Mars for Earthlings

# LESSON 7: Life-Hosting Rocks

***In-Class Activity 1***

*Swelling Rocks*

**Expanding Soil**

Observe the class demonstration or video and answer the following questions.

http://www.youtube.com/watch?v=ACpuYED9WkU

1. According to the demo/video, why does the soil expand?

2. How does the bulk density change? What does this change indicate?

**The Molecular Level**

Observe the diagram below (Figure 1) and answer the following questions.

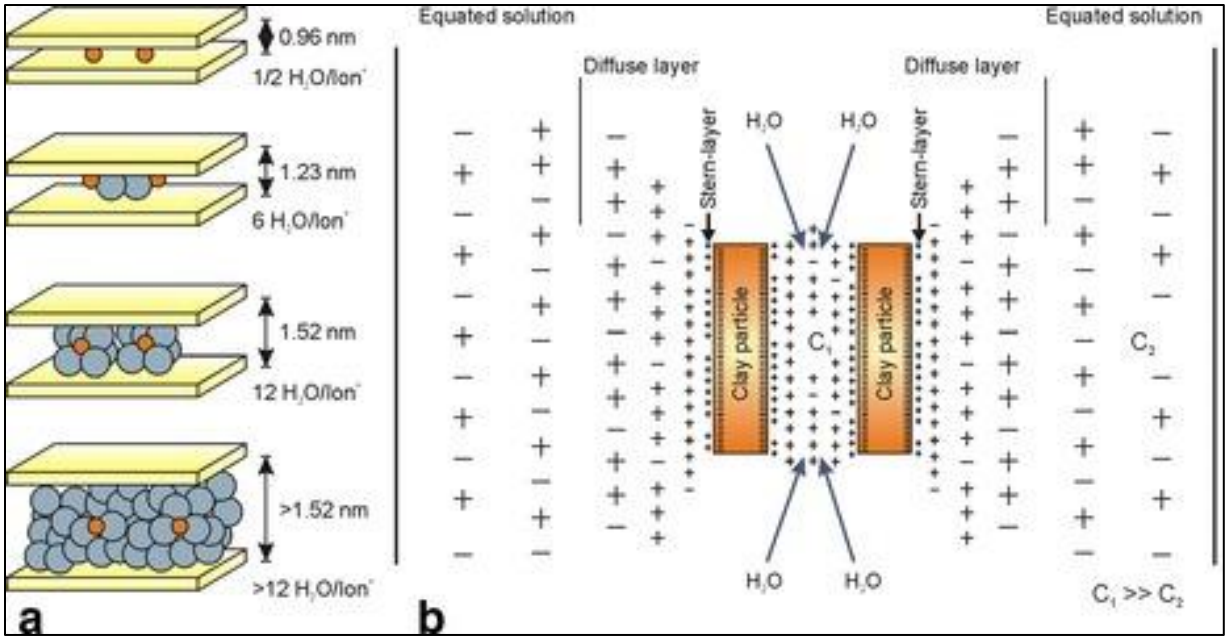


**Figure 1** Butt et al., 2003

1. In Fig. 1a, how do the water molecules influence the structure?

2. Why does the water attract to the clay rather than the sand of the sandy loam (consult Fig. 1b)?

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3. Given your understanding of clays now, if clays [$Na_{0.2}Ca_{0.1}Al_2Si_4O_{10}(OH)_2(H_2O)_{10}$] are observed on Mars….what does this mean?

4. Where might you find clays on Mars (what kind of features)? Hint: consider their environment of formation; do we have evidence for their presence on Mars?

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***In-Class Activity 2***
Life Hosting Rocks_MFE
*Understanding Albedo*

**Last Chance Canyon**
*Scenario*: You are planning to hike Last Chance Canyon in the Guadalupe Mountains National Park. It is arid, no winds, and about 95°F. If you had the following options for attire, which would you choose and why?

- Sleeveless cotton shirt
- White long-sleeve cotton shirt
- Black long-sleeve cotton shirt

**Surface Albedo & Rocks**
Observe the interactive Earth Surface Albedo Map (produced by NASA-CERES) provided by your instructor.

1. What do the colors indicate?

2. Why do some "surfaces" have a higher albedo than others (ocean, desert, forest cover etc.)?

3. Rank the hand samples according to their albedo effect provided by your instructor. How are you making your rankings?

4. Do you think an albedo map of the surface of Mars would be as variable as Earth? Overall, would Mars have a higher albedo than Earth? Why or why not?

**Using JMARS to view Albedo**
Explore TES imagery in JMARS.

1. Add the MOLA colorized elevation map for use as context if desired.
2. Add New Layer → Maps By Instrument → TES → TES-Albedo → View graphic data
3. Zoom to a window (2 or 4) that allows you to differentiate familiar terrain. You can change the transparency of the TES-Albedo map to see the underlying MOLA colorized map to find major geographic regions of interest.

