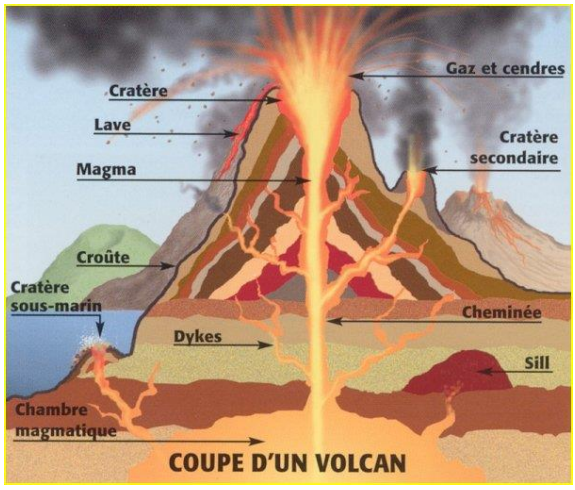
Chapter 4 :

1/ Volcanic landforms:

Volcanic landforms are the products of a rapid succession of phases of construction and destruction. The volcano is a relief of generally conical shape constituted by magmatic materials coming from the depths of the earth through eruption, it is an opening connecting the surface of the globe with the depths. The volcano is a mountain which results from the accumulation of lava around an emission point called a chimney. In a fractured base or a folded mountain range, there is the outpouring of eruptive rocks which have built reliefs with complex shapes.



2/ Igneous rocks, eruptive rock

magmatic or crystalline petrology (eruptive rock), it begins with the genesis of a magma (liquid produced from the fusion of rocks), and continues with the progressive crystallization of the magma with a chemical transformation depending on the SiO2 content, which produces rocks by solidification.

Igneous rocks make up about 95% of the upper crust of the Earth, but are hidden by extensive layers of sedimentary and metamorphic rocks.

<u>Groups of igneous rocks:</u>

Supersaturated rocks (hypersiliceous or acidic) SiO2 >65%

Saturated rocks (intermediate) 65>SiO2>52%

Undersaturated (basic) rocks 52> SiO_2>45%

Ultrabasic rocks (hyposiliceous) SiO_2<45%

The alkalinity of eruptive rocks by retaining the alkaline contents (Na_2O and K_2O) and other MgO contents. And classified on the one hand according to the geometric arrangement of the crystals, we call structure (geometric assembly of minerals).

Depending on their depth of solidification and the resulting structural characteristics, igneous rocks can be divided petrographically into two groups:

A/ intrusive igneous rocks

plutonites come from the solidification of magma deep within the earth, if cooling occurs slowly under the earth's surface with very slow crystallization, in the form of automorphic or xenomorphic crystals. large crystalline rocks called plutonic or intrusive rocks form with a grainy structure (visible to the naked eye, well-shaped crystals of the same size).

they can only be observed on the surface when erosion has already sufficiently stripped away or tectonic movements have raised the massifs.

B/ extrusive igneous rocks

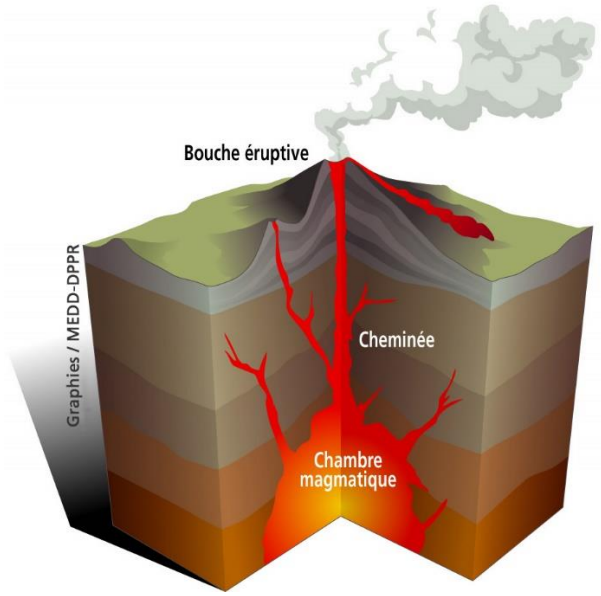
volcanic rocks (effusion rocks) effusive or extrusive, come from magma which penetrated from the interior of the surface of the earth like lava escaped from the surface of the earth and solidified there, the structure where only a few crystals can be visible to the naked eye.

