Activity 24: Sawing a Local Bedrock Specimen

Maine Geological Survey

Objectives:

To have students learn about the textures of local rocks. To have them look for evidence that will allow them to classify the rock as igneous, metamorphic, or sedimentary.

Time:

This activity takes one period per six (6) students (and one extra period for clean-up).

Background:

There are many textural gradations among igneous, metamorphic, and sedimentary rocks. Metamorphic rocks generally show some signs of grain deformation on microscopic and macroscopic levels. Oftentimes a sawn face on the rock will allow you to see banding, folding, kinking, and other signs of deformation that are not visible in the typical hand or "grab" sample. Cutting a flat face through the specimen is the first start in creating a thin section. A thin section is a slice of rock so thin that it can be glued to a microscope slide and viewed under a microscope. Although thin sections are not within the scope of this activity, they are extremely valuable aids in unraveling grain relationships for both igneous and metamorphic rocks. Students can learn a great deal from examining the sawn face on one section of their rock samples. Ideally this activity should follow after some discussion of igneous and metamorphic rocks. If there is a local rock body of some significance near the school, a suite of sawn specimens documenting the various geological relationships makes an excellent display and a valuable teaching tool.

An excellent, non-technical discussion of metamorphic grain deformation is to be found in the opening chapters of Metamorphic Textures by Alan Spry (Pergammon Press, New York, 1970).

Materials:

You will need access to at least a 14 inch diamond drop saw. There are a number of table-top models available and most local rock/mineral or lapidary clubs have members that might be willing to bring theirs into school for several days. Each student will need to bring in a piece of BEDROCK (rock collected from some local outcrop, quarry, or ledge; glacial cobbles and boulders are of little value) that is roughly 6-8 inches in its longest direction. As with any sample, the precise location where the sample was obtained needs to be recorded. A strong detergent, a scrub brush, and access to hot water for cleaning the rock after it is cut will also be needed. A can of some clear spray finish such as Krylon is used to spray the sawn surface AFTER it has been cleaned and dried. This brings out the grain characteristics for easy viewing. This activity is best done on a tile floor. Lab aprons and safety glasses/goggles for the cutter are a necessity. Cleaning cloths/old towels are handy for minor oil spills. Paper towels are useful for drying washed specimens.

Procedure:

After some brief discussion of how the diamond saw works, what safety considerations are involved, and what each student needs to do, have a student clamp her/his rock into the saw vise, turn the saw on, make certain that the coolant is flowing properly, and then bring the saw blade gently down onto the rock surface. Gravity feed will cut through the rock and all the student has to do at this point is watch. When the specimen is almost cut through, the saw operator should hold onto the saw blade FRAME so the saw doesn't drop when the final part of the cut is made. Have the student thoroughly wash, dry, and inspect both cut halves. Choosing the half that shows the most distinct grain structure, give the cut face a coat of the Krylon spray. Then have the student take the specimen and analyze the visible grain relationships.

Special Safety Procedures:

It is very hard to cut oneself with a diamond saw. The saw cuts by grinding its way through a portion of the rock. The real safety issue is to be certain the rock is TIGHTLY clamped in place so it cannot fly out of the saw while being cut. An open-ended wrench should be used to tighten down the rock clamp nuts 1 - 2 turns before each cut. The cutting oil is usually a 40-weight light machine oil; if this gets on the tile floor it may become slippery. You may wish to assign one student to watch for spills. Each student should clean up after his/her specimen has been cut and analyzed.

NOTE: Some students will bring in glacial cobbles or samples of rock that they picked up "out west on vacation." Teachers will have to decide if these will be allowed as samples for this activity. Such specimens, while they may be very interesting, do not produce any insights into the local, Maine, bedrock geology.

Follow-Up:

Have students exchange rocks, write an analysis of the sawn sample and compare notes. In cases where disagreements cannot be resolved, the teacher should offer a third analysis of the sample.

Have students take the rocks home and tell their parents what they learned about the particular sample.

Set up before and after displays showing cut and uncut samples. Enlarged poster-size diagrams of the more interesting samples can be created. The specific details of texture and composition can be labeled with a string or wire running to the appropriate spot on the specimen. These make excellent displays for open house and so on.

