ROCK CYCLE IN CHOCOLATE LAB – INSTRUCTORS NOTES AND TIPS

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The up sides to this lab are that students really have a lot of fun with it, they are exposed to simple experimental design and techniques, and most importantly they learn a lot through this process. There are a few down sides, however. Because this lab is somewhat labor intensive and can be a bit messy, it is difficult to run this lab back-to-back for multiple lab sections. It also requires a lot of equipment (see the equipment list below) and a collection of rocks. I designed this lab around materials I had available, so you may need to modify the lab to fit your collection.

Ideally, each student group will have their own setup. If you are low on equipment, you can have three or four groups work independently on a single rock cycle setup. In this design, each group would start at a different station (melting, crystallizing, sedimentary, metamorphic), and the groups would follow each other through the cycle. If you are going to do this, double check the lab questions for reference back to previous steps.

I strongly recommend running through the lab before you spring it on the students. Each stage of the cycle has its own quirks, and you can head off a lot of confusion and poor results with a few well-timed recommendations to students. Here are some comments for each of the steps:

Melting:

This is pretty straight forward. Keep the different types of chocolate separate to observe the different melting temperatures and rheologies (the white chocolate will be thicker due to the higher cocoa butter content). Mix them together at the end to give yourself enough mass to make it through all the remaining steps.

Crystallizing:

You need two different rates of cooling. Pouring the molten chocolate into very cold water quenches the chocolate nicely, but the resulting chocolate is somewhat water-logged and melts really easily when touched. For a plutonic texture, I suggest using a chunk of granite or gabbro countertop that is at or slightly below room temperature to allow slow cooling, but if the rock is too warm, cooling will take too long.

The plutonic texture is difficult to see, even with a hand lens, so I have students feel the difference by grinding a small sample of it in their teeth. That seems to work best.

Erosion:

I had a hard time trying to simulate erosion due to the consistency of the "igneous" chocolate – it melts too easy to facilitate grinding or grating. So, I cheat and us the edge of a knife to cut some chocolate shavings off of some dark chocolate I keep held in reserve. Once you get past that step, it is pretty straightforward to compress the sediment into a rock (section 3.2-3.6), and bounce angular block of chocolate in a jar to wear away the jagged edges (this is section 3.7)

Lithification:

Using small Plexiglas sheets helps this process quite a bit, but sandwiching the sample between a textbook and a table can work just as well.

In question 3.2, I use a large piece of sandstone to get students to think about burial of sediment by newer sediment.

Metamorphism:

This step takes more pressure than the weight of a hand sample, so I used some clamps. It is easy to over-squeeze the envelope and break the wax paper. It is important to use wax paper for this, as aluminum foil won't stand up to the pressure.

As with the lithification, if you don't have Plexiglas, you could use a textbook or something similar. If you do have Plexiglas, you might also consider getting a hair dryer to add heat the to system while metamorphosing it. This is the point of questions 4.8 and 4.9

Materials (for each group):

- Chocolate (dark and white)
- Aluminum foil
- Wax paper
- Hot plate
- Knife (doesn't need to be sharp)
- Piece of plutonic rock countertop (granite, gabbro, diorite, etc)
- Glass beaker with cold water (ideally sitting in an ice bath)
- Hand lens
- Small glass jar with lid
- Two Plexiglas sheets
- Clamp (for metamorphism)

ROCK SAMPLE LIST:

A – Banded pumice or xenolithic rock
B – Aphyric basalt and/or vesicular basalt
C – Coarse-grained granite with obvious quartz crystals and other minerals (Qtz is important)
D – Medium-grained quartz sandstone (Qtz is important)
E – Quartzite (Qtz is important)
F – Folded gneiss or folded metamorphic rock (the fold is important)
G – Conglomerate with many lithologies (ideally all three major rock types)