

METAMORPHIC SANDWICHES

STANDARDS

See summary of National Science Education Standards.

Original: <http://books.nap.edu/readingroom/books/nses/>

Standard Concept	General standard	Specific standard	General standard	Specific standard	General standard	Specific standard
Grade Level		K-4		5-8		9-12
Science as inquiry (A)	Abilities ... to do ... inquiry	A.1.4.1	Abilities ... to do ... inquiry	A.1.8.4	Abilities ... to do ... inquiry	A.1.12.5
		A.1.4.2				
		A.1.4.4				
		A.1.4.5				
	Understandings about ... inquiry	A.2.4.2				
Physical Science (B)	Properties of ... materials	B.1.4.2	Properties and changes of properties	B.1.8.1		
				B.1.8.2		
				B.1.8.3		
Earth Science (D)	Properties of Earth Materials	D.1.4.1	Structure of Earth system	D.1.8.4		
Science and Technology (E)	Distinguish natural and human-made objects	E.3.4.2				



METAMORPHIC SANDWICHES

INTRODUCTION

Rocks are frequently classified as sedimentary, igneous, or metamorphic. These terms refer to the way the rocks formed. Metamorphic rocks could have started out as any of the types of rocks, but then, with increased temperature and pressure, the rocks are changed into another type of rock.

PURPOSE

Students create a model so they can graphically see how a rock can become changed through pressure and heat. The model is related back to rock samples.

MATERIALS:

- White & wheat bread (1 slice of each per student)
- Peanut butter (if anyone has allergies to peanut butter only use jelly)
- Jelly
- Various candy:
 - M & M's
 - Chocolate rocks
 - Red hots
 - Chocolate, vanilla, peanut butter, butterscotch chips
 - Hearts
 - Etc.
- Gummy animals (i.e. worms, snakes, bears, etc.)
- Marshmallows (or marshmallow peeps from the holidays)
- Raisins
- Wax paper
- Plastic wrap
- Plastic utensils
- Paper plates
- Rulers
- Microwave oven
- Examples of sedimentary, igneous, and metamorphic rocks; especially pairs of rocks showing the rock before metamorphosis such as limestone and marble (metamorphosed sedimentary rock) or granite and gneiss (metamorphosed igneous rock).

PROCEDURE (teacher instructions)

- 1) Explain what metamorphic rocks are: another type of rock that through heat & pressure has changed. Meta=change; morphic=form, from Latin.
- 2) Have examples of rocks and their metamorphic counterpart (i.e. shale=slate; granite=gneiss; limestone=marble, etc)
- 3) Give every student 2 paper plates.



- 4) Have students in groups of 3-4 and hand out on a paper plate white & wheat bread so each student has one slice of each type.
- 5) Pass out one plate each of peanut butter and jelly for each group. Have enough plastic knives for one for each student.
- 6) Have students put peanut butter on one slice of bread and jelly on the other piece.
- 7) Pass out “minerals” (candy), and “fossils” (gummy animals) and binding minerals (marshmallows (peeps)).
- 8) Have students “distribute” minerals, fossils, and marshmallows on each side of their piece of bread.
- 9) Put both sides of bread together on their plate.
- 10) Ask if the sandwich is a metamorphic rock. Answer should be, “No, only a sedimentary rock.” We know it is sedimentary because of the fossils in the rock.
- 11) Have each student in group put his or her sandwich together on a paper plate (stack the sandwiches up). Measure the stack with a ruler and record the height.
- 12) Wrap up each stack with plastic wrap. Ask if the sandwich represents a metamorphic rock; and what type of rock it is now (sedimentary or layered rock).
- 13) Have each student apply pressure to the stack. Get them to sit on it. Each person in the group should sit on the group’s “rock” for about 10 seconds.
- 14) Unwrap “rock” and measure the rock thickness and record the height.
- 15) Place the flattened rock on one plate and then put one plate on top. Number off each group and have them number their “rock.”
- 16) Place each group’s “rock” in a microwave oven either separately or in a group and heat it for 5-7 minutes.
- 17) After taking “metamorphic rock” out of microwave let it cool for a couple of minutes.
- 18) Cut the “metamorphic rock” with a knife to see what has happened to the original rock.
- 19) Elicit responses from students about what they found and learned about metamorphic rocks.
- 20) Offer samples of their new rock to any students who would like to eat their new rocks.

EVALUATION

- 1) Save out an original rock model, not metamorphosed, for comparison.
- 2) Students record their observations of the model rock before and after.
- 3) The end product (rock) is a direct result of how pressure and heat is applied to the sedimentary rock. Students should deduce how rocks can be changed and how the rock cycle works.
- 4) How is the model the same as a rock?
- 5) How is it different?
- 6) How is the application of heat and pressure like that experienced by a rock during metamorphosis, and how is it different?