Figure 1, Figure 2, and Figure 3 are photos of sawn faces on bedrock samples.

References:

Activity developed by Duane Leavitt.

Name_____

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Maine Geological Survey

Student Sheet

Purpose:

To learn about local rocks by examining sawn rock samples.

Materials:

You will need to bring into class a piece of bedrock, that is, a piece of rock that you have removed from a solid ledge. This rock needs to be at least 6-8 inches in the longest direction. The piece should be solid and firm. Trim off any loose or easily broken parts before bringing it to school. Make certain that you record the EXACT location where you obtained your sample. As some analysis and interpretation will be made about the geology in your area based on the rocks the class collects, try to obtain your specimen within the confines of the school district. Rock samples that are of glacial origin, such as materials from a local gravel pit, are not acceptable for this activity. Check with your teacher if you have any questions regarding where you collect the sample. A hammer, cold chisel, and safety glasses/goggles will be needed for sample collection.

Additionally you will need your notebook, pens, and possibly a magnifying glass (optional).

Procedure:

Your teacher will instruct you in how to use the diamond saw to cut a flat surface through your rock specimen. A diamond saw is easy to use and is quite safe as the "teeth" in the saw will not tear flesh. The major safety issue is to make certain that the specimen to be cut is clamped firmly in place before cutting begins. You will wear safety goggles and a plastic apron while cutting the specimen; no exceptions. You may wish to roll up any long sleeves as the saw uses oil as a coolant which usually coats the rock. **HAVE YOUR TEACHER INSPECT THE POSITION OF YOUR ROCK AND TIGHTNESS OF THE CLAMPS BEFORE STARTING THE SAW**.

Once your teacher has approved your setup, start the saw, make certain the lubricant is flowing, and bring the saw blade ever so gently down onto the surface of the rock. As the saw nears the end of its cut you will want to lift up gently on the support arm so the saw does not drop down and bang into the frame after it has cut through the rock.

When the cut is complete, shut the saw off, remove the two sawn halves, and thoroughly wash the cutting oil off the samples. You may need to use a scrub brush and detergent depending on the nature of your rock's composition. Dry both halves thoroughly. Inspect them. Select the half which displays the most interesting texture and, making certain that the sawn face is thoroughly dry, give this face a coat or two of Krylon spray finish.

Use the analysis form provided by your teacher to answer questions about your specimen. Dispose of the unwanted half as directed by your teacher.

Special Safety Precautions:

One more time, **HAVE YOUR TEACHER INSPECT THE POSITION OF YOUR SPECIMEN AND THE TIGHTNESS OF YOUR CLAMPS BEFORE STARTING THE SAW**. Also, watch the floor for oil spills as it may become slippery, and wear SAFETY GOGGLES and apron while doing the actual cutting.

Sawn Specimen Analysis Sheet:

1. Sample Location: _____
2. Rock Type (based on field relations and examination of gross characteristics):

   _____
3. Diagram of sawn surface: (include dimensions or a scale)

4. Describe the texture and any igneous, metamorphic, or sedimentary features that you can identify.

5. Based on your further detailed examination of the rock above, do you still agree with your first identification in #2? What new evidence either supports or modifies your first identification?

6. Do you think cutting a second face at right angles to the first would give you more information about the specimen? Explain your answer.

7. If your specimen is a metamorphic rock, can you decide if the metamorphism is regional or contact based on your observations? Explain your answer.

8. Check with the other members of your class and record the number of igneous, metamorphic, and sedimentary rocks:

   Igneous_____ Metamorphic_____ Sedimentary _____

   What does this survey tell you about geologic processes in your area, assuming that the rocks were a representative sample?

