully outline the rims of all sharp-edged craters with the red marker.
5. Show students an example of a crater with an uneven, eroded, broken rim. See student sheet.
6. Have students carefully outline the rims of all eroded craters with the green marker.
7. Show students an example of a river channel.
8. Have students color (not outline) all channels blue. They may try to show both sides of the channel. Have them put a single line in the middle of the channel.
9. Have students lift the transparencies and examine them. Ask the student what they have made.

Management

- Attach transparencies to the top of each map before class using transparent tape
- Become familiar with the important features in the Mars photo.
- This activity can be modified for individuals, pairs, or large groups. This activity should take one class period.

Reflection & Discussion

1. Which are older: river channels or green craters? How do you know?

   Green craters are older. When a river channel met a green crater the water broke through the rim, entered the crater, broke out somewhere else, and kept going.

2. Which are older: river channels or red craters? How do you know?

   River channels are older. When an impact formed a red crater on top of a river channel the crater covered the channel, but the crater was not eroded.

3. Classify the features by their age (oldest, medium age, youngest).

   Green craters are oldest, river channels are of medium age, and red craters are youngest. Based on the data from questions 1 and 2, the green craters were there before the channels, and the channels were there before the red craters.

4. What caused the difference in size between the young craters and the older craters?

   Most of the big meteorites hit a long time ago. Later, mostly smaller meteorites were left. The earlier meteorites were very large pieces of planetary material that were still being pulled together through the process of Solar System accretion (gathering of material into planetary bodies). As time passed, the impacts were caused by the smaller pieces of material left over from the accretion process, thus making smaller craters.

5. Does the land slope? If so, explain why and in which direction.

   The land slopes downwards from the west to the east. River channels combine as you go downhill. A map of the Mississippi River or some other terrestrial river basin may be used as a comparison. These Mars channels do not show a delta formation as some may suggest.

6. How does the surface of Mars compare to the surface of Earth?

   Students answers will vary.

Transfer/Extensions

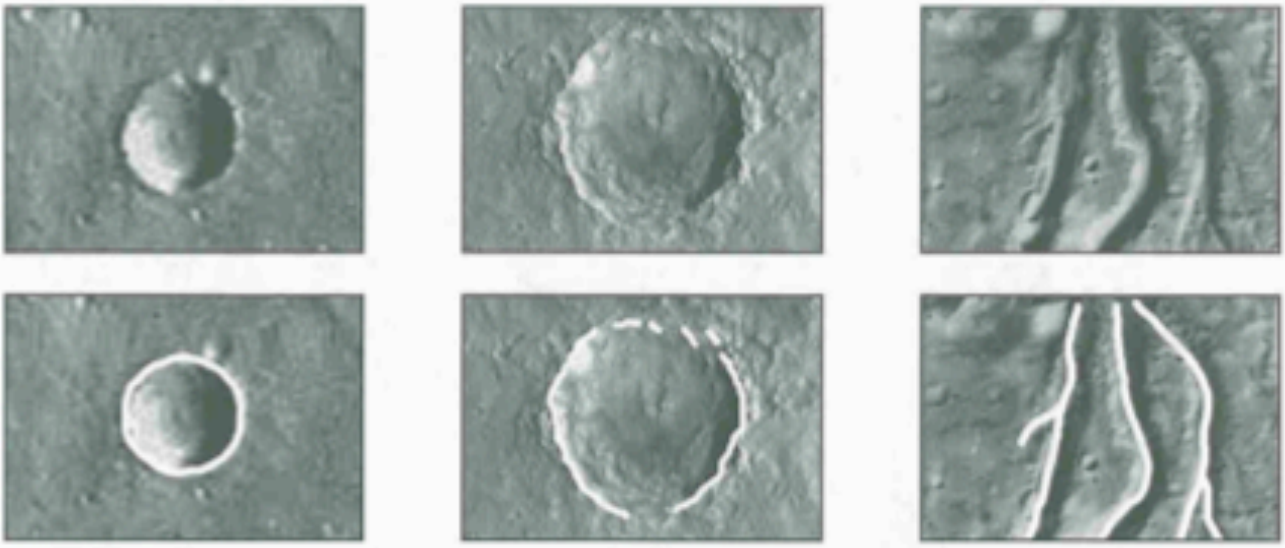
1. Have students find other images of Mars' surface on the World Wide Web. Create feature maps for these areas and determine their geologic history.
2. Have students find images of Vallies Marenaris and the Grand Canyon on the World Wide Web and compare them.

