

Lesson 7: Life Hosting Rocks

Summary

This learning module and related laboratory exercise exposes students to the types of lithologies on Earth that host life and the sedimentary processes that formed them.

Learning Goals

Students will be able to:

- Recognize and identify sedimentary rocks on Earth and Mars.
- Identify sedimentary structures that provide clues as to the environment of formation (i.e. mud cracks, cross-bedding etc.).
- Observe the expansion of clays and explain why water influences clay-rich rocks at the molecular level.

Context for Use

This learning module is meant for adaptation in an introductory earth science course and/or planetary science course. Students need a prior knowledge of minerals before going through this module. Provide an understanding of grain sorting and sedimentary structures resulting from varying energy in the system (i.e. low energy = laminations; cross-bedding = higher energy system).

Description and Teaching Materials

In-Class Activity

In-Class Activity 1: Swelling Rocks

In-Class Activity 2: *Understanding Albedo*

Homework/Lab

Homework 1: The Energy of Rocks

Assessment

- Each *In-Class Activity* and *Homework* has its own method of assessment.

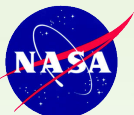
Teaching Notes and Tips

1. The *In-Class Activities* can be utilized as homework as well. The activity is designed as such that students can effectively complete the activity at home.

Mars for Earthlings

References and Resources

1. Image file: [Life-Hosting Rocks](#)
2. Swelling clay-rich soil demonstration:
<http://www.youtube.com/watch?v=ACpuYED9WkU>
3. Ripple-formation video:
<http://www.youtube.com/watch?v=zRGuMddjRGg&list=PL17AFB4B8AB3DCCF7>
4. Laminar-flow video: http://www.youtube.com/watch?v=W3YZ5veN_Bg



Mars for Earthlings

In-Class Activity 1

Life-Hosting Rocks_MFE

Swelling Rocks

Purpose: Explain why clay soils expand and discern where clays might be present on Mars.

Engage

Expanding Soil - Observe the class demonstration or video

[<http://www.youtube.com/watch?v=ACpuYED9WkU>] and answer the following questions.

1. According to the demo/video, why does the soil expand?
2. How does the bulk density change? What does this change indicate?

Explore

The molecular level- Utilize the diagram below to help students understand how clays are made up of stacked layers. (Figure 1) Students should answer the following questions.

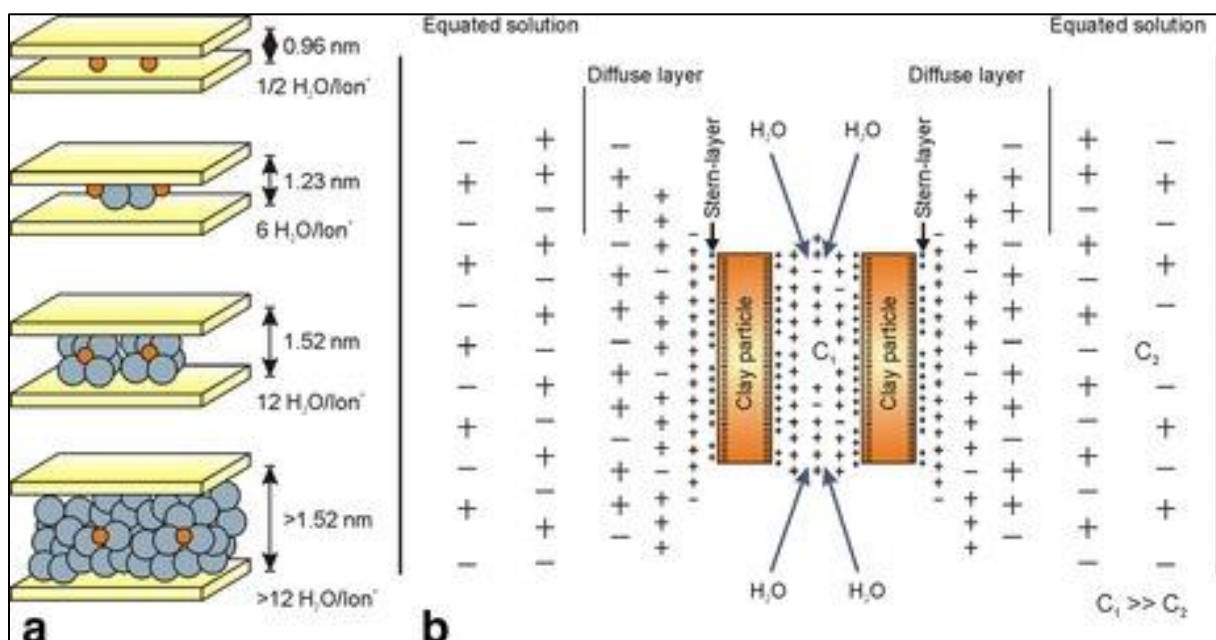


Figure 1: Butt et al., 2003

1. In Fig. 1a, how are the water molecules influencing the structure?
2. Why do the students think the water attracts to the clay rather than the sand of the sandy loam (consult Fig. 1b)?

Mars for Earthlings

Explain

Share the following information about clays with students:

- Clays are expandable due to their layer charge. The higher the layer charge (for example montmorillonite or bentonite) the more the clay will expand.
- The interlayer (the charged layer) attracts water molecules allowing for the clay to expand
- Clays are commonly formed in pedogenic, hydrothermal, or acid lake environments on Earth.

Elaborate

3. Given the students understanding of clays now, if clays $[\text{Na}_{0.2}\text{Ca}_{0.1}\text{Al}_2\text{Si}_4\text{O}_{10}(\text{OH})_2(\text{H}_2\text{O})_{10}]$ are observed on Mars....what does this mean?

Evaluate

4. Where might students look to find clays on Mars (what kind of features)? *Hint: consider their environment of formation, do we have evidence for their presence on Mars?