9. Explain why collecting loose rocks for this exercise would make questions 3 and 4 invalid.

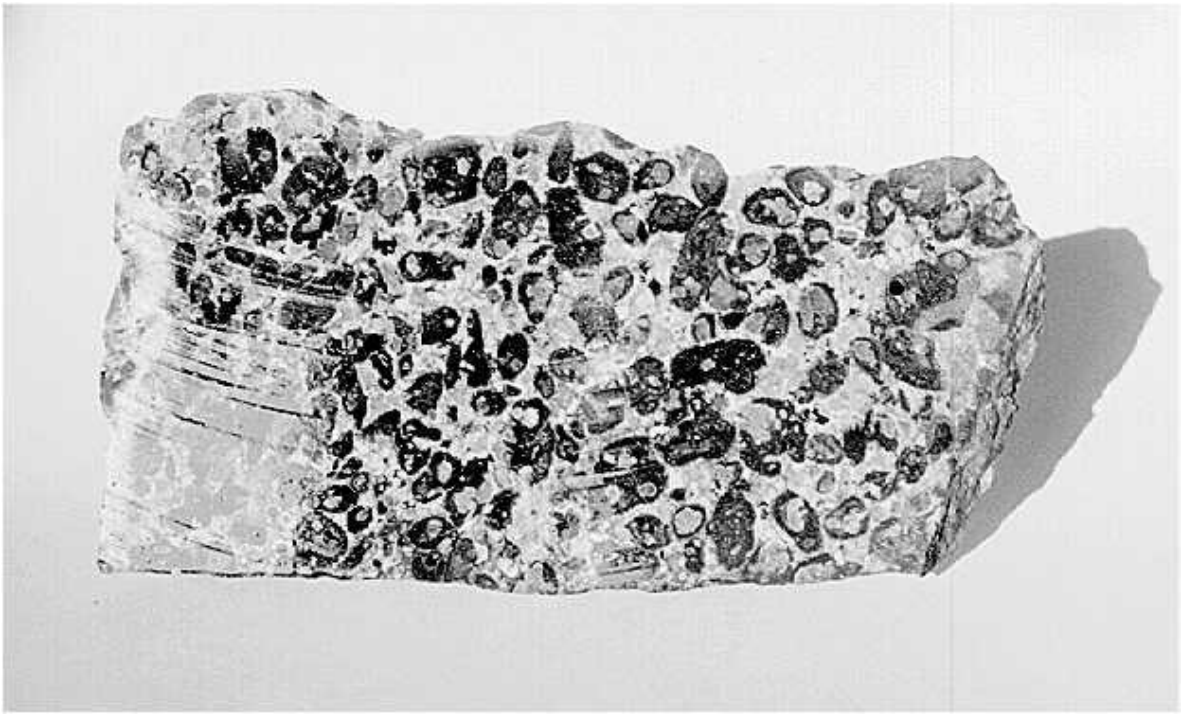

Figure 1. Locally referred to as "leopard rock," this sample is a complex combination of basalt and granite found near Mt. Agamenticus in York.

