Name

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Institutional Affiliations

Course

Date

1. **Describe the rock cycle; be sure to define each rock type (igneous, sedimentary and metamorphic) and briefly describe the processes that lead to the formation of each;**

key earths processes happen in processes, this key possess include water cycle, carbon cycle, nitrogen cycle and rock cycle. Rock cycle is a key each process and as the name suggests “Rock Cycle” rock cycle is considered an earth cycle that happen in a cycle because it involves a continuous process of transformation and interconversion of rocks through geological processes such as crystallization, sedimentation, erosion and metamorphism.

Therefore, rock cycle can be described as the conglomeration or web of the various geographical processes like erosion, sedimentation, metamorphism and crystallization that show how the three major types of rocks are form and breakdown under different conditions of heat and pressure over a long period of time.

**Igneous Rocks**:

Igneous rocks are formed when magma, which is the molten lava solidifies, this can solidify in any place ,this can be inside the earth’s crust, on the earth surface or at volcanoes but on its surface .after the rock cools and crystallize different types of igneous rocks can be formed, depending on the cooling conditions and the compositions inside the magma, is when the rocks formed after can be determined .for example magma from the same rock can form two different rocks after it solidifies depending on whether it cooled quickly or slower, as pf the case of rhyolite and granite, rhyolite being an extrusive igneous rock quickly than granite, giving It a glassy look

There are two types of igneous rocks, extrusive and intrusive igneous rocks.

*Extrusive igneous rocks*: this is formed form lava (which is magma that has submerged from underground). rocks formed in this process is cool almost instantly and they in turn provide a rock that has a glassy appearance as o the case of obsidian and rhyolite. Crystals inside the are small because they do not get enough tie to form because the rocks solidify so quickly. Crystals are usually so small almost invisible and one may need a microscope in order to see them.

*Intrusive igneous rocks:* these are the rock that are formed inside the earths crust and never reach the earth surface. They cool slowly ant heir crystals get enough time to form and so unlike the extrusive rocks they have huge crystals that are visible without the use of a microscope. They are also called plutonic rocks. A good example which well known is granite and pegmatite which usually around northern America

**Sedimentary Rocks**: of the three rocks sedimentary rocks are the ones formed closest the earth surface, an exception of the other rocks is extrusive igneous rocks which are actually formed on the earth surface. The sedimentary rocks are formed with the following Main processes: erosion, weathering, dissolution, precipitation and lithification (compaction and cementation). erosion and weathering involve the effects of wind and rain, they breakdown huge rock boulders even mountains into sand and sediments such as sand, quick sand, pebbles and even mud.in dissolution, water that is slightly acidic or just acidic enough to wear out rocks slowly wears out rocks into sediments providing the materials for sedimentation.

Precipitation and lithification on the other hand are responsible for building new rocks and minerals unlike erosion and dissolution that mainly breakdown rocks to boulders, pebbles and sand. Precipitation happens when rocks and minerals form from the chemicals and other dissolved substances precipitate from water. If for instance a lake or oasis dries up over a significantly long period of time, it leaves behind mineral deposits as of the case of Groom Lake in Nevada and California’s Death Valley.

When the sediments are compressed under intense pressure they compact and cement together forming new types of rocks called sedimentary rocks

**Metamorphic Rocks:** the term metamorphic comes from the word metamorphosis and this simply means the change of one thing from one state to another, the common and most well-known representation of metamorphosis is a caterpillar changing from egg to larva all the way up to a full blown butterfly, so when the other two types of rocks or any other type of rocks turns from its original form to form another new type of rock under some conditions such as pressure and heat then they form metamorphic rocks. They are one of the oldest rocks, some being believed to be up to 3 billion years old

Unlike the other two, sedimentary and igneous rocks which were formed from sediments and magma respectively, metamorphic rocks are formed from already existing rocks, the rocks just change from one type to another with the help of certain specific conditions like exposure to high heat, high pressure or hot mineral-rich fluids. These conditions are usually met inside the earths crush or where tectonic plate meet, there should be too much heat or pressure otherwise the rock will melt and therefore no formation of metamorphic rock will be formed because then rocks are required in solid state in order to form metamorphic rocks. Just like when granite which is an intrusive igneous rock, when subjected to intense heat and pressure the minerals inside it which are mica, quartz felspar change to form the metamorphic rock gneiss

1. **Igneous rocks are classified based on their TEXTURE and COMPOSITION. Define texture and composition**

***Texture:***

Texture in simple terms means the feel, appearance, or consistency of a surface or substance. When looking at the igneous rocks we look at the appearance which is usually size, shape and arrangement and the feel which is whether the surface is course or smooth or glassy, so therefore Texture refers to the size, shape, and arrangement of the mineral grains or crystals within an igneous rock. It provides information about the cooling history and rate of the molten rock (magma or lava) from which the rock formed.