STUDENT WORKSHEET

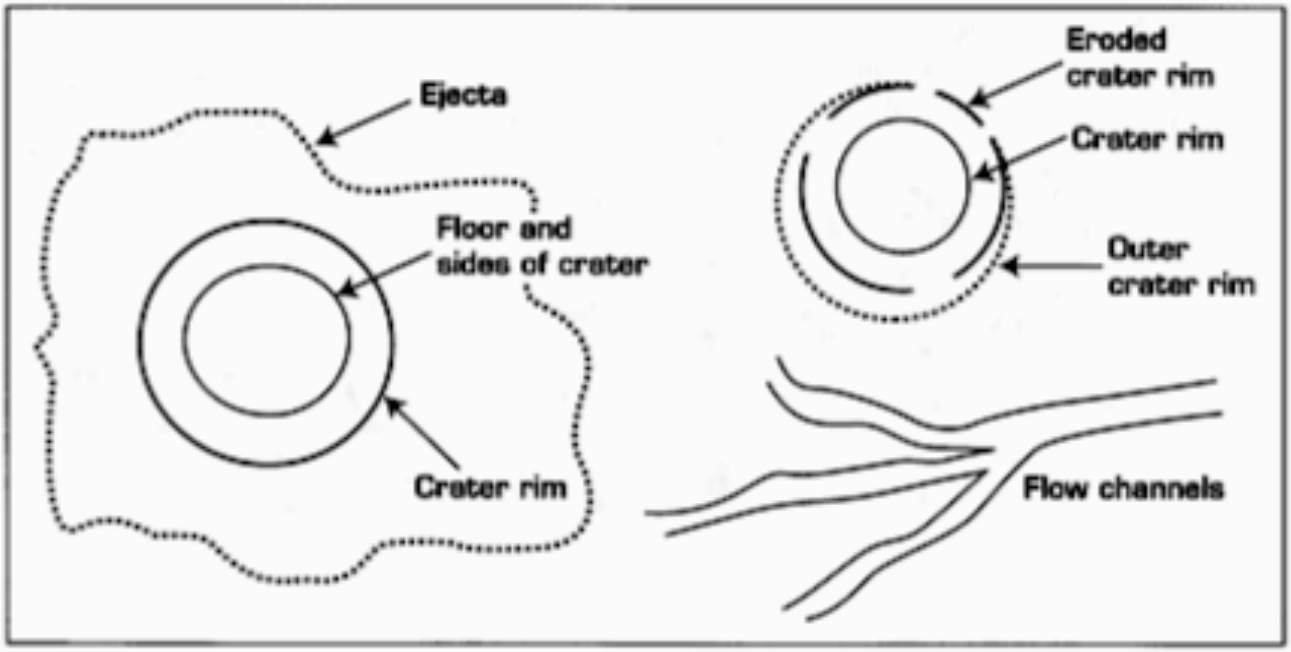
Mars Geologic Mapping

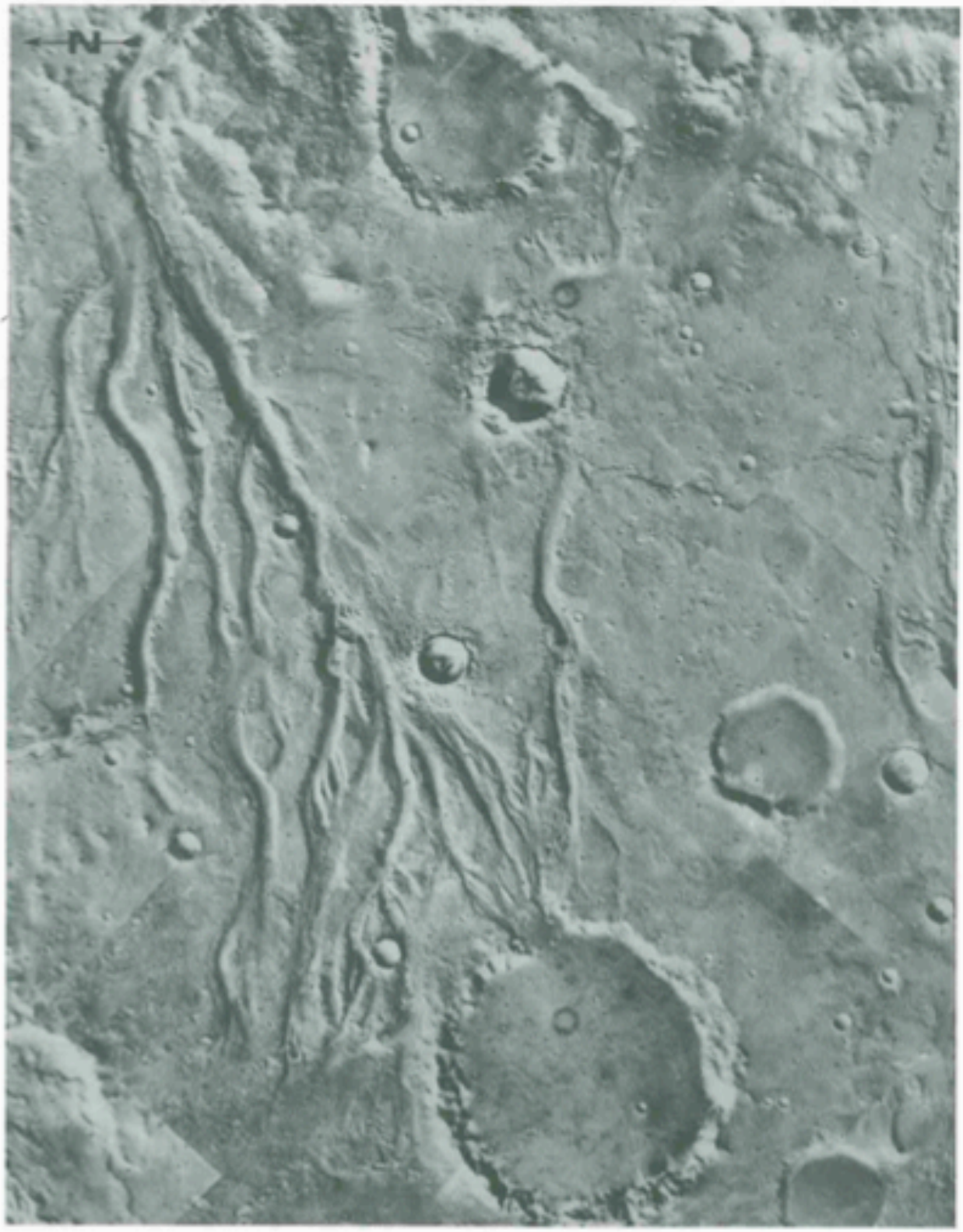
The area in the image of Mars is about 200 kilometers across and shows impact craters and river channels. Mark each feature on the photograph using the examples below.

- Craters with continuous, sharp-edged, unbroken rims. Outline the rims of each one with a red marker.
- Craters with uneven, eroded, broken rims. Carefully outline the rims of all such craters with a green marker.
- River channels. Color (do not outline) all channels with a blue marker.



line in red | line in green | line in blue





Chryse Planitia