Fairystones

Students will learn about minerals and crystals, the difference between a rock and a mineral, and how and why various minerals and crystals form. They will come to understand that some minerals form only at the high temperatures and pressures of **metamorphism**. They will learn that all rocks contain crystals, but that not all crystals have a regular external shape.

Background

Fairy Stone State Park is unique in that it is the only park in Virginia named after a mineral. Fairystones are the popular name for the mineral staurolite. Staurolite is a mineral found in metamorphic rocks, particularly schists. It is composed mostly of the elements oxygen (O), silicon (Si), aluminum (Al), iron (Fe) and magnesium (Mg). Staurolite is found around the world, usually as single crystals. More rarely, staurolite forms twinned crystals. This occurs when two crystals grow together in a particular way. In the case of fairystones, the staurolite twins have a shape like an "X" or, more rarely, like a cross.

Fairystones are found in a number of places in the Piedmont of Patrick and Henry counties. There are a number of local legends about how the fairystones formed, but they actually mark a layer of rock that runs from Turkeycock Mountain in the north to Bull Mountain in the south. Fairy Stone State Park is one of the best places in the world to look for fairystones. This activity examines how fairystones form and what they reveal about the geology of the western Piedmont.

What is the difference between a rock and a mineral? A **mineral** is a specific chemical compound with a specific chemical formula that occurs naturally. Salt (NaCl) can be a mineral. Quartz (SiO2) is a common mineral in the Piedmont. A **rock** is a solid composed of one or more minerals. Granite contains the minerals quartz, feldspar and mica. Limestone consists mostly of the mineral calcite. Fairystones are a mineral that is usually found in a rock called mica schist.

Mica schist, the rock where staurolite is found, forms by metamorphism of mudrocks. Metamorphism is the process by which heat and pressure change (metamorphose) one rock type to another. During metamorphism, limestone becomes marble, sandstone becomes quartzite and mudstone becomes schist. Metamorphic changes occur in rocks because as temperature and pressure increase, different minerals form. In mica schists, staurolite first appears at temperatures of about 450° C and pressures of about 4,000 atmospheres. It disappears, however, if the temperature gets much higher than 600 °C. Because of this, staurolite is called an indicator mineral. This is because any rock that contains staurolite is known to have formed in the temperature range of 450-600 °C.

Procedure

Before the Trip:

Unless you are already familiar with Fairy Stone State Park and, especially where to look for fairystones, this trip will work best if you arrange for a park ranger to meet and guide you.

1. Review the physiographic and/or geologic provinces of Virginia. Note the kinds of rocks found in each. Note that most Piedmont rocks are igneous and metamorphic. Discuss what kinds of rocks might be found in the park.

Grade Levels: K,4,5,6,8

Objectives

Students will:

- learn about rocks, minerals, crystals and metamorphism by using the example of the mineral staurolite (fairystone);
- work together in teams to *collect*, assemble and present information; and,
- apply what they learn in the classroom (information) to what is found in the field (data) and what it means (interpretation).

Materials

For each class:

- park or topographic map

For each student:

- appropriate clothing
- jars and/or bags to collect samples
- magnifying glass (may be shared)

Where

Fairy Stone. To be determined by park.

When

Spring or fall.

Time Required

At least two hours.

2. Look at a geologic map. If you can, determine what kind of rock lies beneath your school and beneath the park you are going to visit. *Is there more than one kind of rock present in Fairy Stone State Park? Discuss some good places to look for fairystones.*
3. Talk about metamorphism and metamorphic rocks. *How does one kind of rock become another? Which sedimentary (or volcanic) rocks become which metamorphic rocks? Look at samples of different kinds of metamorphic rocks.*
4. Talk about fairystones and how they form. Discuss the difference between a rock and a mineral. Talk about how different minerals may indicate the temperature at which a rock was metamorphosed.
5. Talk about crystals. Most rocks are made up entirely of crystals jam-packed together. Some crystals have obvious crystal shapes. Fairy-stones are a good example of this. In most cases, however, the crystals in rocks have grown into each other so that they have irregular shapes. Talk about the factors that might allow nice crystals to form (e.g. having plenty of space to grow in).
6. Go over the park rules in detail. You will need to get permission for any digging that you do.

At the park:

1. Have the class gather and, if you have made arrangements, meet with a park ranger or educator.
2. Look at and identify the various rock types you see in the park. A park employee will know where good outcrops are, but you can often find small pieces of rock in the soil along a stream bank. You can also get an idea of which rocks are local by looking at stream pebbles.
3. Take the class to one of the fairy-stone collecting areas. Follow all rules. Only pick up fairystones lying on top of the ground.

Follow-up:

1. Have the class bring their finds to school.
2. Look for crystal faces on the fairy-stones and look for little bits of rock that might adhere to the fairystones. Can they identify any minerals in the little rock bits (hint, look for mica)? Discuss why well-formed crystals like fairystones have such regular shapes and flat crystal faces.
3. Divide the class in two groups. Have one group find out about the science of fairystones and put together a report on what they can deduce about the geology of an area where they are found. Have the second group make up a "legend" of the fairystones. Discuss these different approaches in the context of what science is and is not.

Extensions

1. Have students find out about other places where staurolite is found.
2. Use of GPS equipment to pinpoint sampling/study locations would be a useful addition to this exercise.
3. Have students make a presentation on metamorphism and the causes of metamorphism.

Credits

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Standards of Learning: Science K..4, 4.8, 5.7, ES.5 a, b ES.6 a. b. c. ES 8, a, ES.8 b, c

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