

Lesson 11: Age & Times of Mars vs. Earth

Summary

This learning module discusses the geologic history of the Earth, the principles scientists use to define the Earth's geologic history, and relative dating techniques.

Learning Goals

Students will be able to:

- Use principles of relative dating to interpret block diagrams, Earth outcrops, and Mars imagery.
- Compare the geologic history of Earth and Mars.

Compare examples

<http://www.jpl.nasa.gov/spaceimages/details.php?id=PIA16098> &
<http://www.jpl.nasa.gov/spaceimages/details.php?id=PIA16099>

Context for Use

Make sure students have a basic understanding of lithologies in addition to the method of crater counting for dating and interpreting the ages of Martian terrain.

Description and Teaching Materials

In-Class Activity

In-Class Activity 1: A Timescale Comparison

Homework/Lab

Homework 1: It's All Relative

Teaching Notes and Tips

1. Expose students to Crater Counting such that students realize the geologic timescale of Mars and that dating of the Mars surface is based upon crater counting.
2. For *Homework 1* make sure students have a basic knowledge of lithology in order to interpret unconformities.

3. Depending on class size, if possible, make copies of the geologic maps for students to use during *In-Class Activity 1*. If class sizes are larger than 30, include these maps in a course packet. Overhead projection of the maps may not be sufficient to engage fully in the activity.
4. *Homework 1* can be adapted for an in-class activity as desired.

Assessment

Methods of assessment are within each individual *In-Class Activity* and *Homework*.

Mars for Earthlings

References and Resources

1. Image File: [Age and Times of Mars vs. Earth](#)
2. YouTube video of the Noachian period on Mars (artist interpretation):
<http://www.youtube.com/watch?v=JfYlvkTQ2pc>
3. Simplified geologic map of the state of Utah:
http://geology.utah.gov/maps/geomap/postcards/pdf/utgeo_postcd.pdf
4. Geologic maps of Mars:
http://www.lpi.usra.edu/resources/mars_maps/1083/index.html
<http://pubs.usgs.gov/sim/3292/>



Mars for Earthlings

Homework 1

Age & Times of Mars vs. Earth_MFE

It's All Relative

Objective: Apply relative dating laws to interpret block diagrams, Earth road cuts, and Mars imagery.

