

Chapter 10

Rocks

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Chapter 10

Section 1 Rocks and the Rock Cycle

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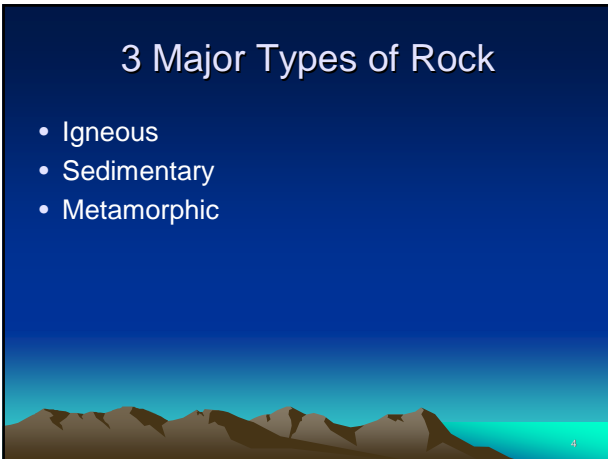
10.1 Rocks and the Rock Cycle

- Magma is the parent material for all rocks.
- Once the magma cools and hardens, many changes can occur.
- **Geology**: the study of the origin, history, structure, and the forces that shape the solid earth.

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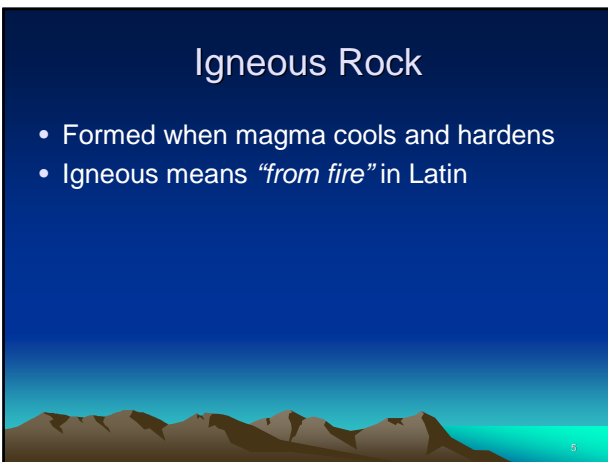
3 Major Types of Rock

- Igneous
- Sedimentary
- Metamorphic



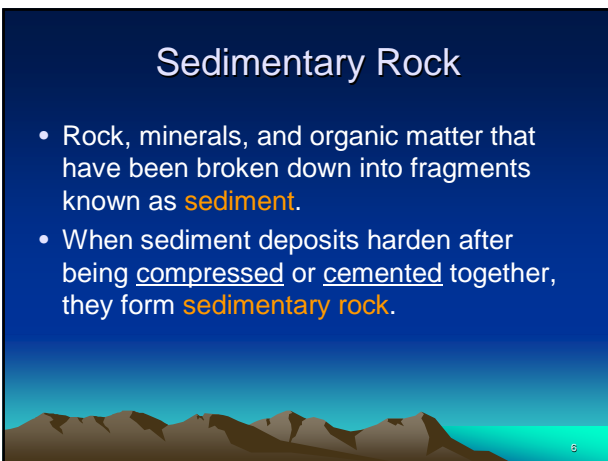
Igneous Rock

- Formed when magma cools and hardens
- Igneous means “*from fire*” in Latin



Sedimentary Rock

- Rock, minerals, and organic matter that have been broken down into fragments known as **sediment**.
- When sediment deposits harden after being compressed or cemented together, they form **sedimentary rock**.



Metamorphic Rock

- Certain forces and processes can change rock into another form.
- Tremendous pressure, extreme heat, and chemical processes can create **metamorphic rock**.



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The Rock Cycle

- Any of the 3 types of rock can be changed into any other type by geologic activity.
- This series of changes is called the **rock cycle**.
- (See page 177 for a good illustration.)



