Exploring Meteorite Mysteries

Lesson 8 — Edible Rocks

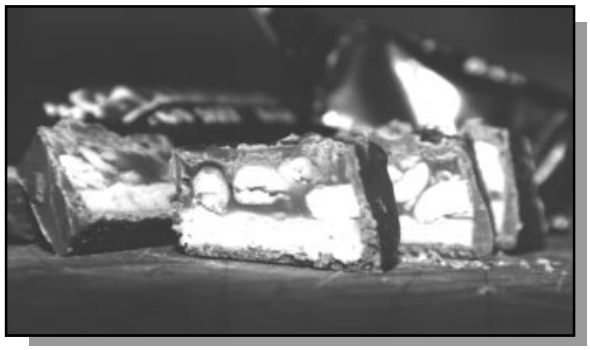
Objectives

Students will:

- observe and describe physical characteristics of an edible sample in preparation for describing rock or meteorite samples.
- work cooperatively in a team setting.
- use communication skills, both oral and written.

Materials

❑ prepared edible samples *(see attached list, pg. 8.3 and recipes, pg. 8.4)*
❑ small plastic bags for samples ❑ knife
❑ "Field Note" Sample Descriptions of candy bars, enlarged and cut into numbered segments *(pgs. 8.7-8.10).*
Note: *If included recipes are not used, then the descriptions may need to be revised by the classroom teacher to more accurately describe the actual samples.*
❑ Student Procedure *(pg. 8.5, one sheet per team of two)*
❑ colored pencils for each team
❑ pen or pencil



Cut surface of "edible rock."

Procedure

Advanced Preparation

1. Prepare samples. Simple recipes are included for some samples. The first six listed on the answer key are especially important since they closely represent meteorite characteristics that will be taught in other lessons. The other samples on the list are good for meeting the objectives of this activity and offer more variety. Use as many as needed, add a few extras to complicate the exercise.

"What are they?"

About This Lesson

This lesson has been designed as a comfortable introduction to describing meteorites. It helps students become better observers by making a connection between the familiar (candy bars) and the unfamiliar (meteorites). Edible "rocks" are used in a scientific context, showing students the importance of observation, teamwork and communication skills. In everyday terms, students draw and describe the food. Students will pair their observations with short descriptions that are in geologic "Field Note" style. As the teacher and class review, appropriate geologic terminology may be substituted by the teacher and subsequently embraced by even very young students. The last part of this activity allows the student to describe rock specimens before they move to meteorite samples in the Meteorite Sample Disk.

Note: Objectives and a formal vocabulary introduction should not be discussed until the end of the activity.

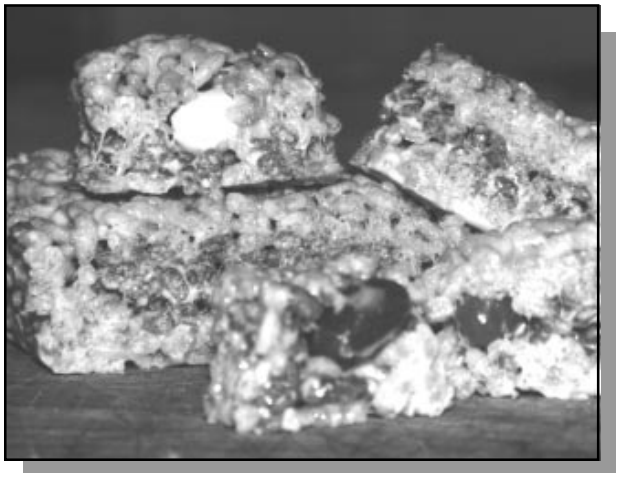
2. Cut the samples so that a flat interior surface is exposed.
   Reserve part or most of each sample — to be eaten by the students as a reward.
3. Place each sample for student teams in a small plastic bag. Each team of two students will have one bag containing one sample.
4. Copy Student Procedure sheets, one for each team of two.
5. Cut enlarged "Field Note" Sample Descriptions into numbered segments. Descriptions are written the way a scientist might take notes in a field record book.
6. Arrange one set of prepared "Field Note" descriptions on a table(s) so that students may easily read and reach each of them (numbered sequence is not important).
7. Have answer key available for teacher.
8. Have a variety of rock samples available (students may bring their own samples).

