

# Igneous Rocks

Vanderbilt Student Volunteers for Science

VINSE/VSVS Rural  
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# Why is the science in this lesson important?

Climate change can cause plenty of different extremely impactful changes to happen to the earth. One recent study found that there is a possibility of increased volcanic activity and a decrease in the amount of magma that can be held by the earth's crust. Another important relevant use for geology is dating in evolutionary biology. Geologists can look at ratios of different iron ions to understand atmospheres of the past and when different species evolved to survive in it.

# Introduction

- **Learning Goals:** Students understand that igneous rocks are formed above and below the earth's surface by cooling melted rock.
- There are 3 types of rocks:
  - Sedimentary
  - Metamorphic
  - Igneous



## What are igneous rocks?

- Igneous rocks form when the melted rock material from inside the Earth cools.
- This cooling and hardening of melted rock material can occur both *on* and *underneath* the Earth's surface

# I. Introduction

**Lava**  **Magma**

Melted rock on or above the Earth's surface.

Melted rock underneath the Earth's surface.

**Extrusive**  **Intrusive**

**Extrusive igneous rocks:**

formed from **lava** *on or above* the Earth's surface.

**Intrusive igneous rocks:**

formed from **magma** *underneath* the Earth's surface.

# II. Examining Igneous Rocks

## A. Intrusive vs. extrusive igneous rocks

**Learning Goals: Students identify the differences between different types of igneous rocks and how minerals impact the qualities of each igneous rock type.**

- Scientists classify rocks as **fine-grained** (small crystals) or **coarse-grained** (large crystals).
  - **Extrusive igneous rocks** cool and harden quickly since they form on the Earth's surface, so **they do not have the time to form crystals.**
  - **Intrusive igneous rocks** form inside the Earth where they cool slowly, so **they have large crystals.**
- Hand out rock box to each pair and a magnifying glass to each student.
- Tell students to take out rocks A-F.
- Have the students sort the rock into fine-grained rocks and coarse-grained rocks.
  - See next slide for answers.

# IIA Intrusive vs. Extrusive Igneous Rocks

Rocks A, B, and C  
have no crystals  
and are fine-grained.



Rocks D, E, and F  
have large crystals  
and are coarse-  
grained.

# IIB. Basaltic vs. Granitic Rocks

- **The color of a rock depends on the minerals that make it up .**
  - Granitic/Felsic** rocks are light-colored. Are called granitic because granite is the most common felsic rock.
  - Basaltic/Mafic** rocks are dark-colored. Are called basaltic rocks because basalt is the most common mafic rock.
  - Rocks **B** and **E** are hard to classify as light or dark. They are called **intermediate** because they are made from minerals of both basaltic/mafic and granitic/felsic rocks.
- **Tell students to sort the rocks (besides B and E) into light-colored and dark-colored.**

# IIB. Granitic vs. Basaltic Rocks

Ask them which rocks they think are granitic and which are basaltic?



**C and F are dark-colored  
Therefore they are basaltic**

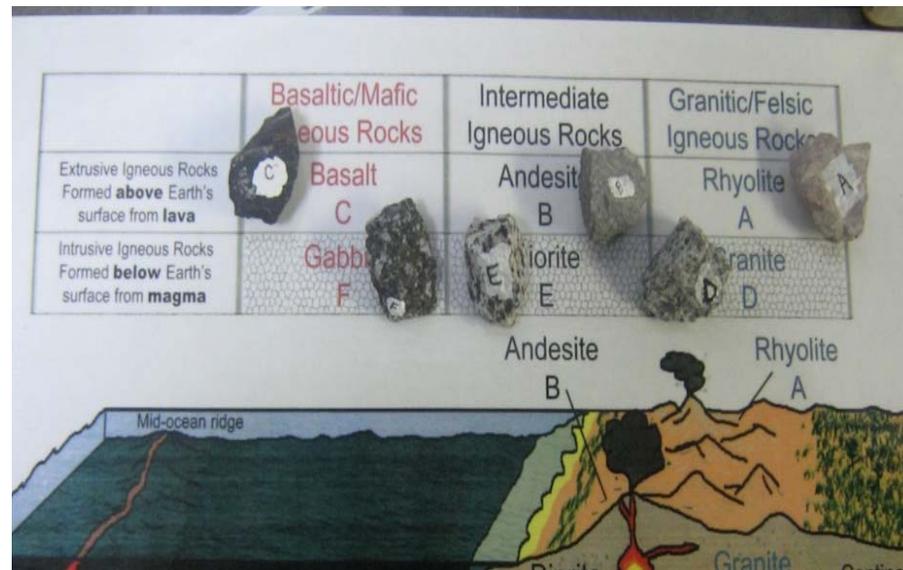


**A and D are light-colored  
Therefore they are granitic**

# IIB. Basaltic vs. Granitic Rocks

Pass out the laminated mats for igneous rocks and the Venn diagrams (1 per pair)

Tell students to place the rocks on the chart.



