"Rock" Candy (Edible Geology)

Objective: Students will learn the physical characteristics of the main varieties of Marin Headlands rocks, and will become familiar with typical descriptive terms for rock characteristics used by geologists.

Three main rocks dominate the Headlands landscape: basalt, chert, and graywacke sandstone. Each rock type has different physical characteristics. In this activity, we'll learn what a geologist looks for in order to identify a rock.

BACKGROUND

Basalt

Basalt is an igneous rock, formed from lava. Pillow shapes in basalt always tell a geologist that the basalt erupted underwater!

When geologists look for *pillow basalt* in the Marin Headlands, they look for rocks that are shaped like 3-foot-long jelly beans. In a roadcut or outcrop (where a geologic formation appears on the earth's surface), the pillows will have curved surfaces, and each pillow will be separated from the others by a thin layer of shale-like dirt.

Micro-crystals can't be seen with the naked eye or a magnifying glass. Rocks that cool slowly, like granite, will appear speckled, since each mineral in the rock forms a different colored crystal.

When the pillows originally erupted from underwater volcanoes, the lava that first contacted the cold seawater quickly solidified, while the interior of the pillow remained squishy and cooled more slowly. When molten rock cools quickly, crystals in the rock are very small. The slower molten rock cools, the bigger the crystals. Thus a pillow basalt will have a *micro-crystalline* outer shell, with bigger crystals in its middle.

"Weathering" is the process of physical disintegration and chemical decomposition of rock material into dirt.
Weathering agents include wind, rain (always slightly acid in composition), and trampling.

In the seastacks in the Headlands and at Point Bonita, pillow basalts are green or black. In outcrops and roadcuts where the rocks are *weathered,* pillows look reddish-orange-brown (kind of rusty) due to the high iron content.

Chert is a sedimentary rock, which in the Headlands, originated from deep sea ooze that hardened into rock. Shale is a sedimentary rock formed by compacted mud or silt.

Chert

When geologists look for chert in the Headlands, they look for rocks that form layers a few inches thick, with each layer separated by a thin coating of shale. The layers are often bent (folded) in deep curves. Chert breaks into rectangular shapes with hard, smooth and colorful surfaces - like jolly ranchers.

Graywacke is a sandstone composed of many different sizes of angular sand grains. In the Headlands, graywacke originated in the deep sea trenches along a subduction zone.

The name "graywacke," comes from an archaic German mining term, grauwacke, *meaning gray gravel.*

Graywacke

When geologists look for graywacke sandstone in the Marin Headlands, they look for rocks with a gritty texture, which feel rough to the touch (a bit like sandpaper). The outer coating of sugar on a gumdrop is like a piece of graywacke sandstone. The grains of graywacke sandstone can be rubbed off just like the grains of sugar on a gumdrop.

CLASSROOM ACTIVITY

Materials needed:

1. jelly beans
2. jolly ranchers
3. gumdrops
4. pencil, paper, art supplies
5. rock samples (basalt, chert, graywacke).

Pass out each type of candy separately, followed by a brainstorming session on how you might describe its physical features. Introduce the vocabulary words into the discussion. Then, pass out corresponding rock samples and compare the physical features of each. Discuss the features found in the candy as they relate to those found in the rocks. Have the students record their observations or create diagrams of each rock type.

Vocabulary:

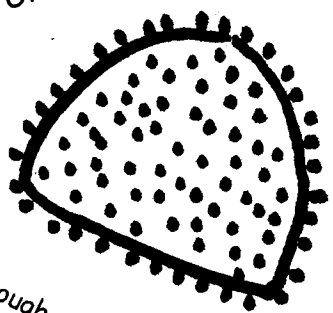
physical features
texture
gritty
blocky
layered
dense

EXTENSION

Students can find good examples of unweathered (or "fresh") and weathered basalt along the Point Bonita trail. (Observe the rocks, but please don't collect them!)

Introduce the concept of weathering. Have students brainstorm how each type of candy would change as a result of exposure to water, physical pressure (crushing), etc. Discuss how the Headlands rocks might change in appearance as a result of weathering. Do you think a weathered rock formation is as strong as an unweathered outcrop? On which types of rock would it be best to build a house?

Gumdrops are like Graywacke Sandstone

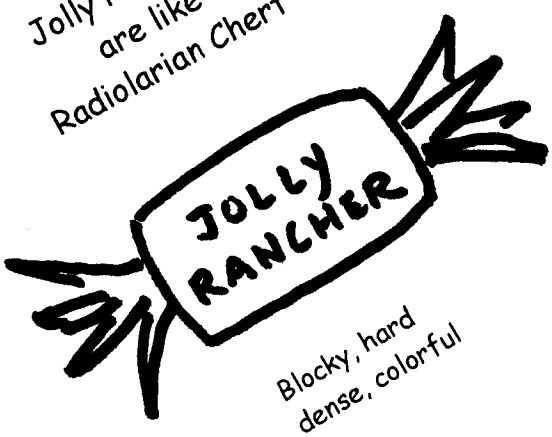


Rough, gritty texture with visible sand grains that are easily rubbed off.

NOTE This activity was adapted from Discovering Nature through Rocks and Minerals by education intern Chris Hey, for the Marin Headlands program, "Rocks on the Move."

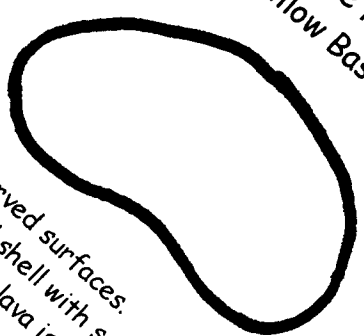
FURTHER READING Lawton, Lawton, and Pantaja, Discovering Nature through Rocks and Minerals, Stackpole Books, U.S., 1997.

Jolly Ranchers are like Radiolarian Chert



Blocky, hard dense, colorful

Jelly Beans are like Pillow Basalt



Curved surfaces. Hard shell with squishy center (before lava is totally cooled).