Classroom Procedure

1. Distribute sample and procedure sheet to each team. Allow student teams to choose sample if possible.

***Note**: Content vocabulary should not be expected initially. The processes of observing and recording should be kept simple.*

2. Explain that each team is responsible for describing and sketching its sample. Encourage students to describe their observations using familiar vocabulary; however, **use no food terms**. Example: The outer layer is a thin coat of light brown material containing cream or tan colored round chunks (i.e., chocolate candy bar coating that contains peanuts).
   Student descriptions need not be exactly like the provided descriptions. In fact their descriptions may be far more detailed than the short descriptions provided, which are in geologic "Field Note" form.
3. Emphasize that working together is important.
4. When sketch and description of sample are complete, students take them, along with their sample, and pair them with the prepared written descriptions. Emphasize that their observations will not be exactly like the "Field Notes." They will likely try several matches before they have the accurate paring. Throughout this step, the teacher will verify correct pairs. Expect questions like, "Is number one peanut brittle?". When they have found the "Field Note" that describes their sample, students should place their sketch, description, and sample next to the correct "Field Note" description. Reward the students by allowing them to eat the reserved part of the candy or other treat. If students have difficulty finding the description of their candy bar then the teacher should encourage them to interact with other groups for help. This step of the lesson will likely become a slightly noisy, cooperative process. As students find a match between "Field Note" descriptions and candy bars, some definitions may be supplied if necessary, i.e. "Platy means flaky flat material."



Rice cereal treats — (meteorite breccia).

Time: Classroom Steps 1 thru 4 take 25-30 minutes total.

5. When all students have successfully matched their samples, each team may describe its sample to the class. The class should have access to the sample and the prepared written description during this sharing. Sketches may be displayed.
6. Conduct a discussion that includes the following points which emphasize basic skills needed to be good scientists:
    - The students made detailed **observations** of a sample.
    - The task was accomplished by using **teamwork**.
    - Although the student's descriptions differed from those provided and each team had a different style, the skills and processes used to observe and record the data were the same for each group.
    - The students **communicated** their observations and then shared the findings **verbally** and in **writing**.
7. During the discussion, the teacher may expand and help define the meteorite and geologic vocabulary in context and encourage students to apply it to their own samples as they progress to the next step. Pay particular attention to vocabulary for the first six samples that use some words especially pertinent to meteorites.
8. Have students test their observation skills again by sketching and describing real rocks.

Vocabulary

texture, density, matrix, breccia, phases, fusion crust, chondrules, inclusions, vesicles, bleb, friable, platy, porous, unfractured, unconsolidated, regolith

Extension

Using Meteorite Sample Disk or photographs of meteorites in disk, students repeat the same procedure of observing and recording (or see Lesson 9—Meteorite Sleuths!).

Teacher Key

1. Peanut Brittle *(chondrites)*
2. Rocky Road *(chondrites)*
3. Chocolate *(iron without fusion crust)*
4. 3 Musketeers™ *(achondrite with fusion crust)*
5. Rice Cereal Treats *(meteorite regolith breccia)*
6. Chocolate brownie *(carbonaceous chondrites)*
7. Snickers™
8. Milky Way™
9. "Bar None"™
10. Hershey Bar™
11. Twix™
12. Butterfinger™
13. Skor™
14. Rolo™
15. Kit Kat™
16. Symphony™
17. M & M™
18. Nestle Crunch™
19. Whatchamacallit™
20. Mounds™
21. P.B. Max™
22. Mr. Goodbar™
23. Hershey with Almonds™

Recipes for samples not easily available commercially.

Note: *Recipes are for a larger quantity than required for the lesson.*

Rocky Road (#2 Edible Rock)
170 g (6 oz.) semi-sweet chocolate pieces (melted)
120 g (2 cups) mini-marshmallows

- butter loaf pan or folded foil
- pour about half of melted chocolate into pan
- pour marshmallows into pan and mix so they are coated with chocolate
- pour remaining chocolate over the marshmallows and spread flat
- refrigerate until cold
- cut a cube so vertical surface is exposed

Solid Chocolate (#3 Edible Rock)
use any thick chunk of solid chocolate

Chocolate Brownies (#6 Edible Rock)

- use any recipe for dark chocolate brownies or a box mix
- add large chunks of semi-sweet baking chocolate or solid chocolate candy (add enough so that the solid candy will be exposed on a cut surface)
- bake and cool completely
- cut, exposing some brownie and some solid chocolate; this surface will be described
- to form the breccia texture, cut the cube in several places, then reassemble the cube in a jumbled manor, incorporating one or two jelly beans and or other edible chunks
- allow the sample to harden so that a good surface may be cut
- cut the sample so that chunks and various chocolate lines are exposed
- students will describe the cut surface

Regolith Breccia Simulant (# 5 Edible Rock)
(Marshmallow cereal treats)
240 g (1/2 cup) butter or margarine (melted)
300 g (10-11 oz.) mini-marshmallows
200 g (8 cups) crispy rice cereal
170 g (6 oz.) chocolate semi-sweet pieces (melted)
1 or 2 jelly beans, chocolate chunks,
or other large edible lumps