The top row has extrusive igneous rocks. The bottom row has intrusive.

The color from left to right gradually gets light.

The rocks in the blue column are lighter in color and granitic/felsic.

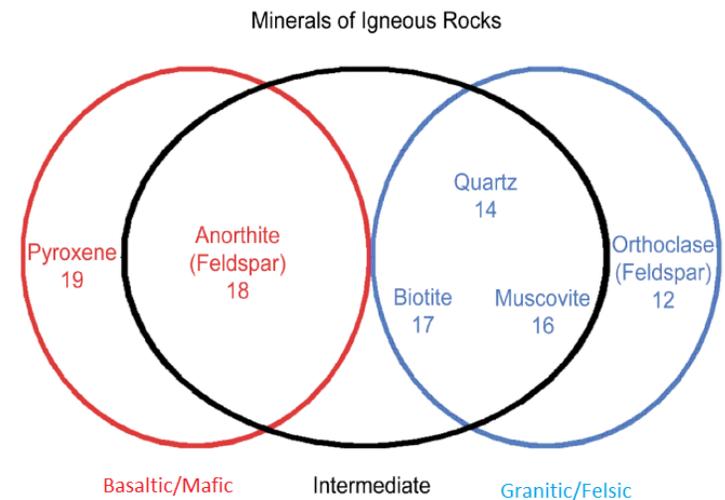
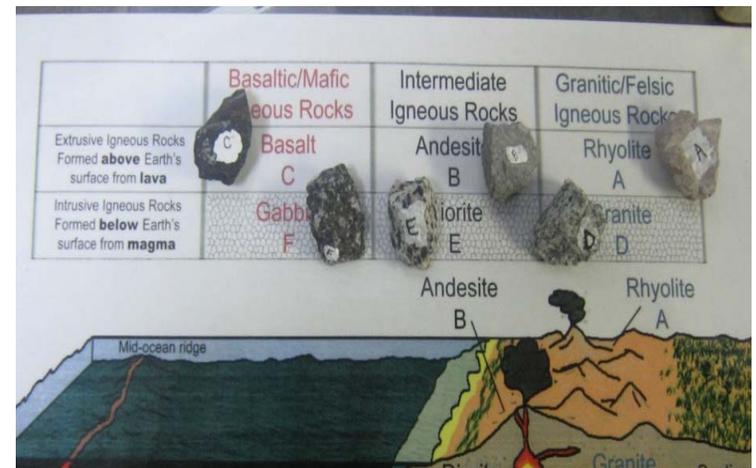
The rocks in the red column are darker in color and Basaltic/mafic.

# IIC. Minerals of Igneous Rock

**Learning Goal: Students remember that minerals are the building blocks of rocks**

- Hand out the mineral sets and magnifying glasses
- Explain the Venn diagram:
  - **Blue circle:** minerals found in a granite/felsic rock
  - **Gray circle:** minerals found in an intermediate rock
  - **Red circle:** minerals found in a basaltic/mafic rock
  - **Overlapping areas:** minerals are found in both types of igneous rocks

**Tell students to place the Venn diagram below the igneous rock mat.**



# IIC. Minerals of Igneous Rocks

Ask students:

**1. What differences in color do they see?**

*Color gets lighter from left to right*

**2. What is the relationship between the color of the mineral and the color of the rocks?**

*Color of rock depends on color of minerals that make it up*

**3. Which type of igneous rock (extrusive or intrusive) is it easiest to identify the minerals that make it up?**

*Intrusive because you can see the different crystals*

# IID. Examining Pegmatite

**Pegmatite** is igneous rock with large mineral crystals. It does not have a specific mineral composition.

Walk through the minerals in the pegmatite with students. Ask them if they can see: orthoclase feldspar, quartz, muscovite, and biotite