4. Describe the albedo map of Mars? Does anything surprise you? What could distort the data?

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5. Are albedo maps a good indicator of lithology? Would it depend on different circumstances or environmental conditions?

**Using Light Grapher**:
Directions (*Note: This section of the lesson requires a webcam):

1. Click "Run Light Grapher"
2. Select the appropriate camera and allow access
3. Click "capture data"

http://kepler.nasa.gov/education/ModelsandSimulations/lightgrapher/

6. Use the hand sample of basalt and sandstone provided by your instructor. Use Light Grapher to see the change in "light" as you pass the sample in front of your webcam. What is the result? How do they compare?

7. Try other objects with varying color and compare.

8. How is this activity an analogy for the albedo effect?

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***Homework 1***
Life-Hosting Rocks_MFE
*The Energy of Rocks*

**Purpose:** Recognize the energy of the environment by its sedimentary structures.

**Corn Syrup and Water Experiments**
Watch the following videos:

- Flume Experiment: http://www.youtube.com/watch?v=zRGuMddjRGg&list=PL17AFB4B8AB3DCCF7
- Corn-Syrup Experiment: http://www.youtube.com/watch?v=W3YZ5veN_Bg

1. As you watch the videos, compare/contrast the following parameters:

| Parameter | Corn Syrup | Water |
|---|---|---|
| Velocity of flow | | |
| Type of structures formed | | |
| High or low energy environment | | |

**The dynamics of sedimentary environments**

2. Compare the following environments of deposition according to the following parameters: [Write your answers a-c to the right of the image]
    a. Processes at work
    b. Strength of weathering and/or erosion
    c. Preservation potential of life

**Figure 2:** Cathedral Cove; Channel Islands National Park, CA. Image: nps.gov

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**Figure 3:** White Sands National Monument, NM. Image: nps.gov

## Sedimentary structures/textures on Mars

3. Similar to Question #3, annotate to the right of each image of Mars below:
    a. What structures do you see?
    b. What is a likely environment of formation?
    c. Was the environment high or low energy in your opinion?

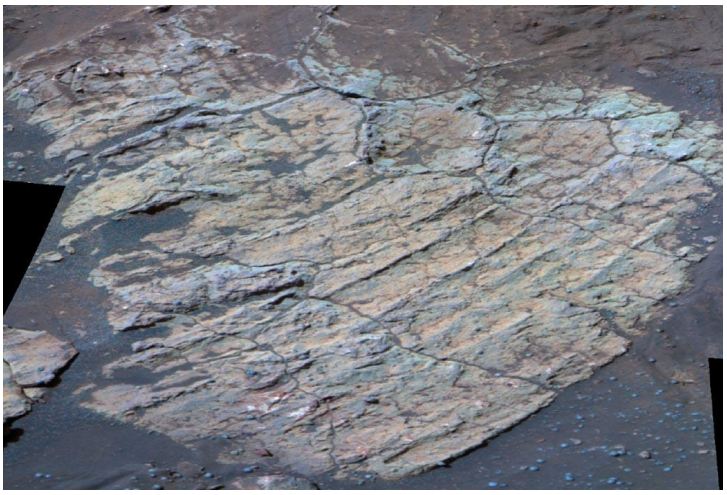

**Figure 4:** "Escher" rock in Endurance Crater investigated by Opportunity rover; Image Credit: NASA/JPL

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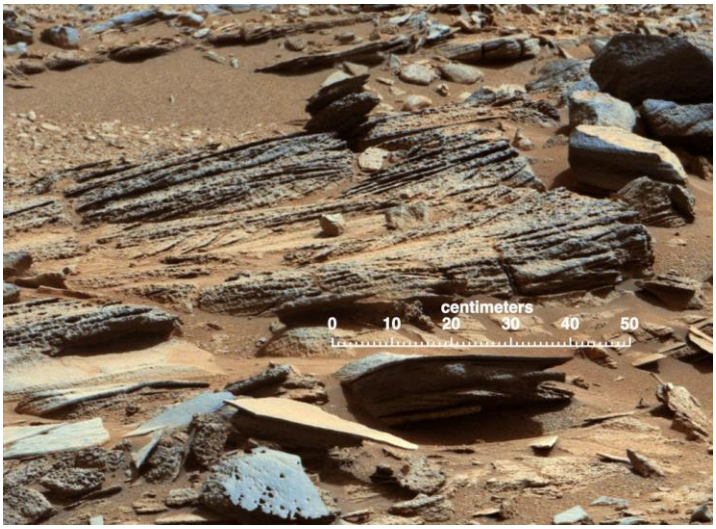


**Figure 5:** "Shaler" outcrop at Gale Crater investigated by MSL Curiosity rover; Image Credit: NASA/JPL-Caltech/MSSS

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