 ***Composition:***

Composition refers to the nature of something's ingredients or constituents, the way in which a whole or mixture is made up. Therefore, in order to classify igneous rocks, there is need to look at the individual constituents and then put them in similar groups. therefor composition refers to the overall chemical makeup of a which may be the chemical properties igneous rock, specifically the types and proportions of minerals present. It depends on the original composition of the magma or lava from which the rock formed.

1. **Define the following igneous rock textures: aphanitic, porphyritic, vesicular, glassy and** **pegmatitic.**

**Aphanitic:** Aphanitic texture refers to a fine-grained texture in igneous rocks (mostly extrusive igneous rocks) where individual mineral grains are too small to be individually visible to the unaided eye. This texture indicates rapid cooling of lava on the Earth's surface, which leads to quick crystal formation. The small mineral grains in aphanitic rocks are typically not distinguishable without the use of a microscope, even the hand lens sometimes cannot be useful when looking at the crystals, when preparing it use of thin sections and a polarizing petrological microscope, which simply means they are Microcrystalline. Examples of aphanitic igneous rocks include basalt and rhyolite.

**Porphyritic**: this is the type of texture that doesn’t have any specific rock, it can be in all of them, both the intrusive and extrusive igneous rocks. Porphyritic texture refers to a mixed texture in igneous rocks that consists of larger mineral grains (phenocrysts) embedded within a finer-grained matrix (groundmass). Since we already know that large crystals are formed from slow cooling and small ones from rapid cooling, then the texture surely tells us that both of them must have happen in order for the texture to have come to existence. This would mean that the cooling would have to have had two stages, the first one being slow and deep inside the crust that would form the large crystals called phenocrysts and a second stage that would involve rapid cooling that forms the finer matrix or groundmass. Porphyritic rocks can exhibit a range of compositions and are commonly found in volcanic or plutonic environments. Examples of rocks with this texture are like andesite granite porphyry.

**Vesicular:** the name vesicular comes from the word vesicles which means small cavities on volcanic rocks produced by gas bubbles. Vesicular texture refers to a texture in igneous rocks that is characterized by the presence of numerous small cavities or vesicles within the rock and on the surface. this process as magma rises to the surface while it reduces its pressure. When this happens gasses dissolve inside the magma and form solutions making it possible for them to create gas bubbles that are responsible for the cavities Inside the rock. When the magma cools the gas gets trapped inside and is responsible for the cavities that form the vesicular texture. Some of the rocks that exhibit this texture are pumice and scoria

**Glassy:** glassy texture is the texture that look like a block of glass, usually like a colored glass with no visible mineral crystals in it. The main compound behind this is silica simply because, when a glass texture is obtained, it simply suggests that the lava cooled so fast, fast enough not to allow any crystals to be formed and that the lava floor had high concentration of silica (SiO2) which is usually found in felsic rocks like rhyolite composition that in some cases end up forming readily made glass. The most common form of rock with this texture is Obsidian.

**Pegmatitic:** these are rock textures that have a course texture which is usually caused by the presence of mineral grains and very large crystals that can go up to 3 cm long. This texture is mainly found in intrusive rocks. Someone may be under the assumption that the extra-large crystals are formed by the extra slow cooling if the magma, this is not the case, instead it caused by dissolved water which allows elements to diffuse extra fast in the area of crystallization. Due to this most rocks with pegmatitic rocks form veins that open up at the end of crystallization, they end up forming rocks like pumice and obsidian

1. **List the common igneous rock-forming minerals (there are eight or nine) and give their formulas**.
* Quartz: SiO2
* Feldspar (Orthoclase, Plagioclase):
* Orthoclase Feldspar: KAlSi3O8
* Plagioclase Feldspar: (NaAlSi3O8 - CaAl2Si2O8)
* Mica (Biotite, Muscovite):
* Biotite: K (Fe, Mg)3AlSi3O10(OH)2
* Muscovite: KAl2(AlSi3O10) (OH)2
* Amphibole (Hornblende): Ca2(Mg, Fe)4Al (Si7Al) O22(OH)2
* Pyroxene (Augite): (Ca, Na) (Mg, Fe, Al) (Al, Si)2O6
* Olivine: (Mg, Fe)2SiO4
* Plagioclase feldspar: (NaAlSi3O8 - CaAl2Si2O8)
* Magnetite: Fe3O4
1. **Define ULTRAMAFIC, MAFIC, INTERMEDIATE, and FELSIC**

**Ultramafic**: the term Ultramafic is used to define rocks that have more of mafic minerals more than other minerals, mafic minerals are Olivine and pyroxene, they contain very low amounts of silica and are usually dark colored which clearly indicates presence of magnesium and iron in relatively high proportions other than just the olivine and pyroxene. The iron and magnesium are not usually as high as the olivine and pyroxene. The contents of silica are usually below 45%

**Mafic**: the term mafic is a blend of two words, the words are magnesium and ferric (which is a Latin word for iron). So essentially rocks that have contents of magnesium and iron are called mafic rocks. Mafic can also be used to refer to dark colored rocks that have olivine and pyroxene which are also commonly referred to as mafic minerals. Contains the silica levels of around 45%-52%

**Intermediate:** another word for sublevel or rather moderate. Refers to chemical compositions that are intermediate between felsic ad mafic compositions which simply means that has both the silicate minerals from the felsic composition and the magnesium and iron from the mafic compositions but both of them in intermediate proportions not having too much of either.

