

How Do Heat and Pressure Create Metamorphic Rocks?

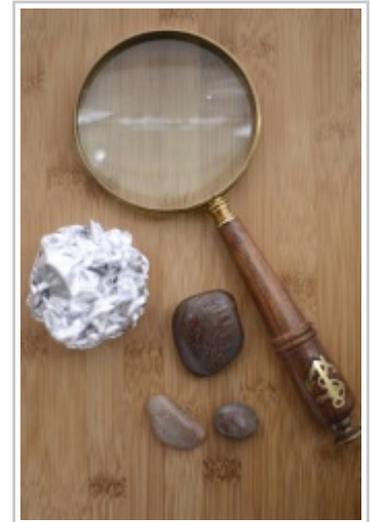
Grade Level: 5th to 8th; **Type:** Geology

Objective

By applying more and more pressure to a piece of aluminum foil “clay,” we can discover, stage by stage, how heat and pressure turn clay into slate, phyllite, and finally schist.

Introduction

Slate is a metamorphic rock that’s created when clay is subjected to a lot of pressure; keep adding pressure and the slate becomes phyllite, and add a lot more pressure and heat and you get schist.



Research Questions

- Since the “ingredients” of all these different rocks are the same, what’s the difference between them?

Terms to Know

- Metamorphic rock
- Alignment of minerals

Materials

- 4 pieces of aluminum foil, about 12”x12”
- 1 hammer
- 1 surface you can pound as hard as you like
- 1 pair of safety goggles
- 1 magnifying glass
- 1 sample of dried unfired clay or mudstone
- 1 sample of slate
- 1 sample of phyllite
- 1 sample of schist

Experimental Procedure:

1. Take a piece of aluminum foil and wad it loosely into a ball. Now look at it closely. You should notice that the surface of the foil has become a lot of little flat surfaces (some will be curved, that’s okay) that are all facing different directions. Now set it down next to your sample of clay or mudstone. The molecules in it are too small to see even with the magnifying glass, but if you looked at it under a microscope you’d see that it’s made of particles that are all facing different directions, just like surfaces in the ball of foil.
2. Wad the second piece of foil into a ball like the first one and put it down on your pounding surface. Press it down really hard and squash it as flat as you can with your hand. When you look at it closely this time—you might want your magnifying glass now—you’ll see that the little surfaces are still pointing in lots of different directions, but most of them are starting to point in the same direction. This is like slate; that’s clay that has been under so much pressure that it’s

turned into rock, and the particles in it are more or less lined up, or aligned, along the same plane.

3. Create a third foil ball, squash it flat with your hand, and set it on the pounding surface. Put on your safety goggles and gently whack it with the hammer until it's about half as thick as it was before. Now it's most like phyllite, which you should also look at with the magnifying glass. Like the minerals in the phyllite sample, most of the surfaces in the foil are pretty well aligned with each other.
4. Make one last foil ball, squash it, and whack it like you did with the last one. But this time, keep it on the pounding surface and keep your goggles on. Now you want to pound the foil as hard as you can and smash it as close to completely flat as it'll get. Some pieces might break off; that's okay, that happens a lot to schist when it's forming, too. When that happens it's called shearing. When you've gotten all your aggression out on that piece of foil, take a good look at it with the magnifying glass. Now you'd have a hard time finding any surfaces that aren't facing the same direction as all the others; like the minerals in schist, which you should also look at with the magnifying glass, they're all lined up parallel with each other.

Bibliography

- *Dig It!: Over 40 Experiments in Geology*, by Lockwood DeWitt and B. K. Hixson, pp. 210-217 (Loose in the Lab Science Series, 2003).