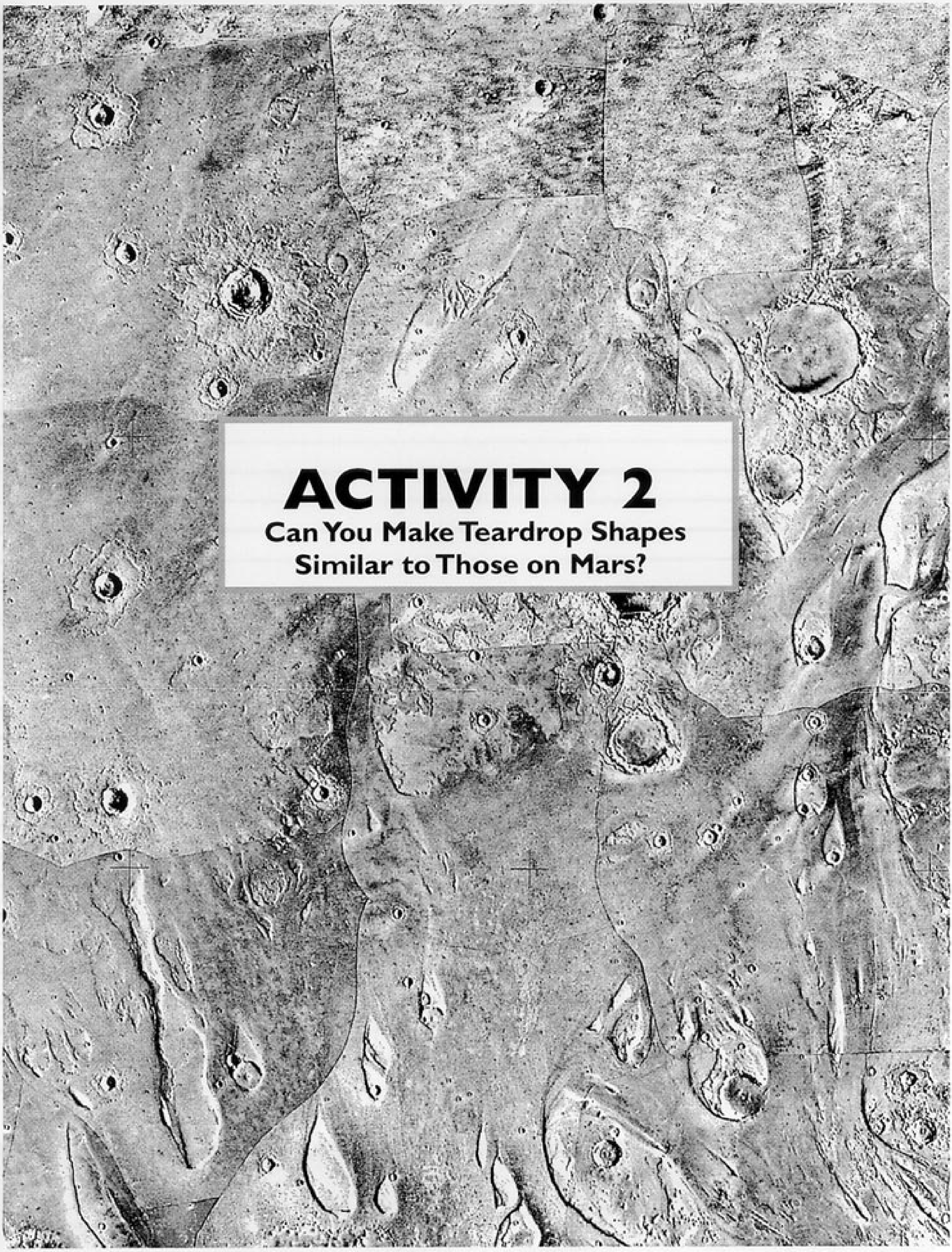
# ACTIVITY 2

## Can You Make Teardrop Shapes Similar to Those on Mars?



# NOTES

# AT A GLANCE

## Overview

Students study images of Martian teardrop-shaped landforms and list what they think are the most important reasons for why these landforms took on their particular shapes. They identify the variables and attempt to recreate the teardrop shapes in the stream table. By attempting to create a specific shape in their stream table, students gain experience in experimental design and in how altering variables leads to different results.

## Content Goals

The teardrop-shaped landforms at the mouth of Ares Vallis lend strong support to the idea that water flowed on Mars.

## Skill Goals

- *Designing* and *conducting* experiments to test hypotheses.
- *Controlling* variables to understand cause and effect.
- *Documenting* the experimentation carefully so that others can repeat the work.
- *Analyzing* the data collected in a data table.

## Possible Misconception

Landforms are shaped the way they are for no particular reason.

*Ask: How do mountains, valleys, plains, etc. get their shapes?*

## Materials

Stream table, different grades of sand, cake frosting, bottle caps, assorted materials related to the set ups you create, image packet and as many additional images of the teardrop-shaped landforms at the mouth of Ares Vallis as possible.

## Time

1-3 class periods

In Activity 1, students released the water and observed its effect on the sand. Activity 2 has a different goal. Rather than leaving the shapes up to chance, students are asked to create a very specific shape – landforms similar in shape to those at the mouth of Ares Vallis pictured in Fig. 2.1.