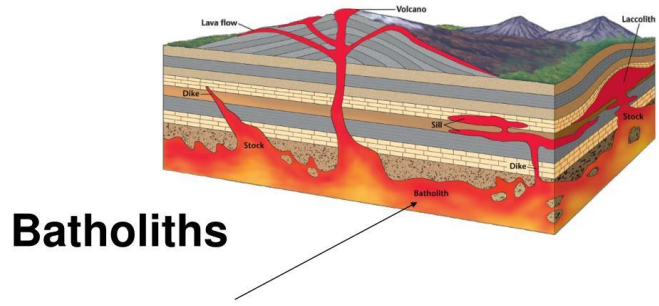
they characterize flowed or explosion rocks, they consolidate on the surface following rapid cooling, and vein rocks, automorphic centimetric crystals intersecting the structures of the surrounding country and most often corresponding to the backfilling of a fracture (joint or fault). It is the micrograined structure (very small crystal size) to micrilitic (small elongated crystals) and sometimes vitreous structure.

1/ Batholithes

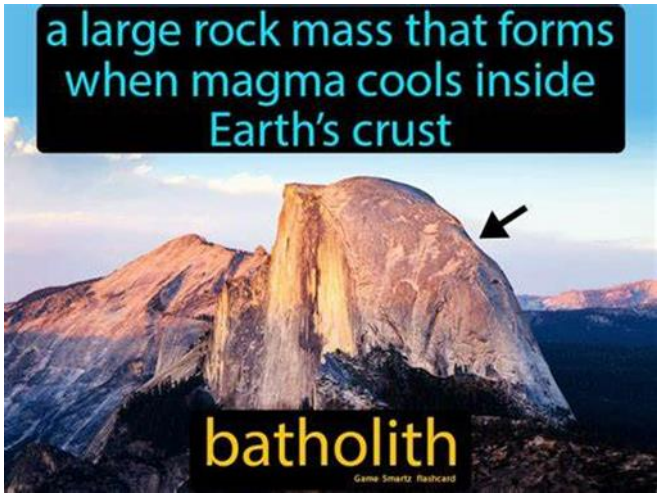
The term batholith (from the Greek bathus, deep and lithos, rock) also called intrusive or discordant massif designates a mass of magmatic plutonic rocks from a few km to more than 100 km.

A batholith is an allochthonous pluton that forms when magma is trapped and cools inside the Earth's crust. it is frequently bordered by a zone of contact metamorphism giving a halo of metamorphism and is accompanied on the surface by explosive volcanism.





batholiths are generally made up of felsic rocks or intermediate rocks such as granite, quartz mozonite or diorite. when they are still moving, we will call them plutonic diapirs. Erosion of batholiths by the process of exfoliation.



2/ plutons

Is a crystalline massif formed of plutonic rocks, constituting a large ovoid mass or a large lens (laccolite, lopolite) the plutons therefore only appear on the surface following processes of erosion and isostatic reequilibration. Two main types of plutonic rocks are represented: granites and gabbros. Allochthonous plutons or extravases, These are generally the types of plutons that we encounter at the outcrops. These magmatic intrusions are located in the roots of eroded mountain ranges, in the metamorphic zone.

The mechanism that governs the formation of a magmatic liquid is the partial melting of a source. (for acidic granite the magma is crustal and for alkaline granite is calc alkaline)

The influence of density plays the role of an elevator; if it disappears before reaching the surface, the magma will be blocked at depth and will cool slowly to form a pluton.

