Life Sciences and Art

Batiking Yellowstone: Using art to interpret Science!- Teachers Lab

6-8

Lesson plan by TBI

Content:

VOCABULARY

Caldera
Continental hot spot
North American plate
Microorganisms
Cyanobacteria
pH
Thermophiles

NATIONAL SCIENCE STANDARDS

NA-VA.5-9.2 Using knowledge of structures and functions

NA-VA.5-8.6 Making connections between visual arts and other disciplines

NL-ENG.K-12.1 Reading for understanding

NS.5-8.7 History and Nature in Science.
Science as a human endeavor
Nature of Science

LESSON GOALS:

Understanding that Yellowstone National Park is a unique and dynamic ever changing system that is fueled by a continental hot spot. Life in the region is dependent on the chemistry and heat generated by the hot spot. We can interpret this nature beauty through the art of batik.

LEARNER OBJECTIVES:

1. Students will understand the relationship between the continental hot spot, the Yellowstone caldera and life in thermal features.

2. Students will create an art interpretation of dynamic Yellowstone.

Background content:

Use the TBI Batik_pictures10_07.ppt to illustrate Yellowstone National Park features

Yellowstone National Park is an area of active volcanism. It contains an active volcano, and has one of the world's largest calderas (a depression left by the eruption activity), measuring 45 miles by

30 miles. A continental hot spot is one theory that explains Yellowstone's volcanic nature. Hot spots are areas where hot semi-fluid rock is close to the Earth's crust. The North American plate, that plate that Yellowstone and most of western North America sits upon is moving in a SW direction at about 1 inch per year. The plate movement has created a series of calderas and lava flows appearing first along the Oregon and Nevada border 16.5 – 15 million years ago tracking to the Northeast to its present location in Yellowstone were the Yellowstone caldera that was created 640,000 years ago. The geography is very visible from satellite photography, showing the remarkable absence of mountain ranges, attesting to their destruction by volcanic eruptions *(Picture 1)*.

Within the Yellowstone caldera and the surrounding area the land is in constant motion, 1000-3000 earthquakes occur annually. Heating and cooling conditions from the magma chamber below expand and contract the earth's crust. There are two very active regions in YNP the Mallard Lake Dome and the Sour Creek Dome. Ground movement can be as much as 2 inch in just one year *(Picture 2)*. As a result of the underlying geologic activity, the park contains 14,000 thermal features including geysers, hot springs, mud pots and fumaroles *(Picture 3)*. YNP has the largest concentration of geysers in the world with approximately 300 active geysers. Grand Prismatic is the 3rd largest hot spring in the world *(Picture 4)*. Steamboat geyser is the world's tallest active geyser, throwing water 300 feet into the air *(Picture 5)*.

Microorganisms, organisms so small that you can't see them with your naked eye, make up the largest mass of living creatures on earth; more than plants and animals combined *(Picture 6)*. In YNP different kinds of microbial life like bacteria, algae, fungus, viruses, and a relatively new form of life, archaea, form spectacular colorful communities in the thermal features. These communities are visible to us because of the shear number of individuals present in these protected and extreme environments *(Picture 7)*. The temperature and pH of the thermal environments dictate the type of microbial community that thrive in different the wide array of thermal habitats present in Yellowstone.

Yellowstone's thermal features support abundant microscopic life that prefers high water temperatures. These heat loving organisms, thermophiles, can often tolerate extreme pH levels, and/or waters laden with heavy metals and elements like arsenic, mercury, sulfur and iron. These organisms also referred to as extremophiles because of the extreme conditions in which they live, have evolved to tolerate and even make a living in these conditions, using various forms of chemicals as an energy or food source *(Picture 8)*.

Many of Yellowstone's microorganisms make there energy through the sun's energy and the process of photosynthesis. The first photosynthetic microbe, cyanobacteria, evolved 3.5 billion years ago and is believed to have transformed the largely carbon dioxide atmosphere of early earth into an oxygen rich atmosphere we have today. Cyanobacteria are prevalent throughout YNP in neutral to slightly alkaline hot springs *(Picture 9)*.

The goal of environmental education is to get you excited about science, and we use YNP as our backdrop. So view the dramatic color and wonder of the thermal features in YNP, and produce masterpieces of silk *(Picture 10)*.

MATERIALS AND SUPPLIES:

TO ORDER SUPPLIES FOR BATIKING:

Go to **www.dharmatrading.com** or call **1-800-542-5227**. All of the supplies can be purchased at this website. There is a classroom kit that can be purchased called the Dyna-flow class kit, stock #DFCK, $59.95.