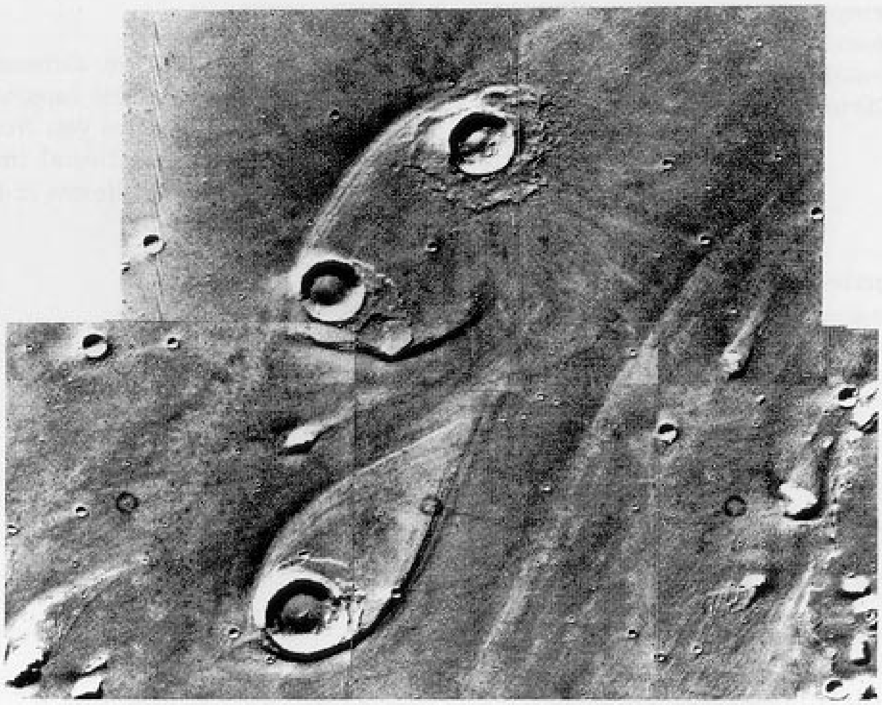


**Fig. 2.1**
*Landforms at the Mouth of the Ares Vallis. Bottom landform is 45 km in length.*

# PROCEDURE

1. Have your students study Image 10 and list the three things they think were most important in having these landforms take on their particular shapes.
   *This might include things such as the crater, the direction of water flow, the rate of water flow, the size of the sediments, the height and initial shape of the landform, the degree of soil compaction, the relative positions of the three craters, etc.*

2. Have students make a list of all the things they could change (i.e., the variables) in order to create particular shapes in the stream table.
   *This might include the stream table angle, size of particles making up the channel bed, the amount of water used, the length of time the water flows, the rate of release, obstacles in the water course, the amount of sand in the stream table, the compaction of the channel bed, etc.*

3. As a class, discuss the topics below.
   - What is the actual size of the crater and landforms?
     *(Landforms are 45 km [28 mi] long. Crater is 10 km [6.25 mi] across.)*
   - If the channel in the stream table were scaled up to the width of Ares Vallis (25 km [16 mi]), how big would the scaled-up sand particles be? What is the significance of this?
     *(The sand particles would be boulder size at a comparable scale and therefore the surface textures of the channel and the model will be different.)*
   - Did the impact craters come before the shaping of the landform? *(Yes)* How can one tell?
     *(Its ejecta blanket has been eroded.)*
   - Have students look at Images 1 or 5. What does the presence of many streamlined landforms over a wide area suggest? *(Large amounts of water may have flowed at one time.)*

4. Review the activity challenge and ground rules below with your class.

5. Once a group has obtained a teardrop-shaped landform and the class has seen it, ask them to repeat their initial success by following the procedure they wrote down.

## Challenge

Create landforms in the stream table similar in shape to those pictured in Image 10.

## Ground Rules

a) Flowing water can be the only shaping agent.

b) Prior to releasing the water, you can prepare the channel in any way except by actually forming the landform shapes you are trying to have the water create.

c) For each setup you must document how you prepared the channel, which variables you held constant and which ones you changed, and how the water affected the setup. The documentation has to be specific enough so that some one else could achieve a similar result by following your descriptions.
*Students might consider varying things such as the inclination of the stream table, rate of water flow, amount of water, presence of obstacles, degree to which the sand is packed, or size of sand grains (if different grades are available). They might also see if having impact craters makes a difference.*

# TEACHING POINTERS

You may want to let students experiment with different materials for the stream channel. For example, finer sand will give different results than large-grained or mixed sands. Some teachers report obtaining shapes nearly identical to Image 10 using prepared cake frosting. This is not as surprising as it may seem. Scale is a problem in the stream table. When comparing the sizes of the channels in the stream table and Ares Vallis, each sand grain in the stream table is more on the scale of a gigantic boulder. The stream table channel and sand would have to be much smaller to properly represent the channel and silt in Ares Vallis. We cannot make the channel much smaller, but we can make the particles comprising the channel smaller. Hence, cake frosting. Cake frosting's particle size is smaller than sand's, and it is malleable and can be shaped by flowing water.

Set out a variety of items such as bottle caps, pipe cleaners, straws, nuts, bolts or pebbles and sticks to direct the flow of water and blocks to tamp the sand. Let students select from the assortment. They should think carefully about the role of the craters and use materials and techniques to reproduce their effects. It is likely that students will notice teardrop-shaped islands forming around craters. Bottle caps set in the frosting with the stream table set at about a one-degree slope work well.