- butter a deep rectangular baking pan
- melt butter in microwave or in large pan on the stove
- add marshmallows and melt (2 min. in microwave)
- stir until smooth
- pour over cereal and stir to coat all cereal,
- press half of mixture into deep buttered pan
- spread cereal layer with melted chocolate
- press remaining mixture on top of the chocolate
- allow cookie to cool enough to cut but not until completely hardened (should still be partly moldable)
- cut one cube about 5 cm square, then cut again once or twice
- embed one or two jelly beans in part of the cut cube
- mold cut pieces together again to form a “breccia”
- allow to harden
- recut to expose interior and jelly bean

Lesson 8 — Edible Rocks

Student Procedure

<u>Materials</u> - Per Two Students

❑ sample "rock" ❑ this procedure sheet ❑ pen or pencil ❑ map pencils

<u>Procedure</u>

1. With your partner, choose **one** sample to observe.

2. Carefully observe the sample. You may remove the sample from the bag, but handle it carefully and **do not taste**.

3. Make a large, detailed sketch of the sample. The sketch should show the **interior** cut surface that is flat and any important details of the exterior. You may use the back of this paper for your sketch.

4. Write 2-3 sentences describing the physical characteristics of the **cut surface** of the sample. **Do not use any food terms**. For example, do not use the word chocolate. Make your description as clear and complete as you possibly can.

5. When you have completed Step 4 take your description, sketch and sample to the table where the "Field Note" descriptions of the food samples are located. Find the description that fits your sample. Check with your teacher to see if you identified the correct match. You will likely try several of the descriptions before you find the one that describes your sample. You may get help from others. Try checking with the teacher or a dictionary for unfamiliar words.

6. Place your description, sketch, and sample beside the "Field Note" description for your sample.

7. Your effort will be rewarded with another part of the sample to eat.

"Field Note" Sample Descriptions

These food descriptions are in geologic "Field Note" style. Therefore, they may be short and sometimes cryptic. Use of geologic terms will encourage students to stretch their minds.

1. Sample is a thin layer. There is a golden matrix surrounding tan rounded or broken inclusions. The inclusions have a reddish brown rim or crust.

2. Sample consists mainly of white, soft rounded to angular blebs completely surrounded by a uniform dark brown matrix.

3. Sample is a solid dark brown dense mass with no obvious fusion crust.

4. Sample has a homogeneous light brown interior with a few small vesicles. The exterior looks like a fairly regular, dark brown fusion crust with some patterning.

5. Sample appears to have been distorted. The dominant phase is made of rounded light tan fragments containing many void spaces. A dark brown thin layer fills spaces between some rounded fragments. There are some large foreign inclusions.

6. Sample is totally dark brown with two phases. The dominant phase is shiny and crumbly. The other phase is dense and slightly lighter in color. A light fusion crust appears on only one side.

7. **Outside:** Thin medium-brown layer with ripple-marks on the bottom
Inside: **Bottom** - (~1/3) flat dense buff layer
Top - (~2/3) pebbles consolidated in a fine grained tan matrix

8. **Outside:** Thin medium brown layer with wavy ripple marks on the bottom
Inside: **Bottom** - dense dark buff layer
Top - shiny, smooth, medium tan layer

9. **Outside:** Medium brown layer, thin on the bottom, the thicker top contains angular inclusions
Inside: Thin alternating horizontal layers of smooth dark brown and fragmented dark brown

10. Dense medium brown sample, flat on the bottom with three parallel ridges on top.

11. **Outside:** Thin medium brown layer with wavy ripples on the bottom
Inside: **Bottom** - poorly consolidated light tan porous layer
Top - shiny smooth medium tan layer

12. **Outside:** Thin medium brown layer
Inside: Poorly consolidated, friable, shiny to dull golden platy fragments

13. **Outside:** Medium brown layer, very thin on bottom and side, thicker on top with large wavy ripples
Inside: Thin dense layer of shiny light-golden unfractured material

14. **Outside:** Thin, medium brown, edges higher on outside of top, sides slanted
Inside: Smooth material that is yellowish brown and sticky

15. Four segments of layered material.

Outside: Thin, medium brown
Inside: Alternating light and medium colored material

16. Solid medium brown throughout, single dense layer with a valley or dip in the top.

17. Sample consists of unconsolidated pebbles with various colors and regular shape. Each individual pebble has a medium brown interior with a thin, hard colored shell.

18. Sample has a thin layer of dense brown material, containing very light inclusions at the bottom. The sample top has a depression in the middle with a ridge on each side.

19. Sample is a rectangular layer of rounded light pebbles surrounded by a thin coating of medium brown. Some yellowish brown sticky material is above the pebbles.

20. Sample interior consists of white, moist-looking fragments. These are surrounded by a dark brown exterior layer.

21. Irregular sample.

Outside: Bumpy medium brown
Inside: Yellow brown solid material resting on light tan fragments, some large tan fragments are found near the top

22. **Outside:** Dense layer of medium brown with a dip in the top
Inside: Light tan pebbles that have settled to the bottom

23. Dense sample of medium brown material, rounded on the top and flat on the bottom, with a few light brown pebble inclusions.