The kit contains:

- 30 2.25 bottles of Dyna-Flow
- 5 droppers
- 6 resist applicator bottles
- 6 size #7 applicator tips
- 24 5/8" bamboo sumi brushes
- 10 oz. Silk Salt
- 8 oz. water-based resist
- Instructions for silk painting

Or, supplies may be ordered separately from Dharma Trading.
The silk can also be ordered from Dharma – pre-stretched silk on hoops can be found on this website and are very easy to use and can be transported home by students with little damage. The hoops come in 3, 6, 8 and 10 inch round or square sizes. The 10 inch square seems to work very well. A package of 3 is $3.79 each if you order 10 or more.

To order a bolt of silk: Contact Exotic Silks of California 1-800-845-SILK. A 50 yard bolt is $3.00 per yard and the 8mm Habotai silk should be ordered. This can be used to make banners.

YOU WILL ALSO NEED:

- Ice cube trays
- Safety pins
- Rubber or fabric (from old pantyhose)
- Bands
- Iron
- Blow dryer (not necessary but helpful)
- Drop cloths
- Paper towels
- Table salt and/or rock salt
- Vine charcoal (can be purchases at a craft store such as Michael's)

· Various images
· Silk dye (in the kit if you ordered it)
· Paint brushes (in the kit if you ordered it)
· Gutta resist (in the kit if you ordered it)
· Resist applicator bottles and tips (in the kit if you ordered it)
· Access to and containers for water
· Masking tape
· Scissors
· 4 small cinder blocks
· 2 8 foot lengths of PVC pipe 2-3 inches in diameter

ACTIVITY OUTLINE:

1. Order needed materials in advance of the activity.

2. Gather a variety of YNP microbial pictures to be used by the students.

3. If a banner is to be made, spread drop clothes in the area to be used for painting in order to catch drips.

4. Set the four cinder blocks up with the PVC pipe inserted into the top holes to create a framework onto which the silk banner can be stretched.

5. To stretch the silk, cut a piece as long as is needed. Pin the silk every 1.5 to 2 feet to the PVC pipe using the rubber or fabric bands. The fabric bands can be made by cutting the legs of old pantyhose into bands. Tie the fabric or rubber bands to the PVC pipe and then, using the safety pins, pin the silk to the end of the bands. Try to pin the silk so that there is little to no drooping as the paint will run if there is too much slack.

6. Using the resist to draw the lines, divide the banner into blocks keeping in mind that it is difficult for students to paint in the middle of the silk. That space can be left blank or be filled in later with a class design. When creating the blocks for students to paint, use double lines to prevent the paint from running.

7. Before having students paint, provide an introduction to Yellowstone National Park and the vibrant color patterns we see in the thermal features. Emphasize the important role that microbes have in life as we know it, and that the color pattern in the features are related to unique and extreme organisms found in these protected thermal features.

8. *A demonstration of the process is helpful to save on supplies as students have a tendency to use too much paint, gutta resist, and/ or salt.*

9. When students are ready to start, have them practice their pictures on a piece of paper if needed. This step may vary depending on the time you have, and the age group you are working with. Students should then draw the picture on the silk using the vine charcoal. This picture should now be outlined with the resist. Instruct students that they need only a very thin line of the resist and that there shouldn't be any gaps in the lines. The resist is what stops the paint from running so it should be used any place that a different color is desired.

10. Allow the resist to dry. This is where the blow dryer can be helpful. If it is used, dry with the dryer on low setting and hitting the silk at an angle. If the high setting is used, it may cause the resist to run.

11. Once students are ready to paint, give every two students an ice cube tray with yellow, red and blue paint. Two students can share one ice cube tray.

12. Make paper towels and the salt available at one central point. If students are using the salt, they must put it on their painting when it is still wet.

13. After painting is complete, the paint must be set. To set the paint, place a towel over the silk and iron it on low setting using a circular motion until the silk is hot to the touch. Sunlight will also set the paint.

14. After heat setting the paint, rinse the silk in lukewarm water to remove the resist and charcoal. Some paint will come off with the salt and resist.

CLOSURE AND ASSESSMENT:

Student will be assessed on participation and creativity.

RESOURCES:

TBI POWER POINT:
Batik_pictures10_07.ppt

Lydia Dambekalns, 2005.
Earth View: Art View. The Science Teacher.
43-47pp.