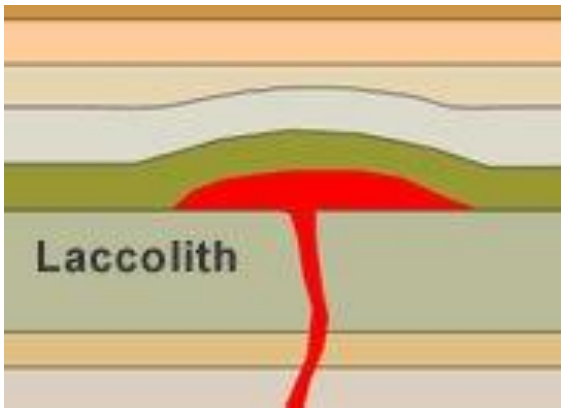
Influence of viscosity the major factor in trapping at depth. viscosity increases with silica and alkaline content.

Influence of temperature, any state of matter is changing phase. a liquid will therefore remain liquid as long as the intrinsic temperature of the matter remains above the liquidus. The magmas can therefore remain trapped at depth and if the temperature of the magma goes below the liquidus, it will begin to crystallize in place and form a pluton.

Influence of water, a magma in these conditions will crystallize at a higher temperature in the absence of water than with it. Water also plays a major role in trapping magmas at depth, through its effect on the solidus.

3/ laccolith

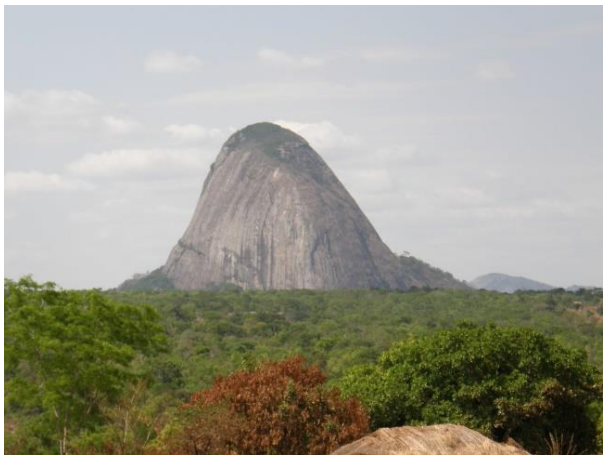
The towers at an altitude of nearly 3000 m form a crown of sharp mineral teeth, coming from a volcanic uprising under the sedimentary layer in the Miocene, then sculpted by glacial erosion. A laccolith is an intrusion of magmatic rocks which is placed parallel to the surrounding area by deforming the upper layer.



They are often large, sometimes several tens of kilometers in diameter, these intrusions then form species of blades insinuating themselves into their surroundings.

4/ Monadnocks

Called inselbergs, are isolated rocky hills located in a flat plain. These are often the result of softer sedimentary rocks eroded around a hard intrusive igneous body.



Extrusive igneous rocks

1/ Ash cones:

A scoria cone, or ash cone, is a volcanic edifice of conical shape, formed by the stacking of ejecta (fragments of magmatic rocks ejected by a volcanic eruption) in these ejecta the proportion of scoria and ash is variable , but slag is the majority. scoria cones are monogenic volcanoes or formed by a small series of eruptions.

Cônes de scories "standards" sur le Mauna Kea (Hawaï)

2/ A shield volcano

Is a volcano characterized by effusive eruptions producing fluid lava flows. Its relatively flat cone shape evokes that of a shield placed on the ground. It has at its summit, a large volcanic crater

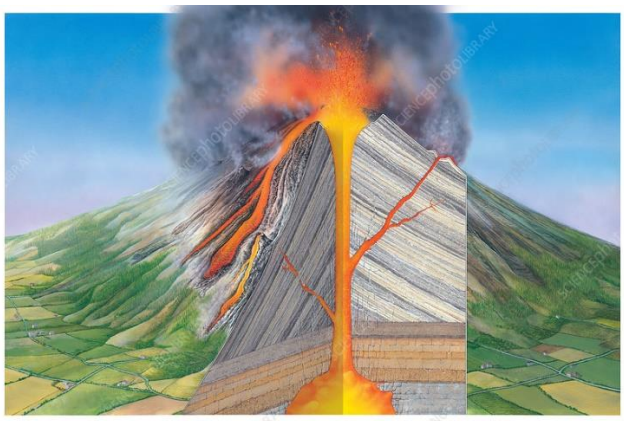
The largest shield volcano on earth is an underwater volcano, the massive dormant volcano known as Tamu measures 3.5 km in height, summit about 2000m below the surface of the ocean.

