FIELD: EARTH SCIENCE -GEOLOGY

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

The rock cycle is a continuous geological process that transforms rocks from one type to another over millions of years. It involves three main types of rocks: igneous, sedimentary, and metamorphic.

a. Igneous Rocks:

- These rocks form from the cooling and solidification of molten rock, known as magma or lava. As magma cools and solidifies beneath the Earth's surface, it creates intrusive igneous rocks (e.g., granite). When lava cools rapidly on the Earth's surface, it forms extrusive igneous rocks (e.g., basalt).

b. Sedimentary Rocks:

- Sedimentary rocks result from the accumulation and compaction of sediments, such as sand, clay, and organic matter, over time. These sediments can be transported by wind, water, or ice and eventually become compressed into rock. Examples include limestone, sandstone, and shale.

c. Metamorphic Rocks:

- Metamorphic rocks are formed from pre-existing rocks (igneous, sedimentary, or other metamorphic rocks) that undergo high heat and pressure deep within the Earth's crust. This causes them to recrystallize and change their mineral composition and texture. Common examples include marble (from limestone) and schist (from shale).

The rock cycle involves the continuous transformation of rocks between these three types through various geological processes, including melting, cooling, erosion, sedimentation, burial, heat, and pressure. These processes are driven by geological forces and take place over millions of years, shaping the Earth's surface and creating a diverse array of rock formations.

2. Igneous rocks are classified based on their texture and composition . Define TEXTURE AND COMPOSITION.

Texture:

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 conditions of the rock.

Composition:

Composition refers to the mineral makeup of an igneous rock. It is determined by the types and proportions of minerals present.

3.Define the following igneous rock textures : aphanitic ,phaneritic ,porphyritic ,vesicular glassy and pegmatitic.

a. Aphanitic Texture:

- Aphanitic texture refers to the fine-grained nature of an igneous rock in which the mineral crystals are too small to be seen with the naked eye. These tiny mineral grains require a magnifying glass or microscope to be observed. Aphanitic rocks typically form when molten lava cools rapidly on the Earth's surface or in shallow subsurface environments.

b. Phaneritic Texture:

Phaneritic texture describes an igneous rock with coarse-grained mineral crystals that are large enough to be visible without the aid of magnification. This texture is typically observed in intrusive rocks that cool slowly beneath the Earth's surface, allowing sufficient time for larger crystals to grow.

c . Porphyritic Texture:

Porphyritic texture is characterized by the presence of both large, well-formed crystals (phenocrysts) and smaller, fine-grained crystals (groundmass) within the same rock. This texture suggests a two-stage cooling process. The larger crystals form in an earlier stage when the magma cools slowly beneath the surface, while the groundmass crystallizes rapidly on the surface.

d. Vesicular Texture:

Vesicular texture- is defined by the presence of numerous small cavities or vesicles within an igneous rock. These cavities are the result of gas bubbles, often dissolved gases like water vapor and carbon dioxide, becoming trapped in the rock during solidification. Vesicular rocks are typically associated with volcanic eruptions and rapid cooling of lava.

e. Glassy Texture:

Glassy texture is characterized by the complete absence of visible mineral crystals within an igneous rock. Instead, the rock appears glassy and smooth. This texture occurs when molten lava cools extremely quickly on the Earth's surface, preventing mineral crystals from forming.

f. Pegmatitic Texture:

Pegmatitic texture refers to igneous rocks with exceptionally large mineral crystals, often ranging from several centimeters to meters in size. These rocks form in the late stages of crystallization from highly enriched, water-rich magmas that allow for the growth of these oversized crystals.

4.List the common igneous rock forming minerals(there are eight or nine ) give their formulas;

Common igneous rock-forming minerals include:

* Quartz (SiO2): Silica or silicon dioxide
* Feldspar (Orthoclase, KAlSi3O8): Potassium aluminum silicate
* Plagioclase Feldspar (Albite, NaAlSi3O8 to Anorthite, CaAl2Si2O8): A group of sodium-calcium aluminum silicates
* Mica (Muscovite, KAl2(AlSi3O10)(OH)2 or Biotite, K(Fe,Mg)3(AlSi3O10)(OH)2): Potassium-rich aluminum or iron/magnesium aluminum silicate
* Amphibole (Hornblende, Ca2(Mg,Fe)4(Al,Fe,Ti)3(Si4O11)2(OH)2): Calcium iron/magnesium aluminum silicate
* Pyroxene (Augite, (Ca,Na)(Mg,Fe,Al)(Al,Si)2O6): Calcium sodium iron/magnesium aluminum silicate
* Olivine ((Mg,Fe)2SiO4): Magnesium iron silicate
* Biotite (K(Fe,Mg)3(AlSi3O10)(OH)2): Potassium iron/magnesium aluminum silicate
* Hornblende (Ca2(Mg,Fe)4(Al,Fe,Ti)3(Si4O11)2(OH)2): Calcium iron/magnesium aluminum silicate (part of the amphibole group)