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Review #1

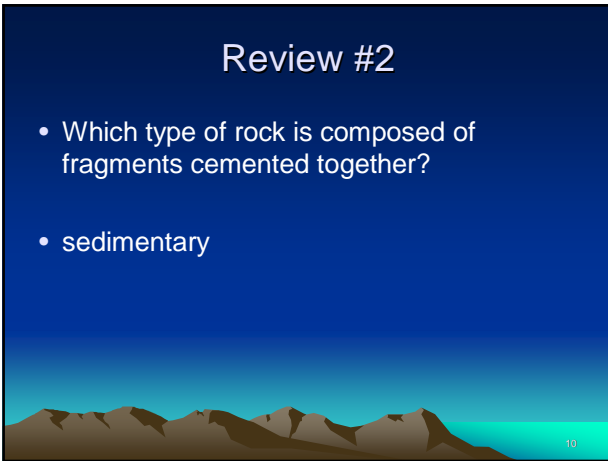
- Which major type of rock forms from magma that cools and hardens?
- igneous



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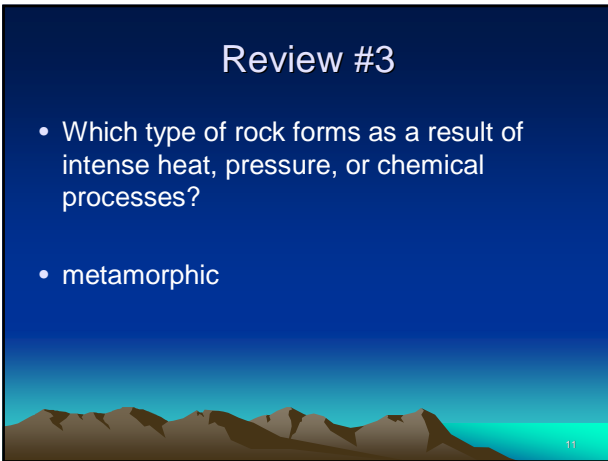
Review #2

- Which type of rock is composed of fragments cemented together?
- sedimentary



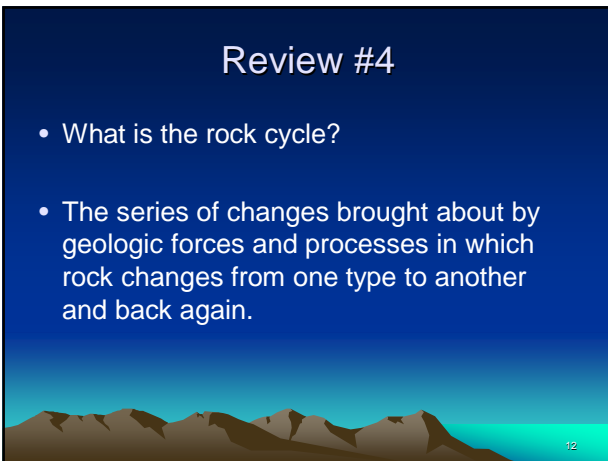
Review #3

- Which type of rock forms as a result of intense heat, pressure, or chemical processes?
- metamorphic



Review #4

- What is the rock cycle?
- The series of changes brought about by geologic forces and processes in which rock changes from one type to another and back again.



Chapter 10

Section 2 Igneous Rock

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Intrusive vs. Extrusive

- **Intrusive** igneous rocks form when magma cools deep below the surface.
- **Extrusive** igneous rocks form when lava cools rapidly on the surface.
- Intrusive and extrusive rocks differ mainly in the size of their crystalline mineral masses (or grains).

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Texture of Igneous Rocks

- Crystal size gives the rocks texture.
- **Intrusive** rocks cool slowly underground
- Cool slowly = large crystals.
- Large crystals = coarse-grained texture.
- **Extrusive** rocks cool rapidly on the surface
- Rapid cooling = small crystals.
- Small crystals = fine-grained texture.

