Review igneous rocks

1. How do igneous rocks form?
2. What is one possible indication of an igneous rock?
Crystal close-ups

Turn to “Thin Sections of Igneous Rocks” in FOSS Science Resources on page 184.
Crystal close-ups

1. How were the photomicrographs useful in providing more information about the rocks?

2. What did you notice about obsidian?
Look at the samples of igneous rocks and a sandstone.

Discuss how the crystals are different from the particles in the sandstone.
Look for crystals

1. Do all of the rocks have crystals?
2. Are all the crystals the same size?
Introduce salol

This material is called salol. At room temperature it is frozen, just like rocks. We can melt and refreeze the salol over and over again.
Focus question

- Student-generated question, e.g., What affects crystal formation in igneous rocks?
Introduce melting temperature

• How could we find out at what temperature salol melts and crystallizes?
Salol melts at 40°C or a little higher. When the temperature goes below 40°C, the salol will begin to crystallize, or freeze.
Discuss crystal investigation

1. Why do crystals look different in different igneous rocks?
2. What are some of the variables that might affect the crystals that form in rocks?
3. What are some of the variables that we could test with the salol to see what affects how crystals form?
Magma is molten rock below Earth’s surface. This location is **intrusive**.

Molten rocks that flow out onto Earth’s surface is called lava. This location is **extrusive**.
Intrusive and extrusive

Slide 13 from *Earth’s Interior* slide show.

**Magma is molten rock.**
Melted rock that reaches Earth is called lava.
Melted rock inside Earth's crust is called magma.
Intrusive and extrusive

1. How would these two different environments, inside and outside of Earth, be different from each other?

2. Could minerals cool down and crystallize to form rocks in each location?
3. In which place, on Earth’s surface or inside it, would molten rock cool down more quickly?
4. How could you design an investigation to find out what effect the variable of cooling rate has on crystal formation?
Describe materials

The materials are available,

• plastic containers
• ice water
• room-temperature water
• hot water
• thermometers
• metric rulers
• hand lenses
• safety goggles
Plan the investigation

Notebook sheet 29, *Cooling-Rate Investigation*
Provide structure

a. Get two bottles of salol.
b. Place the two bottles of salol in the hot water to melt.
c. Place one bottle on its side in the cold water. Place the other bottle on its side in the room-temperature water. Hold the bottles to keep them on their sides.
Provide structure

d. Observe and record every 30 seconds.

e. Compare the crystals in the two bottles when all the material has crystallized.
Start the investigation

• Begin your investigation.
• Describe and record your observations, with a focus on comparing the size of the crystals in the two samples.
Start the investigation

• You won’t need more than 15 minutes to carry out the investigation.
• Record your findings, and write a conclusion.
Discuss what happened

1. What did the salol look like before you placed it in the hot water?
2. How long did it take for the salol to melt?
3. What happened when you removed the salol from heat?
4. What did the crystals look like?
Salol Crystal Formation

View video
Discuss crystal shape

Crystal shape is one of the properties that geologists use to help them identify minerals. All minerals have a characteristic crystal shape, which means if you see one type of crystal, it helps you identify what mineral it is.
Have a sense-making discussion

Report the results of the investigations by giving a short synopsis of what you did and the results.
Have a sense-making discussion

1. What was the relationship between the cooling time and crystal size?
2. Which of the igneous rocks you observed have smaller crystals?
3. Since the crystals in basalt and obsidian are small, did those rocks cool quickly or slowly?

4. In which environment would rocks cool quickly, intrusive (inside Earth) or extrusive (on Earth’s surface)?
Have a sense-making discussion

5. Which of the igneous rocks have larger crystals?

6. Since the crystals in granite are bigger, did those rocks cool more quickly or more slowly?

7. In which environment would rocks cool slowly, intrusive (inside Earth) or extrusive (on Earth’s surface)?
Have a sense-making discussion

• What differences might you expect between a rock that formed deep under the surface and a rock that solidified nearer the surface?
Salol Crystal Formation
“Extrusive Rock Formation” and “Intrusive Rock Formation”
View online activities

“Yosemite National Park Tour” and “Hawaii Tour”

### Earth History: Yosemite Tour

This tour uses Google Earth. You will need a recent version of Google Earth to run this tour. If you need to download a current version of Google Earth or encounter any problems installing or using the program, go to the Google Earth website.

Google also provides a variety of tools, resources, and tips for using Google Earth. Check out the online Google Earth learning center.

To download a tour, right click (or control click if on a Mac) on the file you would like to download. Choose “Save File As” and select a destination to download the file. Open the KMZ file with Google Earth.

<table>
<thead>
<tr>
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<tr>
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### Earth History: Hawaii Tour

This tour uses Google Earth. You will need a recent version of Google Earth to run this tour. If you need to download a current version of Google Earth or encounter any problems installing or using the program, go to the Google Earth website.

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<td>Hawaii</td>
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### Google Earth Settings

You will need an Internet connection when using Google Earth. Once you have installed Google Earth, change these default settings before you begin work:

- Display distance units in kilometers Change miles to kilometers in “Preferences” under the Google Earth drop-down menu.
- Ensure that the Terrain layer is on in the left sidebar of Google Earth, locate the Layers menu. Check the Terrain box to turn terrain on.
- Remove unnecessary layers In Layers menu of the left sidebar, deselect all the boxes except “Terrain.” This will remove place names and political boundaries from the images. You may want to add boundaries, roads and place names after students have first had an opportunity to view Google Earth without these labels.

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*Earth History Course, 5.2: Salol Crystals*  
*Step 19*  
*Slide 33*
Read “Minerals, Crystals, and Rocks” on page 68.
Review vocabulary

Spend a few minutes reviewing the vocabulary for this part. Update the vocabulary index and table of contents in your notebook.

• crystallize
• extrusive
• intrusive
Answer the focus question

- What affects crystal formation in igneous rocks?
Wrap-Up/Warm-Up

Talk with a partner about how you developed and use your models about the formation of igneous rocks to better understand Earth history.