5. Define ULTRAMAFIC,MAFIC,INTERMEDIATE and FELSIC;

In Earth science and geology, these terms refer to different categories of igneous rocks based on their mineral composition and silica content:

1. Ultramafic:

Ultramafic rocks are a category of igneous rocks with the lowest silica content (less than 45%) and the highest percentage of iron and magnesium minerals. They are typically rich in minerals like olivine and pyroxenes. Ultramafic rocks are associated with mantle-derived magmas and are commonly found in areas where tectonic plates are converging or in oceanic crust.

1. Mafic:

Mafic rocks have a moderate silica content, ranging from 45% to 52%. They are rich in iron and magnesium minerals and often contain minerals like plagioclase feldspar, pyroxenes, and olivine. Basalt, a common mafic rock, is often associated with volcanic activity and oceanic crust.

c. Intermediate:

Intermediate rocks fall between mafic and felsic in terms of silica content, typically ranging from 52% to 65%. They contain a mix of minerals from both the mafic and felsic categories. Diorite is an example of an intermediate rock and is commonly found in continental crust.

d. Felsic:

Felsic rocks have the highest silica content, exceeding 65%. They are rich in minerals like quartz, feldspar, and muscovite mica. Granite is a well-known felsic rock and is commonly found in continental crust. Felsic rocks are associated with volcanic activity in continental settings.

6. For each of the following igneous rocks, state if it's extrusive or intrusive and whether it's Ultramafic ,mafic intermediate or felsic: Peridotite ,Basalt, Gabbro, Andesite, Diorite ,Rhyolite and Granite;

a. Peridotite:

-Intrusive: Peridotite is an intrusive ultramafic rock. It is typically found in the Earth's mantle and is not commonly exposed on the Earth's surface.

b. Basalt:

-Extrusive: Basalt is an extrusive mafic rock. It is often associated with volcanic eruptions and is found in oceanic crust.

c. Gabbro:

- Intrusive: Gabbro is an intrusive mafic rock. It is the coarse-grained equivalent of basalt and forms beneath the Earth's surface.

d. Andesite:

- Extrusive: Andesite is an extrusive intermediate rock. It is commonly found in volcanic regions associated with subduction zones.

e. Diorite:

- Intrusive: Diorite is an intrusive intermediate rock. It forms beneath the Earth's surface and has a coarse-grained texture.

f. Rhyolite:

- Extrusive: Rhyolite is an extrusive felsic rock. It is often associated with volcanic eruptions in continental settings and has a fine-grained texture.

g. Granite:

- Intrusive: Granite is an intrusive felsic rock. It forms beneath the Earth's surface and has a coarse-grained texture. Granite is a common rock in continental crust.

7.List and briefly describe the three types of volcanoes:

Volcanoes come in various shapes and sizes, but they can generally be categorized into three main types based on their characteristics and eruptions:

1. Shield Volcanoes:

Shield volcanoes are the largest and broadest type of volcano with gently sloping sides. They are named after their resemblance to a warrior's shield. These volcanoes are primarily built up by the flow of low-viscosity basaltic lava, which can travel long distances from the vent . Shield volcanoes are known for relatively non-explosive eruptions. They often produce lava fountains and lava flows that can spread over large areas. The lava emitted is typically hot and runny, allowing it to flow easily.

1. Stratovolcanoes (Composite Volcanoes):

Stratovolcanoes are tall and steep-sided volcanoes characterized by layers of different volcanic materials, including ash, lava, and volcanic rocks. These layers are the result of repeated eruptions over time. Stratovolcanoes are known for both explosive and effusive eruptions. They can produce a variety of volcanic hazards, including pyroclastic flows, ash clouds, and lava flows. Stratovolcanoes often have a central vent and may be associated with a crater or caldera at the summit.

c. Cinder Cone Volcanoes:

Cinder cone volcanoes are the smallest type and have steep, conical shapes. They are typically composed of volcanic cinders, ash, and volcanic rocks ejected during eruptions. Cinder cone volcanoes are often associated with short-lived, explosive eruptions. They tend to produce pyroclastic materials that accumulate around the vent, creating the characteristic cone shape. These eruptions can be relatively small in scale compared to stratovolcanoes.