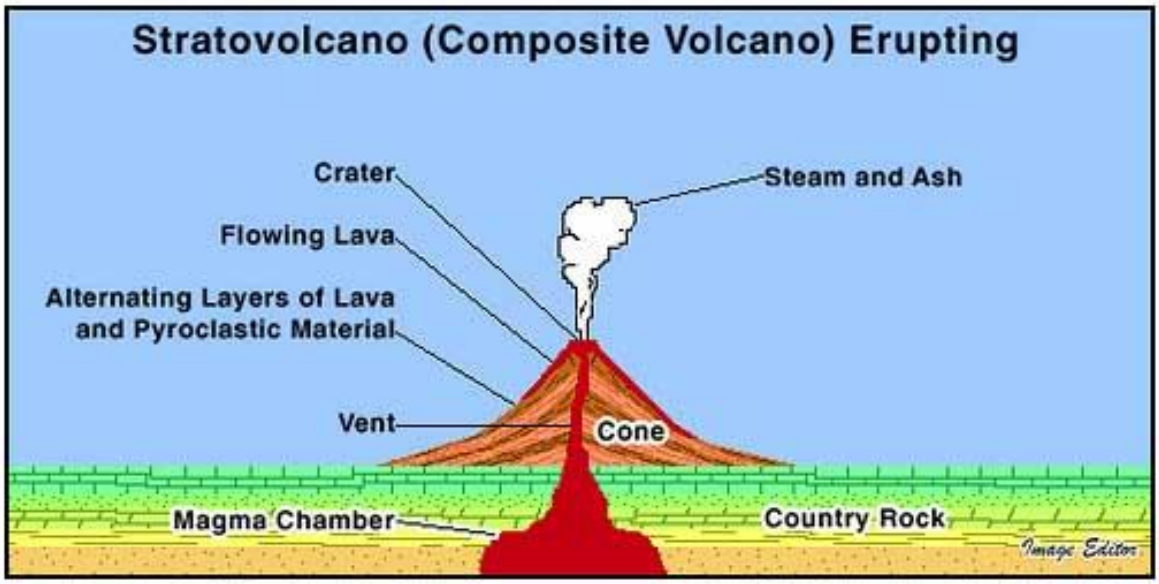

Exemples de volcans boucliers : Galapagos, La Réunion, Islande, Sicile, Tahiti

3/ A stratovolcano or composite volcano

Is a volcano made up of numerous layers (strata) of hardened lava and tephras, unlike shield volcanoes. stratovolcanoes are characterized by a conical shape and a steep profile and a crater. These volcanic edifices were constituted by a succession of explosive eruptions and effusive eruptions. Volcanic products are generally felsic, rich in silica (very viscous) which means that they cool and harden before being able to respond far, have traveled up to 15km with steep slopes of the flanks.

Stratovolcanoes are common in subduction zones, forming chains and clusters along plate tectonic boundaries where oceanic crust is pulled beneath the continental crust or another oceanic plate, they are also found in the interior of subduction zones. a tectonic plate.





4/ a caldriera or caldera

Is a vast circular or elliptical depression, generally of kilometric order, often with a flat bottom, located at the heart of certain large volcanic edifices and resulting from an eruption which empties the magma chamber underlying the roof of the magma chamber and falls into the bedroom. This cauldron-shaped depression is limited by a circular or elliptical vertical cliff; the ring-shaped cliff or fault can reach several hundred meters in height

the size of calderas can vary by a few kilometers in diameter. Many calderas fill with water by tapping rivers or collecting rainwater and thus form lakes like Crater Lake (United States) or Askja (Iceland).

