

Metamorphic Rocks

Classification and Formation

December 3rd, 2009

SUMMARY

Metamorphic rocks are one of three groups of rocks. Metamorphic rock forms when an already existing rock changes due to heat, pressure, or chemically active fluids.

Metamorphism

- Metamorphic rocks are made from already existing igneous, sedimentary, and even other metamorphic rocks.
- Metamorphism is the change of one type of rock into another. (Ex: igneous -> metamorphic)
- Due to this, we say that each metamorphic rock has a **parent rock**, the rock from which it was formed. (Ex: shale (sed.) is the parent rock of slate (met.))
- Metamorphism is the process that causes rocks to change by changing its mineral content, texture, and even the chemical composition of the rock.

Metamorphism is caused by heat.

- Heat can cause a variety of changes in rocks.
 - First, it can cause the recrystallization of minerals to something that is more stable in its new environment. (The bonds of the atoms change.)
 - Second, it can change the chemical composition of the rock.
- The source of heat comes from radioactive decay and thermal energy from the formation of Earth.
- The deeper a rock goes into the earth, the greater the temperature becomes. The greater the temperature, the more changes that occur.
- If the temperature becomes too high, the rock will melt. Then, we no longer have a metamorphic rock. Rocks do not melt to become metamorphic!

Metamorphism is caused by pressure.

- Pressure can cause a variety of changes in rocks.
 - First, it can cause the rock to become more dense by tightly compacting the grains together (this increases the mass found in a volume).
 - Second, it may cause minerals to recrystallize.
 - Third, it can flatten or fold the rock. (change its texture)
- Near the surface of our planet, rocks tend not to flatten or fold because the temperature of the rock is low. Instead it will break or fracture.
- As the temperature increases, the rock becomes easier to mold/bend and it is easier for the pressure to flatten or fold it.

Metamorphism is caused by chemically active fluids.

- Fluids made of water and other chemicals, like carbon dioxide, may cause change in rocks.
- These fluids can speed up recrystallization of a rock.
- The fluids can also dissolve minerals and deposit them from an area where there is high pressure to an area where there is low pressure.

Foliation in metamorphic rocks

- Slate is a common rock used as building material because it easily breaks into sheets.
- This is because it has foliation.
- **Foliation** is an arrangement of minerals in flat or wavy parallel bands.
 - Foliation occurs when rocks are under pressure.
 - Foliation is common in rocks produced by metamorphism that affect large areas.
 - Occurs when the minerals flatten and line up in bands.
 - We may not always see it, however if the rock cleaves, you can infer it is foliated.

Nonfoliation in metamorphic rocks

- Metamorphic rocks that are not foliated are called nonfoliated rocks.
 - This occurs when rocks are made of mostly one mineral.
 - This occurs when there is a lack of pressure.
- Examples of nonfoliated rocks include quartzite (parent rock: sandstone) and marble (parent rock: limestone)

An example of metamorphism (image on next page)

- Shale is a sedimentary rock that forms near the surface.
- Shale changes to slate as pressure causes the minerals to form layers. Mica begins to grow as recrystallization begins.
- Slate changes to phyllite deeper in the crust where the temperature and pressure increase.
- Phyllite changes to schist as the temperature and pressure increases further. New minerals replace older ones.
- Schist changes to gneiss. The minerals separate into light and dark layers. Any evidence of the original parent rock (shale) have been removed.

How Rocks Change

Because pressure and temperature increase with depth, rocks change when they are buried deeper in the crust.

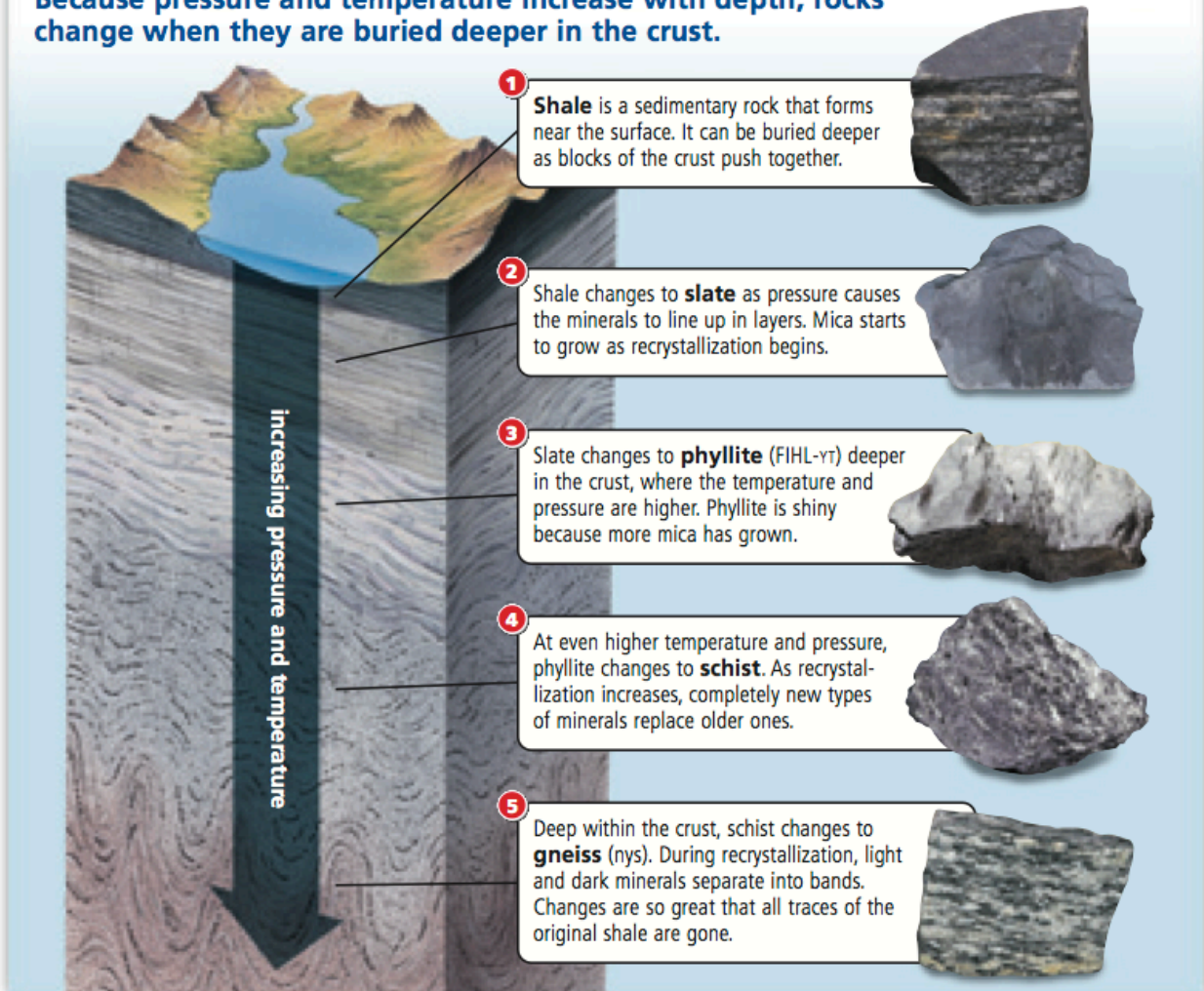


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