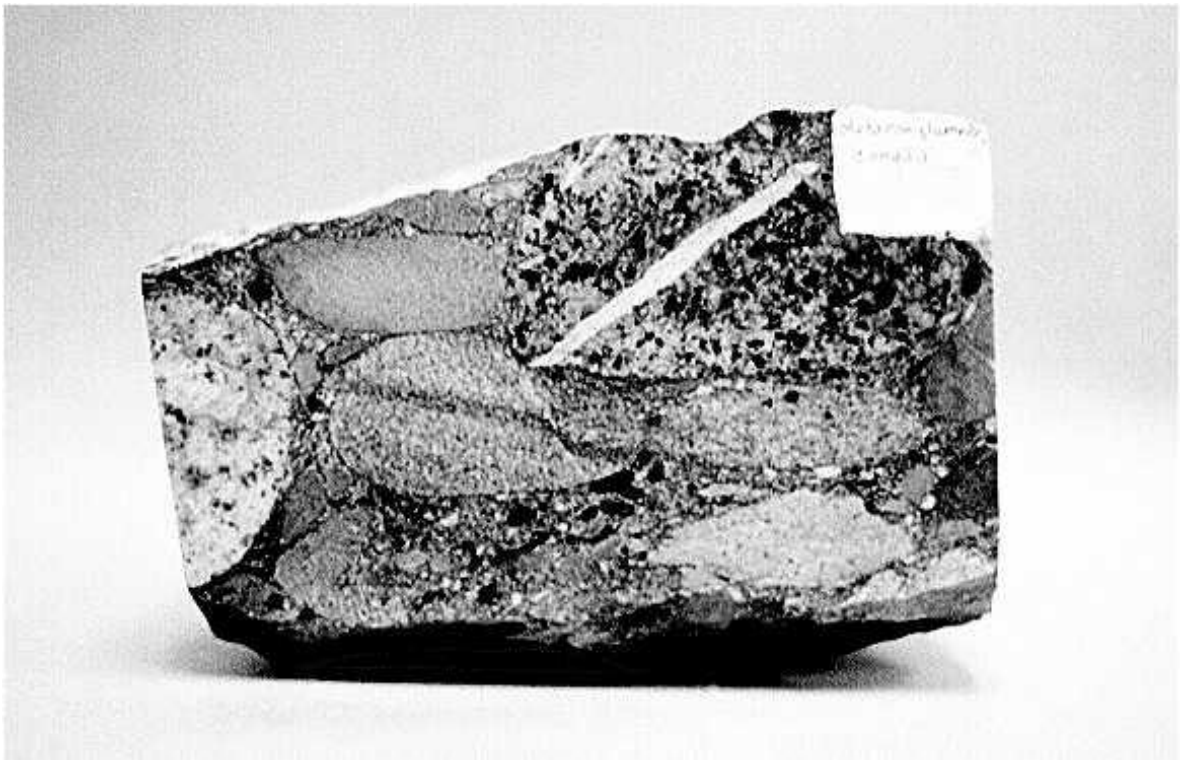

Figure 2. A metamorphosed conglomerate from New Brunswick.

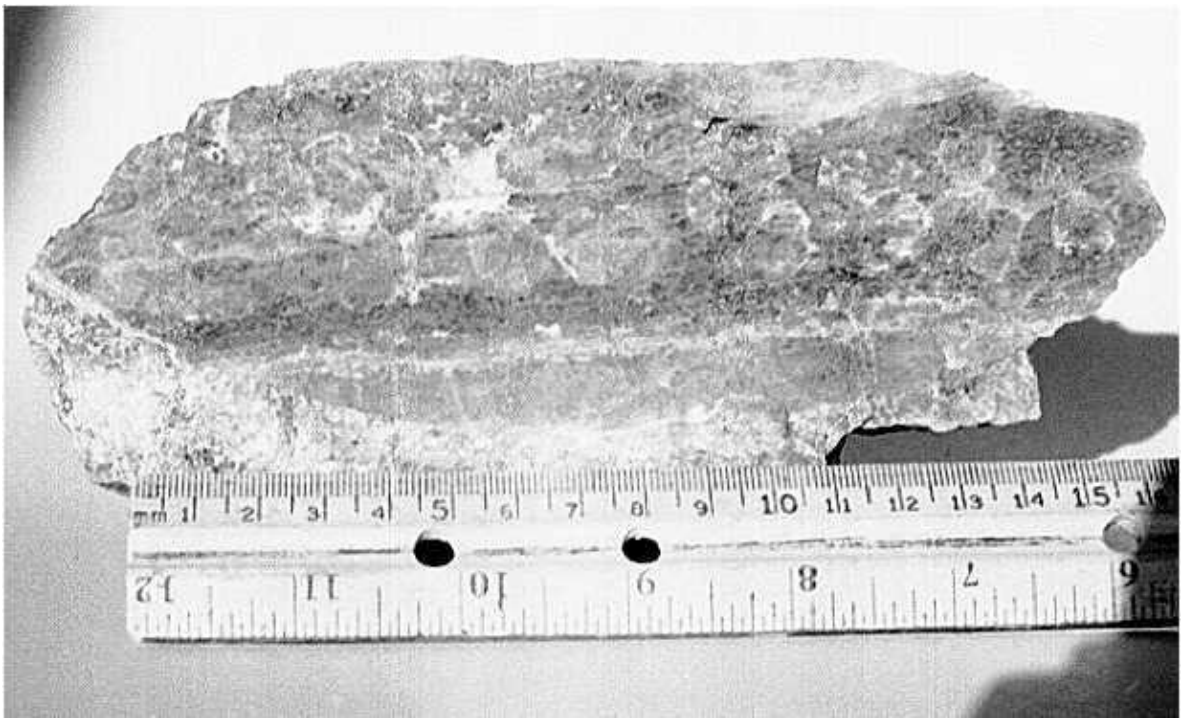

Figure 3. Showing partially formed garnet crystals; this sample is from one of the many calc-silicate (metamorphic) rocks that are common in Maine.