Competitive Exams Volcanoes, Magma, And Volcanic Eruptions

Get video tutorials on geography @ Youtube Examrace Channel

Watch video lecture on YouTube: Watch YouTube video on vulcanicity and volcanoes Vulcanicity, Volcanoes

Find this video at: https://www.youtube.com/video/hLF0IPv7vUU?rel=0

Volcanoes, Magma, and Volcanic Eruptions

Volcanic eruptions are caused by magma

Types of Magma: Types of magma are mixture of liquid rock, crystals, and dissolved determined by chemical composition of the gas expelled onto the earths surface. magma.

How Magmas Form In The Earth

In order for magmas to form, Borne part of the earth must get hot enough to melt the rocks present. Under normal conditions, the geothermal gradient, which is bow the temperature in the earth changes with depth or pressure, is not high enough to melt rocks, and thus with the exception of the outer core, most of the earth is solid. Thus, magmas form only under special circumstances, and thus. volcanoes are only found on the earths surface in areas above where these special circumstances occur. As pressure increases in the earth, the melting temperature changes as well. For pure minerals, there are two general cases. If the mineral contains no water (H20) or carbon dioxide (C02) and there is no water or carbon dioxide present in the surroundings, then melting occurs at a single temperature at any given pressure and increases with increasing pressure or depth in the earth. This is called dry melting. If water or carbon dioxide are present within or surrounding the mineral, then melting takes place at a single temperature at any given pressure, but first decreases with increasing pressure. Since rocks are mixtures of minerals, they behave somewhat differently. Unlike minerals, rocks do not melt at a single temperature, but instead melt over a range of temperatures. Thus, it is possible to have partial melts, from which the liquid portion might be extracted to form magma. The two general cases are:

1. Melting of dry rocks is similar to melting of dry minerals, melting temperatures increase with increasing pressure, except there is a range of temperature over which there exists a partial melt. The degree of GSO - 800 -C High - High partial melting can range from 0 to 100%.
2. Melting of wet rocks is similar to melting of wet minerals, except there is range of temperature over which partial melting occurs. Again, the temperature of beginning of

melting first decreases with increasing pressure or depth, then at high pressure or depth the melting temperatures again begin to rise.

Volcanic Eruptions

In general, magmas that are generated deep within the Earth begin to rise because they are less dense than the surrounding solid rocks.

- As they rise they may encounter a depth or pressure where the dissolved gas no longer can be held in solution in the magma, and the gas begins to form a separate phase.
- When a gas bubble forms, it will also continue to grow in size as pressure is reduced and more of the gas comes alit of solution. In other words, the gas bubbles begin to expand.
- If the liquid part of the magma has a low viscosity, then the gas can expand relatively easily. When the magma reaches the earth's surface, the gas bubble will simply buried, the gas will easily expand to atmospheric pressure, and a non-explosive eruption will occur, usually as a lava flow (Lava is the name we give to a magma when it is on the surface of the earth).
- If the liquid part of the magma has a high viscosity, then the gas will not be able to expand very easily, and thus, pressure will build up inside of the gas bubble(s). When this magma reaches the surface, the gas bubbles will have a high pressure inside, which will cause them to burst explosively on reaching atmospheric pressure. This will cause an explosive volcanic eruption.

Non-Explosive Eruptions

Nonexplosive eruptions are favored by low gas content and low viscosity magmas (basaltic to andesitic magmas).

- If the viscosity is low, non-explosive eruptions usually begin with fire fountains due to release of dissolved gases.
- Lava flows are produced on the surface, and these run like liquids down slope, along the lowest areas they can find.
- Lava flows produced by eruptions under water are called pillow lavas.
- If the viscosity is high, but the gas content is low, then the lava will pile up over the vent to produce a lava dome or volcanic dome.

Explosive Eruptions

Explosive eruptions are favored by high gas content and high viscosity (andesitic to rhyolite magmas), Explosive bursting of bubbles will fragment the magma into clots of liquid that will cool as they fall through the air. These solid particles become pyroclasts (meaning - hot fragments) and tephra or volcanic ash, which refer to sandsized or smaller fragments.

- Blocks are angular fragments that were solid when ejected.
- Bombs have an aerodynamic shape indicating they were liquid when ejected.
- Bombs and lapilli that consist mostly of gas bubbles (vesicles) result in a low density highly vesicular rock fragment called pumice.

Tephra and Pyroclastic Rocks

Tuff Clouds of gas and tephra that rise above a volcano produce an eruption column that can rise up to 45 km into the atmosphere. Eventually the tephra in the eruption column will be picked up by the wind, carried for some distance, and then fall back to the surface as a tephra fall or ash fall. lf the eruption column collapses a pyroclastic flow will occur, wherein gas and tephra rush down the flanks of the volcano at high speed. This is the most dangerous type of volcanic eruption. The deposits that are produced are called ignimbrites if they contain pumice or pyroclastic flow deposits if they contain non-vesicular blocks. If the gas pressure inside the magma is directed outward instead of upward, a lateral blast can occur. When this occurs on the flanks of a lava dome, pyroclastic flows called a glowing avalanche or nuue ardentes (in French) can also result. Directed blasts often result from sudden exposure of the magma by a landslide or collapse of a lava dome.

Volcanic Hazards

- Ash Falls (tephra falls)
- Hot Ash Flows (pyroclastic flows)
- Mud flows: Lahars
- Volcanic Landslides (debris flows and debris avalanches)
- Lava Flows
- Volcanic Gases