

Goal: Students should be able to understand how metamorphic rocks change during metamorphism

### **Packing your suitcase demonstration**

Concept: As the subducting slab progresses into a subduction zone, it encounters progressively higher pressures and temperatures, in particular relatively high pressures for a given temperature. The result is that the elements in the rocks have to rearrange themselves into mineral structures that are more tightly packed.

The suitcase represents the rock.

The contents represent the elements – pieces of clothing represent non-volatile elements.

Liquid toiletries (shampoo, toothpaste, etc.) represent volatile elements.

The journey represents experiencing metamorphism. The packing and the people who are packing represent the conditions of metamorphism (P and T). First a large suitcase is used, then the metamorphism requires that a smaller suitcase is used.

Start by showing the suitcase and putting some of the contents in and describing what they represent within the subduction zone. Pieces of clothing are non-volatile elements: e.g. “This shirt could be calcium, these pants could be aluminum, the socks might be sodium.” The toiletries are volatile elements: e.g. shampoo could be H<sub>2</sub>O, toothpaste could be CO<sub>2</sub>... Make the point that you are checking your bag, so you can have a large bag, and lots of liquids. The stuff you are putting in should be put in such that it is not tightly packed.

Then give the suitcase to a group of students. Give them a much smaller bag. Their job is to be the agents of metamorphism and pack the contents into the smaller bag. They will hopefully realize that they can leave out some of the volatiles (you may give them hints if they are not recognizing this).

#### ***Questions to ask:***

What happens during our journey that might decrease the suitcase contents?

*some answers: use up some of the shampoo, toothpaste, etc.*

How can we fit the clothing into the smaller suitcase?

*some answers: roll things up more tightly, fit socks inside of shoes, remove air*

What do these accommodations correspond to in our analog of subduction zone processes?

*answers:*

*Use of toiletries corresponds to devolatilization.*

*Packing clothes more tightly corresponds to more closely packed mineral structures*

*Removing air corresponds to porosity reduction*

Other questions they or you can ask:

What happens to the volatiles that leave the suitcase? What mineral structures allow elements to pack the elements more tightly? How much of the volatiles actually leave the subduction zone rocks? At what stage during metamorphism do they leave the rocks?

Some of the powerpoints associated with this minilesson provide answers to these questions.

**Useful information**

**Average mineral densities (g/cm<sup>3</sup>)**

<b>Greenstone</b>		<b>Blueschist</b>		<b>Eclogite</b>	
Laumontite	2.29	Lawsonite	3.09	Omphacite	3.3
Analcime	2.3	Glaucophane	3.07	Garnet	4.2
Pumpellyite	3.2	Chlorite	2.65		
Albite	2.62	Albite	2.62		
Illite	2.75				
Calcite	2.71	Aragonite	2.93		