

Introduction to Metamorphic rocks: Assignment #1

Also known as the “finally – the – last – rocks – I – have – to – learn – about” assignment.

Metamorphic rocks form because of heat and pressure **BUT DO NOT MELT**. Igneous or sedimentary rocks exposed to high heat (from contact with magma/lava or burial) and/or pressure (from movement of the earth's crust) changes the composition, shapes and positions of their mineral crystals. These form new **HIGH TEMPERATURE** minerals (like Garnet and Mica) and therefore produce rock names you might name your pets one-day like: *Marble, Slate, Phyllite, Quartzite, Schist and Gneiss* – pronounced “nice.”

Use the page 87 in the lab book and pages 63-65 in the textbook to answer the following:

1) Define Contact, Regional, and Hydrothermal metamorphism

- a) Contact = _____

- b) Regional = _____

- c) Hydrothermal = _____

2) Contact Metamorphism

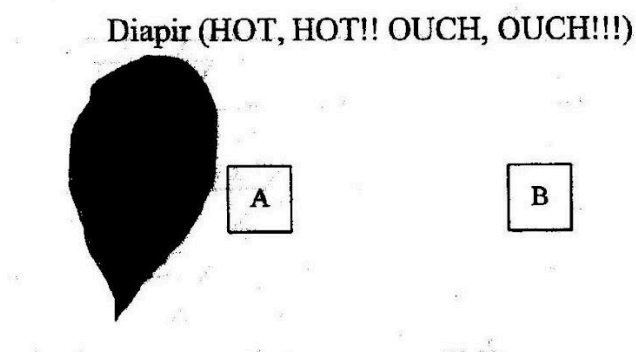
The main cause for **contact metamorphism** is heat - usually provided by magma rising in the earth (diapir) or lava on the earth's surface. The picture below shows a diapir rising through the earth's crust.

- a) What happens to the temperature of the country rock as you move away from the pluton from A to B?

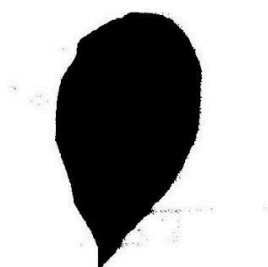
- It increases / decreases.

- b) The amount of metamorphism in the country rock moving from A to B

- It increases/ decreases.



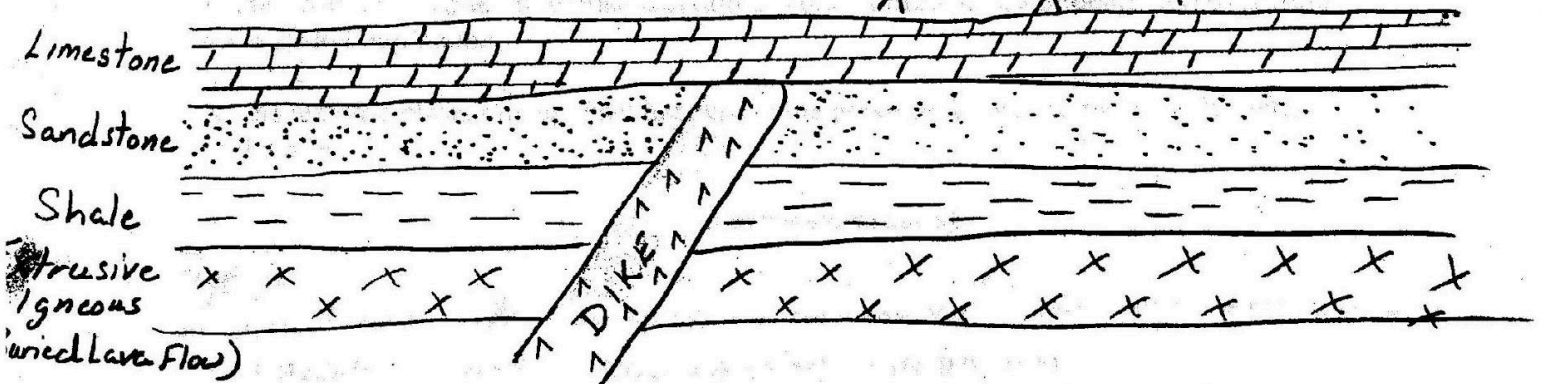
- c) The diapir has now come to rest and is beginning to crystallize in the pluton. The metamorphosed region of surrounding country rock is called the **Aureole** (or **halo**). See figure 3.33 in the text page 64. Draw and label the **aureole** and **pluton** on the diagram below.