**Felsic**: felsic is used to describe rocks with high silica content, they are like the absolute opposite of ultramafic. Also, unlike mafic they have light colors this is due to the fact that they have light elements such as silicon, oxygen and potassium. There silicate levels

1. **For each of the following igneous rocks state if it is extrusive or intrusive and whether it is ultramafic, mafic, intermediate, or felsic. Peridotite Basalt Gabbro Andesite Diorite Rhyolite Granite**

**Peridotite:** Peridotite is an intrusive igneous rock which makes it have a course surface. It has silicate minerals, such as olivine and pyroxene, which makes it ultramafic. In conclusion peridotite is intrusive and ultramafic

**Basalt:** Basalt is an extrusive igneous rock, formed on the surface of the earth. It is mafic in composition, because it’s usually formed from low viscous lava. This makes vasal both mafic and extrusive

**Gabbro:** formed from the slow cooling of magnesium rich send iron rich magma.its formed from Maga, which makes it intrusive and the magnesium and iron making it mafic. Gabbro is a mafic intrusive rock

**Andesite:** Andesite can be both extrusive and intrusive, depending on its formation. It is an intermediate igneous rock with a composition between mafic and felsic. Extrusive andesite forms from volcanic eruptions, while intrusive andesite forms through the slow cooling of magma beneath the surface. This makes andesite both intrusive and extrusive and intermediate since it can have a sublevel amount of mafic and felsic compositions

**Diorite:** Diorite is an intrusive igneous rock forms inside the earths crust. It is intermediate in composition because it has moderate levels of silica and high levels of alkali metals. Diorite is therefore intermediate and intrusive.

**Rhyolite:** Rhyolite is an extrusive igneous rock. It is felsic in composition because it is the richest in silica of all the volcanic rocks. Rhyolite forms from the rapid cooling of lava on the Earth's surface, often associated with explosive volcanic activity. this makes it an extrusive felsic rock

**Granite**: granite is formed from magma that is has content of silica which makes it an intrusive (because of the magma) and felsic (because of the silica content).

1. **List and define the three types of volcanos**

The three main types of volcanoes are shield volcanoes, stratovolcanoes (composite volcanoes), and cinder cone volcanoes.

 ***Shield volcanoes****:*

shield volcanoes just as the name suggests are the type of volcanoes that have a low profile and resemble a warriors shield that has been placed on a flat surface. This shape is made possible by less viscous lava which as compared to viscous lava travels farther and forms thinner layers. Through continuous eruption of the volcanoes layers of molten lava slowly accumulate and form a shield like doom that is called a shield volcano

most volcanoes are exclusively basalt, this type of lava is usually very fluid and its for that same reason why most shield mountains are not steep, this is because you can’t pile up a fluid that easily runs downhill

 ***Composite volcanos***

They are named after the word composite which means something made up from several elements. Composite mountains are actually made up of several element, they are cone like mountains thousands of feet tall that mainly compose of several components such as lava flows, pyroclastic, mudflows and lava domes.

They are usually active over a long periods of time ad this is what they are usually very tall with a cone like shape because they erupt periodically.

Composite volcanos are also called stratovolcano and hey sometimes experience explosive eruptions that lead to formation of features like calderas that form on collapsed summit craters.

The lava from stratovolcanoes usually cools and hardens before spreading because of its high viscosity and this leads to the accumulation of layers of layers around the same point which is actually the point of eruption and this leads to them pilin up high enough to form composite volcanoes. They form most common mountains and also among the highest ones too.

 ***Cinder cones volcanos:***

Cinder corn mountains are formed from cinder, which is the pyroclastic fragments such as the volcanic ashes, solidified lava pieces, volcanic clinkers, pumice and hot gases. The cinder volcanoes are known as the simplest forms of volcanoes simply because they are formed around the volcanic vent by the gas charged lava that is blown into the air by a great force.

The blown-up gas charged lava breaks into small pieces and then accumulates around the vent which later solidifies and forms an oval shaped or circular shaped corn which has a bowl-shaped crater, they grow rapidly and can even reach up to 900 feet. Ash cones are found along the flanks of shield volcanoes, and this is because of the reason, for the formation of cinder cone volcanoes are the massive eruptions of mafic rock fragments and lava. Most of the cinder cones erupt only once and may form as flank vents on larger volcanoes or occur on their own.and the flank vents not being the main vents have less guarantee of ever erupting again