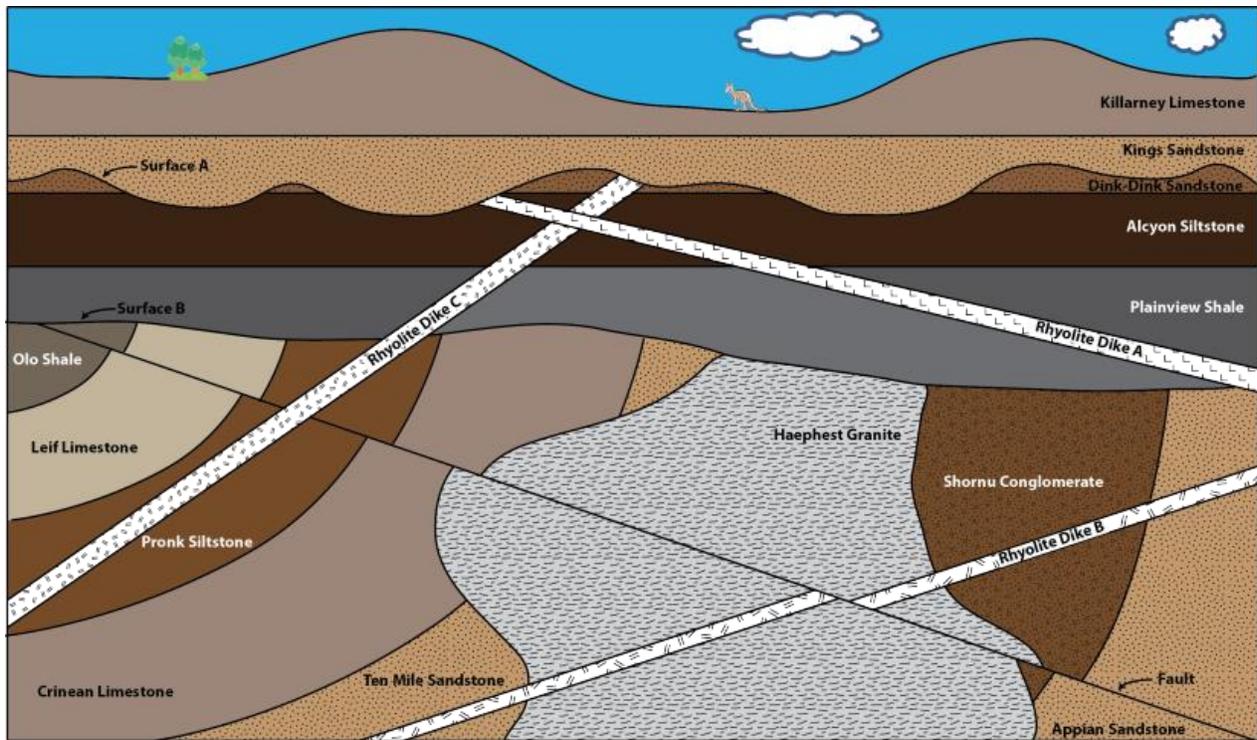


Figure 1 Block diagram. Source: <http://fractalplanet.wordpress.com/2013/02/11/relative-dating-activity/>

1. How many unconformities (erosional breaks) are present in the image? Name each kind and explain your reasoning.
2. What law did the students use to determine the relative ages of the Ten Mile Sandstone and Appian Sandstone?

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3. List the order of geologic events by name from *oldest to youngest* below (i.e. Surface A, Rhyolite Dike C, Ten Mile Sandstone etc.):

Road Cuts on Earth

Navigate to the website: <http://www.gigapan.com/gigapans/104247> to view the Moab Fault Zone in Utah.

4. How many faults do the students observe?
5. How many geologic units do they see? What criteria are they using to differentiate their geologic units?
6. What principle of relative dating is most useful for interpreting this image?
7. Are there any unconformities? If so, how many and what type?



Mars for Earthlings

Tractus Catena on the south of Alba Mons

Below (Figure 2) is an image taken by THEMIS of a fracture zone on Mars. Observe the image and answer the following questions:

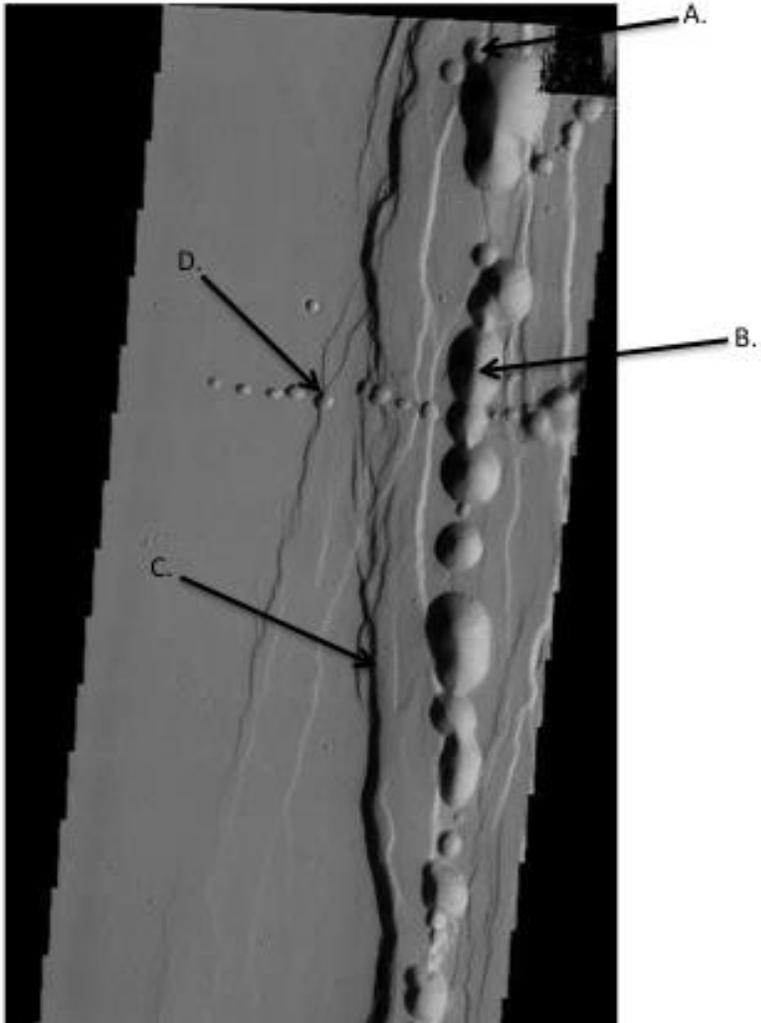


Figure 2 Tractus Catena on the south of Alba Mons, Mars. Themis image; Image Credit: NASA/JPL/ASU. Source: <http://themis.asu.edu/node/5918>

8. Order the geologic events (A-D) from *oldest to youngest*. Make sure the students note the entire image as you make their decisions.

9. What makes this image difficult to interpret?

10. What law(s)/principles of relative dating did they use to interpret the image?

11. If they are already familiar with tectonics, are features B and D likely related to extension or compression? Have students justify their answers.