Draw in and label the aureoles on these igneous intrusions on the dike, sill and lava flow on the pictures below

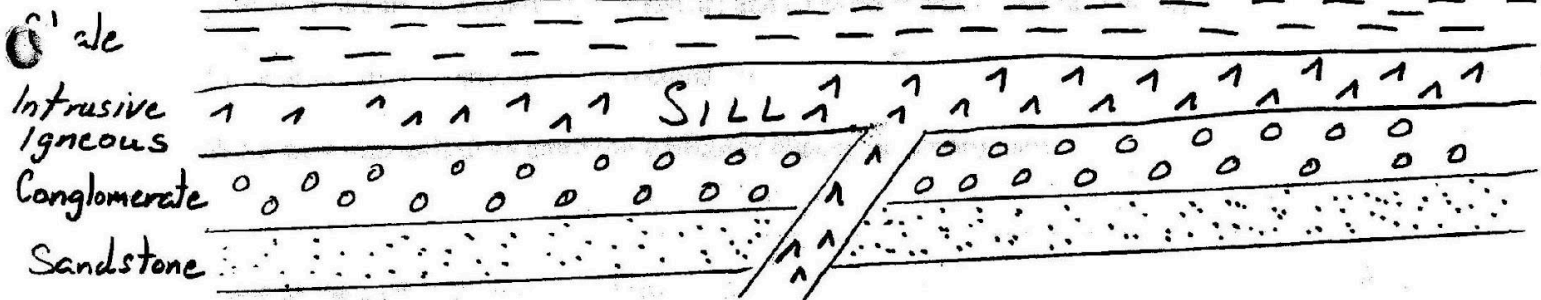
Dike

CROSS SECTION



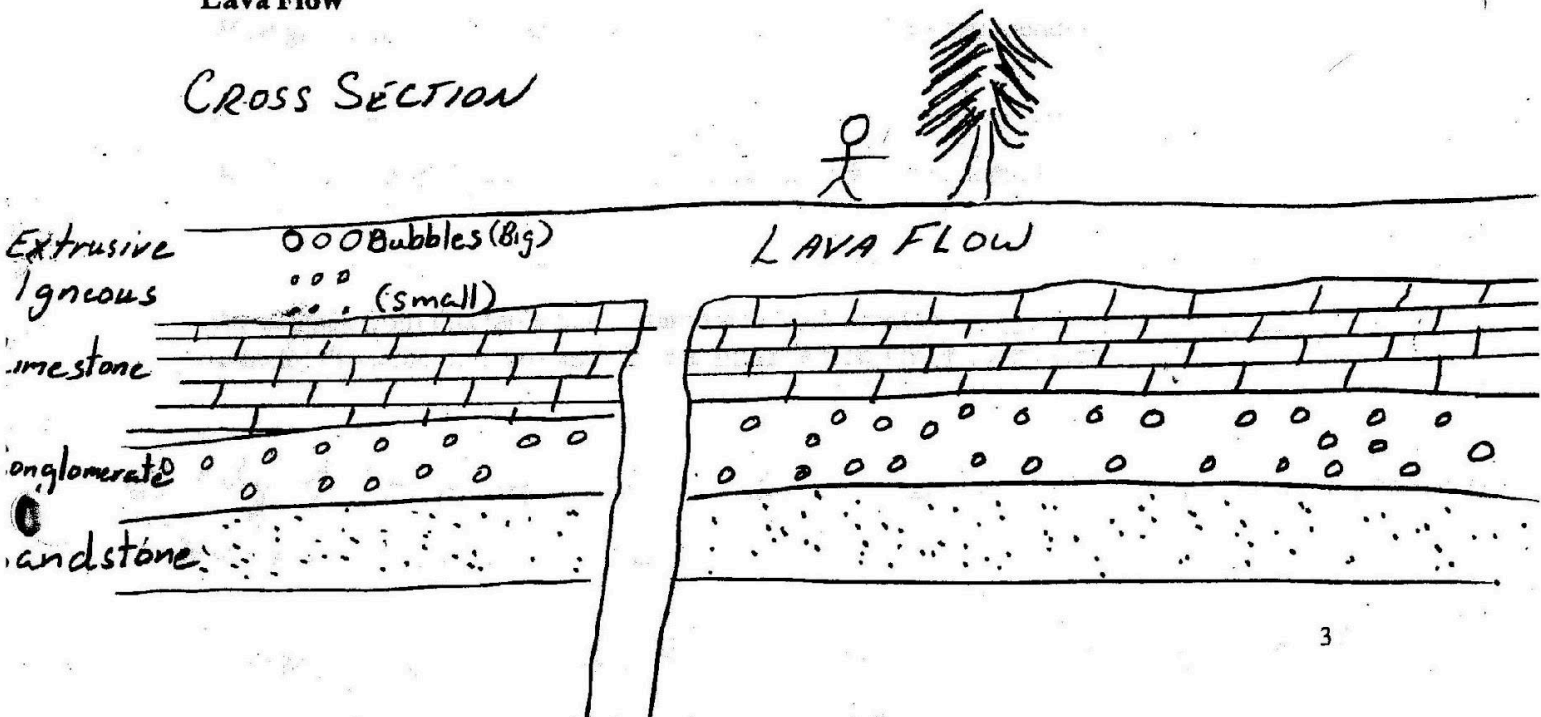
Sill

CROSS SECTION



Lava Flow

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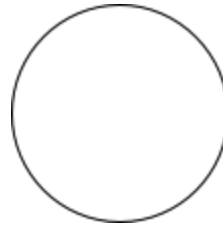
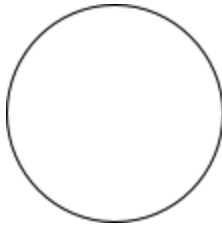


3) Regional Metamorphism

The main cause of regional metamorphism is **pressure** (with heat to a lesser extent). This type of metamorphism takes place over very large areas (MOST OF BRITISH COLUMBIA for example!) because of the movement of tectonic plates.

- Think of a vehicle accident on a freeway. Lots of cars slam into one another causing high pressures as they collide and pile up.
- British Columbia is like a heap of debris left over from a freeway vehicle accident only the collisions involve HUGE tectonic plates piling up.
- As tectonic plates pile up, the pressure felt by the rocks on the bottom of the pile ...
 - increases/ decreases.

a) Regional metamorphism creates **foliation** in rocks as the minerals align. Read **Textural Changes** on page 61. In the circles below, draw how minerals orient in a foliated rock vs. an unfoliated rock. (see figure 3.30)