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Intrusive Igneous Rocks



gabbro



granite



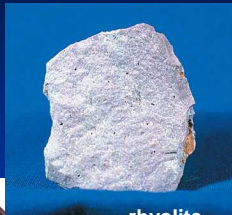
diorite

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Extrusive Igneous Rocks



basalt



rhyolite



obsidian

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Lava Glass

- When highly viscous, silica-rich magma cools rapidly, crystals don't have time to form.
- Obsidian is formed this way.



Got Gas? Cool Fast!

- When magma with lots of dissolved gases cools rapidly, the gases become trapped in the rock.
- This produces a rock full of holes, like pumice.



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Mixed large & small crystals

- **porphyritic** texture = a mix of large and small crystals .
- Because...
- Some igneous rocks form from magma that cools slowly at first, then rapidly as it nears the surface.
- This produces large crystals surrounded by smaller crystals.

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Composition of Igneous Rocks

- **felsic**: high silica, light color. Main mineral components are orthoclase feldspar and quartz.
- **intermediate**: medium-colored made of plagioclase feldspar, hornblende, pyroxene minerals and biotite mica.
- **mafic**: low silica, lots of iron and magnesium. Main minerals are plagioclase feldspar and pyroxene minerals. Dark color (usually).

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Igneous Rock Structures

- Intrusions vs extrusions
- **Intrusions** = igneous rock that form underground.
- **Extrusions** = igneous rock formed on the surface.



Intrusions

- **Batholith**: largest. Means “deep rock”. At least 100 square km.
- **Stock**: less than 100 square km.
- **Laccolith**: “lake of rock”. Dome or arc of rock pushed up.
- **Sill**: parallel layers of hardened magma.
- **Dike**: vertical layers of hardened magma.



Extrusions

- **Volcano**: extrusive rock surrounding a central vent.
- Solid central vent of an eroded volcano is called a **volcanic neck**.
- **Lava plateau**: when lava spreads out and fills a large area, covering hills & valleys.



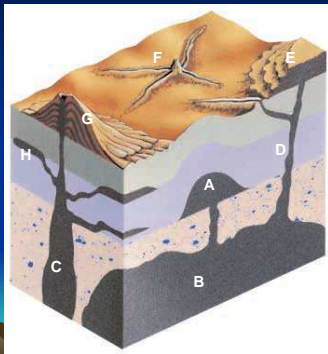
Comparing Intrusions & Extrusions



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Intrusions & Extrusions



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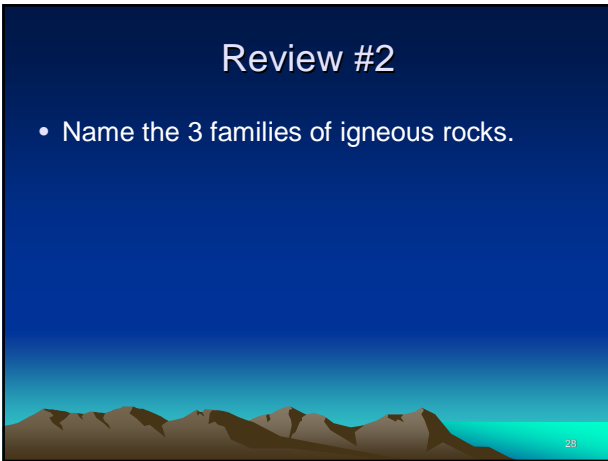
Review #1

- What determines whether an igneous rock will have large crystals or small crystals?

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Review #2

- Name the 3 families of igneous rocks.



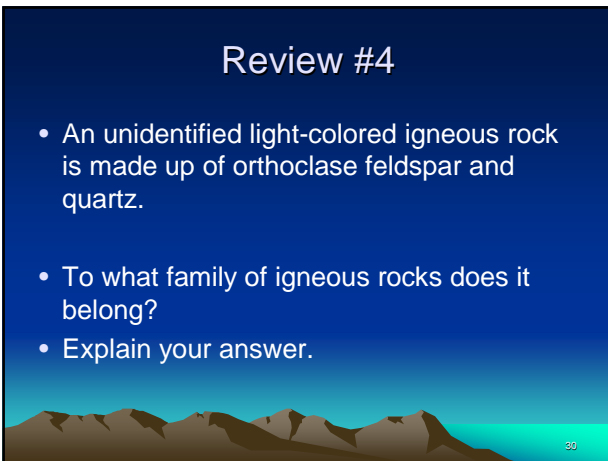
Review #3

- What is a batholith?