5/ A lava dome

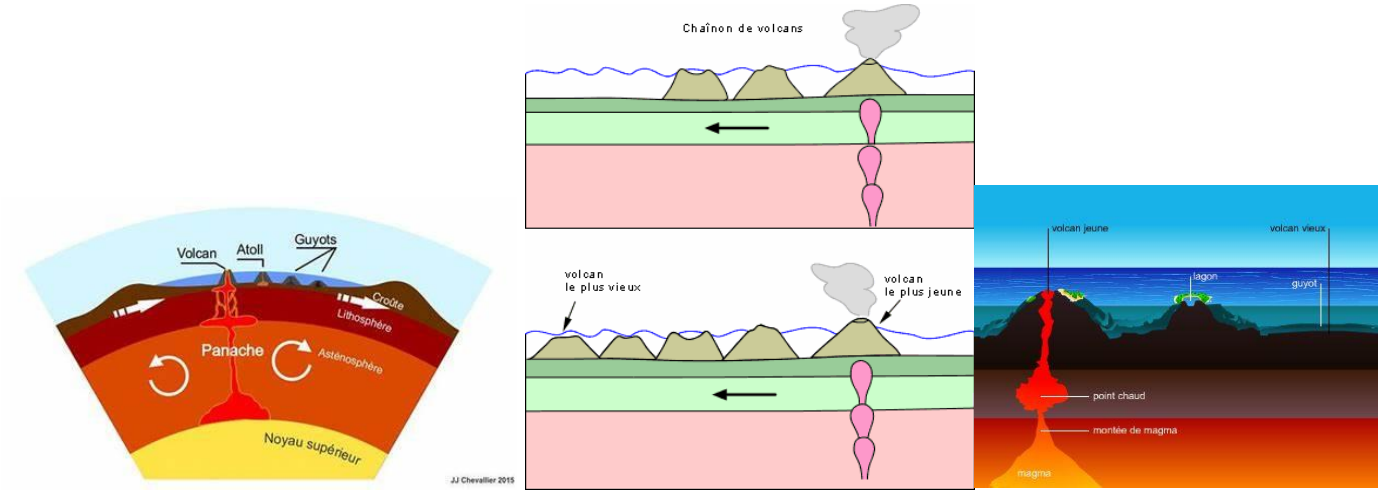
Is a volcanic structure composed of a mass of lava whose high viscosity prevents it from flowing down the sides of a volcano, thus obstructing the lava exit point.

A lava dome forms when silica-rich lava emitted by a volcano fails to flow or flows insufficiently. it then accumulates at the top of the volcanic chimney and forms a mass measuring from a few meters to several hundred meters in height, it can explode when the pressure becomes too strong, an explosive eruption follows which can produce a volcanic plume.

6/ A hot spot

A region on the surface whose intense volcanic activity is due to warm mountain rises called plumes, Within the Earth, certain areas of the mantle that are warm and less dense are at the origin of an upwelling of rocks under the effect of the Archimedean thrust, resulting in the formation of a mantle diapir which rises in the form of a plume.

The displacement of tectonic plates relative to mantle upwelling is at the origin of volcanic alignments on the Earth's surface. the accumulation of materials reintroduced into the material as a result of subduction, and potentially enriched with radioactive elements.



Hotspot volcanism is caused by magmatism that has broken through the lithosphere to its upper part of the Earth's crust. Hotspots are suspected of being involved in the phenomenon of active rifting.

7/ Flood basalt

Or basalt trap is the result of a giant volcanic eruption or a series of eruptions that cover large tracts of land or ocean floor, Flood basalts covered areas as vast as a continent, creating large plateaus and mountain ranges, One explanation for flood basalts is that they are caused by the combination of continental rifting and associated melting, then a mantle plume produces large amounts of low viscosity basaltic magma.

Flood basalts begin at a depth of between 100 and 400 km in the asthenosphere. A flood basalt is the result of a giant volcanic eruption or series of eruptions that cover large swaths of the Earth and the ocean floor. These have a very low viscosity, which is why they flood rather than form higher volcanoes.