Is pegmatite intrusive or extrusive? *Intrusive – it has large crystals*



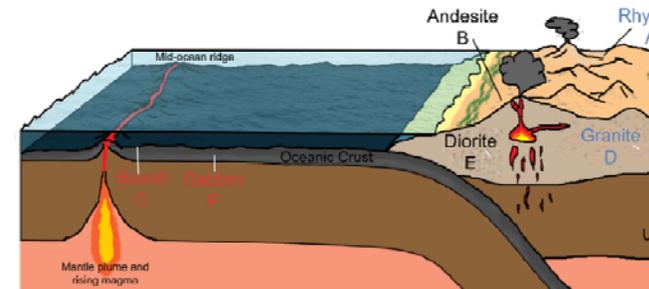
Is the pegmatite granitic or basaltic?

*Granitic because it's made of light-colored granitic minerals*

# III. Where do Igneous Rocks come from?

- Have the students to place the rocks on their labels (A, B... ) in the diagram below the chart.

|  | Basaltic/Mafic Igneous Rocks | Intermediate Igneous Rocks | Granitic/Felsic Igneous Rocks |
|--|------------------------------|----------------------------|-------------------------------|
| Extrusive Igneous Rocks Formed <u>above</u> Earth's surface from lava  | Basalt<br>C                  | Andesite<br>B              | Rhyolite<br>A                 |
| Intrusive Igneous Rocks Formed <u>below</u> Earth's surface from magma | Gabbro<br>F                  | Diorite<br>E               | Granite<br>D                  |



- Tell the students to notice where these rocks are forming:
  - Basaltic/mafic rocks form at rifts in the ocean called mid-ocean ridges.
  - Granitic/felsic rocks form near volcanos on land.

**Have the students put their rocks and minerals back in their boxes so you can collect them while setting up for the next part of the lesson.**

**LOOK AT EVERY BOX before you pack them up to make sure all the rocks 13 have been put back**

# IV. Examining Volcanic Rock

**Learning Goals: Students observe demonstrations to understand how shield and stratovolcanoes can produce igneous rock.**

- Pass out 1 volcano diagram to each pair.
- Ask the students if they know the difference between stratovolcanoes and shield volcanoes?
  - **Shield volcanoes** are broad volcanoes that have slow moving lava flows.
  - **Stratovolcanoes** are tall volcanoes that erupt explosively.

# IVA. Examining Volcanic Rock

## Demonstration: Stratovolcanoes vs. Shield Volcanoes

### Safety Guidelines:

- 1) VSVS volunteers must wear goggles.
- 2) Keep the margarine container in the box for the stratovolcano demonstration.
- 3) Use the tongs to handle dry ice.

### Steps:

- 1) Take the margarine container out of the box and place it on the small plastic plate so that the students can see.
- 2) Fill the margarine container 2/3 full of water.
- 3) Add one squirt of laundry detergent to the water.
- 4) Using the tongs, drop 2 pieces of dry ice into the container.
- 5) Quickly place the lid *with the small holes* on top of the container, making sure to press it on fully.

The mixture should start to slowly ooze out of the holes in the lid, like how a shield volcano slowly erupts.



# IV.A Examining Volcanic Rock

## Stratovolcano Demonstration:

- 1) Put the margarine container back in the deep container.
- 2) Make sure the margarine container is 2/3 full of water.
- 3) Using the tongs, drop 2 pieces of dry ice into the container.
- 4) Quickly place the lid *without holes* on top of the container, making sure to press it on fully.

Point out that the lid bulges before it flies off, like how gas builds up in a stratovolcano before it erupts.

Repeat the demonstrations.



# IVB. Special Types of Volcanic Rocks

## Pass out cases of volcanic rock (M-F-N)

Tell students that these are special kinds of igneous rocks called **volcanic rocks** because they come from volcanoes.

All of these rocks come from stratovolcanoes.

Have students work with their partner to make observations about each rock and record them on the back of their observation sheet.

**If time is short, take notes on the board.**

Have the students stop working and ask them about their observations.

Work through each rock:

1. Name the rock for them.
2. Ask them what they observed.
3. Read some (**not all**) of the fun facts provided for each rock in the manual.



# Clean Up

## **CLEAN UP:**

- 1) Collect all the volcanic rocks and put into the cases in their labeled positions.**
- 2) Collect the volcano diagrams and the magnifying glasses.**
- 3) Empty the liquid from the margarine container.**
- 4) Put all the demo materials back in the deep plastic box so they don't spill.**