- b) The porosity (size of pore spaces between grains) **increases** / **decreases** from that of the parent rock.
- c) What happens to the density of the metamorphic rock compared to the parent rock?
It is **higher** / **lower** in the metamorphic rock than the parent rock.

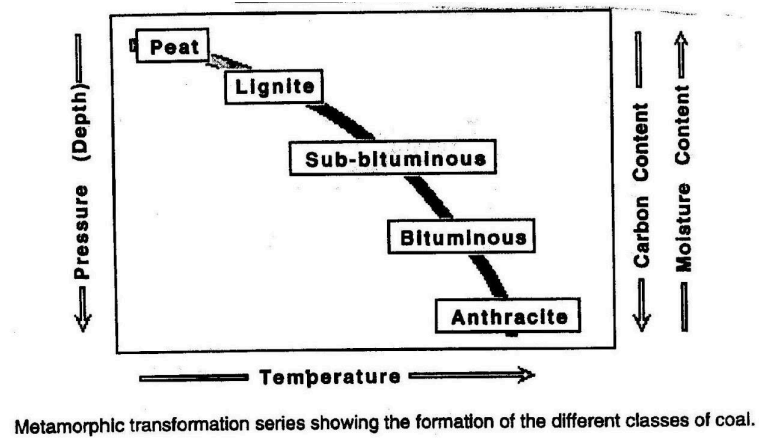
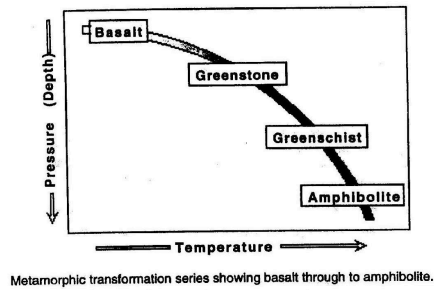
4) Metamorphic grade (See page 61)

a) The metamorphic grade of rock is _____

The higher the temperature and pressure that a metamorphic rock was formed at, the higher the metamorphic grade of the rock. See the diagram 3.28 on page 61.

d) Bastion Mountain exhibits moderate grade metamorphism. What conditions (depth and temperature) did it likely form at?

- e) The diagram shows grades of coal. Why is anthracite coal so much more valuable than lignite, or low-grade coal?



- f) For the diagram below place the following common sedimentary rocks in the correct location according to their metamorphic grade. See page 66 figure 3.35 as a reference.

Gneiss, Phyllite, Schist, Slate, Shale

