

Geology 001 Exam 2 Review – Rock Cycle and Isostasy, Continental Drift, Seafloor Spreading, and Plate Tectonics

Review all questions discussed in class (see Presentation PDFs for review)

Rock Cycle:

Three main origins of magma: eruption of mantle magma at hot spots and mid-ocean ridges to form dense, silica-poor rock of the seafloor (basalt, gabbro), eruption of silica-enriched magma formed at subduction zones from the melting of the upper mantle mixed with water – forms continental rock (andesite, diorite), magma derived from remelted continental rock to form very light, silica-rich continental rock (rhyolite, granite).

Origin of crustal rock as mantle magma – igneous rock. Weathering of igneous rock to sediments and ions – formation of sedimentary rock by deposition. Main types of sedimentary rock: detrital (conglomerate, sandstone, mudstone), carbonate (limestone, dolostone), evaporite (rock salt, rock gypsum), and organic (coal). Fossils are preserved in sedimentary rock.

Burial of sedimentary rock to form metamorphic rock. Foliated metamorphic rock (slate, phyllite, schist, gneiss) vs. nonfoliated metamorphic rock (marble, quartzite).

Paths through the rock cycle: uplift of metamorphic rock, weathering and erosion, deposition of sedimentary rock. Other paths through the rock cycle (e.g. melting of metamorphic rock to make magma and igneous rock.)

Mechanisms of uplift and subsidence – related to isostasy (lithosphere floating in equilibrium on the asthenosphere) – changes in density of the crust (heating / cooling), changes in thickness of the crust (plate collisions – thicken crust, erosion – thins crust). Erosion of mountain range from above causes rebound of rock in deep roots back toward the surface.

The Continental Drift Hypothesis:

Early Champions: Alfred Wegner, Alexander DuToit

Pangea, Laurasia / Gondwanaland

What were the lines of evidence advanced in support of continental drift?

Permian-age fossil and sedimentary rock distributions

Distribution of Permian-age glacial features

What were some of the reasons why continental drift failed to gain wide acceptance as a theory?

The Seafloor Spreading Hypothesis:

What new technologies made exploration of the deep ocean floor possible?

Sonar

Magnetometry

What features of the seafloor were discovered by these technologies?

Midocean ridges, trenches, aseismic ridges, seamounts, guyotes

What is seafloor spreading? How does it explain the features of the ocean floor?

Why was the seafloor spreading hypothesis not accepted by most geologists when it was first proposed?

What is remnant magnetism?

What is apparent polar wandering?

Why did the study of apparent polar wander paths convince many geologists that continents move?

What are magnetic reversals? How can magnetic reversals be used to date rock layers?

What are seafloor magnetic polarity stripes?

How were surveys of remnant magnetic polarity conducted over the ocean floor used to prove conclusively that seafloor spreading was real?

Plate Tectonic Theory

How does plate tectonic theory explain each of the following:

- Global distribution of earthquakes and depth distribution of earthquakes

- Global distribution of volcanoes

- Global distribution of seafloor age

Plate tectonic boundaries: convergent, divergent, transform

Examples of modern plate tectonic boundaries:

Ocean-ocean convergent – western Pacific rim, eastern Caribbean, Aleutian Islands

- Earthquakes (shallow, intermediate, deep), stratovolcanoes, island arcs

Ocean-continent convergent - west coast of South and Central America

- Earthquakes (shallow, intermediate, deep), stratovolcanoes, high mountain range

Continent-continent convergent – India-Asia, Africa-Europe

- Earthquakes (shallow), NO volcanoes, high mountain range

Divergent – mid-Atlantic ridge, east Pacific rise, Africa-Arabia

- Earthquakes (shallow), volcanoes, rift valleys

Transform – San Andreas fault system

- Earthquakes (shallow)

Hot spots and Aseismic ridges – Hawaiian Islands, Emperor Seamounts

Causes of plate motion – slab push, slab pull