Review #4

- An unidentified light-colored igneous rock is made up of orthoclase feldspar and quartz.
- To what family of igneous rocks does it belong?
- Explain your answer.



Chapter 10, Section 3

Sedimentary Rock

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10.3 Sedimentary Rock

- Most sedimentary rock is made up of combinations of different types of **sediment**, which is loose fragments of rock, minerals, and organic materials.
- Two main processes convert loose sediment into sedimentary rock—**compaction** and **cementation**.
- **compaction** sediment is buried beneath other layers and the pressure forces fragments together
- **cementation** dissolved minerals bind sediment grains together to form rock

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Formation of Sedimentary Rocks

- There are three main classes of sedimentary rocks
- **Clastic**: forms from deposited fragments compacted and/or cemented together.
- **Chemical**: formed from minerals that precipitate from water.
- **Organic**: forms from the remains of organisms.

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Types of Sedimentary Rock



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Clastic Sedimentary Rocks

- **clastic sedimentary rock** forms when fragments of preexisting rocks are compacted or cemented together
- classified by the size
- **conglomerate**: rock that contains large, rounded pieces
- **breccia** rock that contains large, angular pieces
- **sandstone** rock composed of sand-sized grains
- **shale** rock composed of clay-sized particles

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Chemical Sedimentary Rocks

- **chemical sedimentary rock** rock that forms when minerals precipitate (or settle) from a solution
- When water evaporates, the minerals that were dissolved in the water are left behind.
- Rocks that form through evaporation are called **evaporites**. Gypsum and halite are common evaporites.

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Organic Sedimentary Rocks

- **organic sedimentary rock** rock that forms from the remains of plants or animals
- Examples: coal and some limestones
- Coal forms from decayed plant remains that are compacted into carbon.
- Organic limestones form when marine organisms, such as coral, clams, oysters, and plankton, remove the minerals calcite and aragonite from sea water. When they die, their shells become limestone.
- Chalk is a type of limestone formed from the shells of one-celled marine organisms.

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Sedimentary Rock Features

- Sedimentary rocks have a number of easily identifiable features.
- Stratification (layering)
- Ripple marks
- Mud cracks
- Fossils
- Concretions

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Stratification

- Layering of sedimentary rock is called **stratification**. Stratified layers, also called **beds**, vary in thickness and composition.
- Stratification occurs when the conditions of sediment deposition change.

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Ripple Marks & Mud Cracks

Ripple Marks

- Ripple marks form when air or water flows over sand to form ripples, and the ripples are preserved in the rock. Ripple marks form at the beach or on a river bed.

Mud Cracks

- Mud cracks form when muddy deposits dry and shrink. The shrinking causes the drying mud to crack.
- Mud cracks form on river floodplains or on dry lake beds.



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Fossils

- Fossils are the remains of organisms that are preserved in rock



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Concretions

- Concretions are lumps of minerals that precipitate from fluids and build up around a nucleus or in a cavity in existing rock
- The crystal cavities are called **geodes**.



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Chapter 10, Section 4

Metamorphic Rock

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Metamorphism

- The changing of one type of rock to another by heat, pressure, and chemical processes is called metamorphism.
- Most metamorphic rock forms deep beneath the surface of the earth.
- All metamorphic rock is formed from existing igneous, sedimentary, or metamorphic rock.

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Formation of Metamorphic Rocks

- **Contact metamorphism:** rock that comes into contact with magma.
- **Regional metamorphism:** tectonic activity (plate movement) causes tremendous heat and pressure in rocks at plate edges.
- Most metamorphic rock is formed by regional metamorphism.

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Classification of Metamorphic Rocks

- foliated or nonfoliated?
- **Foliated** = parallel bands of minerals (stripes)
- **Nonfoliated** = no stripes



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Foliated Rocks

- Can form in one of 2 ways
- Extreme pressure can flatten the minerals in the original rock and push them into parallel bands (stripes).
- Foliation can also occur when minerals of different densities separate into bands.
- Examples: slate, schist, gneiss



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Nonfoliated Rocks

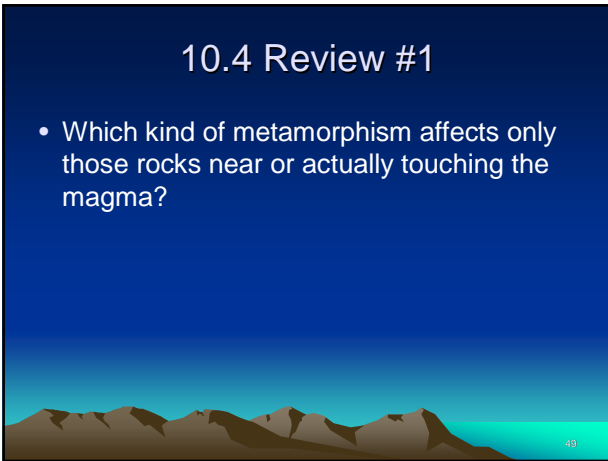
- No bands of crystals (no stripes).
- **Quartzite** = metamorphosed sandstone. Heat and pressure recrystallize the sandstone so the spaces between the grains disappear. Quartzite is very durable and weathers very slowly.
- **Marble** = metamorphic rock formed from the compression of limestone.



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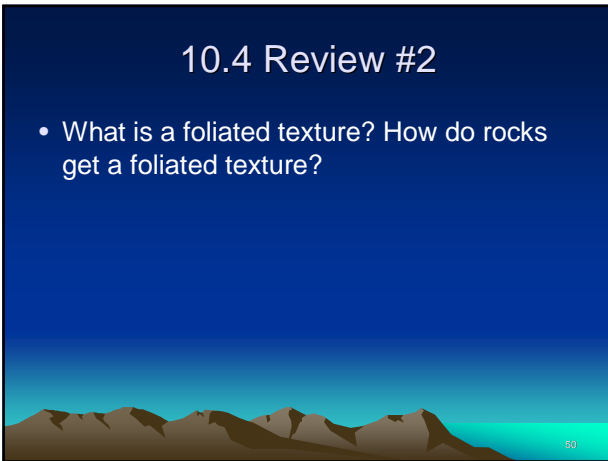
10.4 Review #1

- Which kind of metamorphism affects only those rocks near or actually touching the magma?



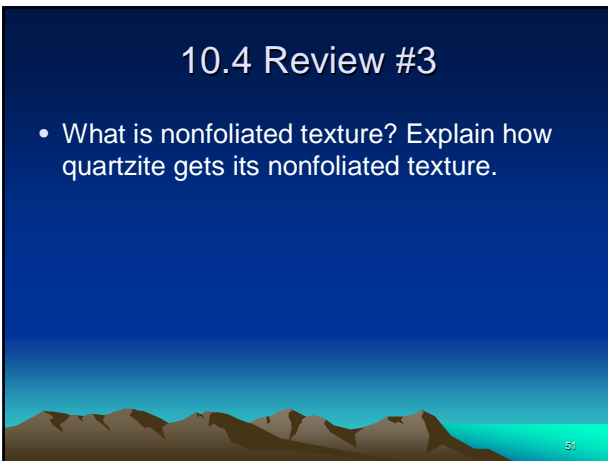
10.4 Review #2

- What is a foliated texture? How do rocks get a foliated texture?



10.4 Review #3

- What is nonfoliated texture? Explain how quartzite gets its nonfoliated texture.



10.4 Review #4

- The metamorphic rock phyllite breaks into flat sheets. Is phyllite foliated or nonfoliated?
- Explain your answer.

10.4 Review #5

- Why does most metamorphic rock form from regional metamorphism?
