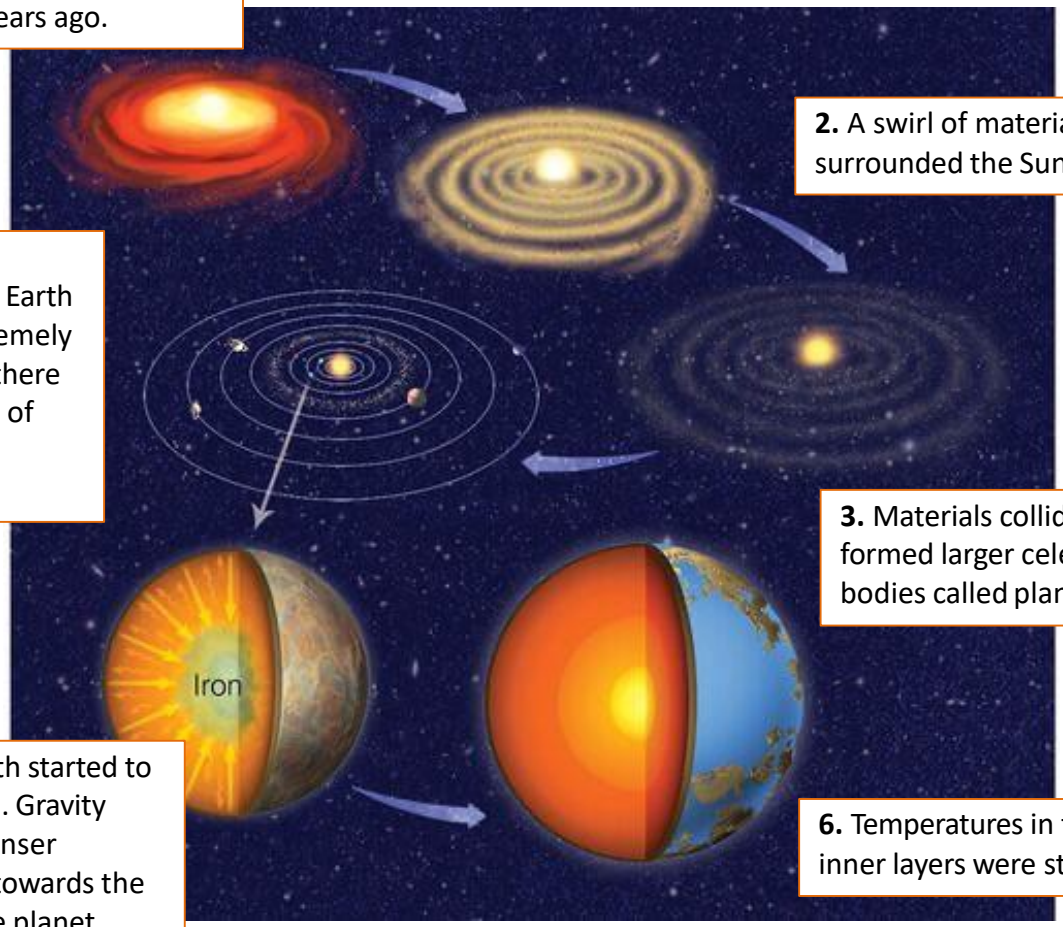
THE GEOSPHERE

Biology and Geology 1º ESO

The origin of the Earth

The Earth is the third planet from the Sun. It's the only planet in our Solar System with water in three states. The Earth is also the only planet where there is life.

1. The sun formed 4600 million years ago.



2. A swirl of materials surrounded the Sun

3. Materials collided and formed larger celestial bodies called planetesimals

4. Our primitive Earth was extremely hot and there was a lot of volcanic activity

5. The Earth started to cool down. Gravity pushed denser materials towards the core of the planet

6. Temperatures in the Earth's inner layers were still very high

Accretion of planetesimals

Our planet has four yares:

1. The **atmosphere**, which is the gaseous layer.
2. The **hydrosphere**, which contains water in three states.
3. The **geosphere**, which is the solid layer.
4. The **biosphere**, where life exists.

Density differentiation

Layers of the geosphere

The geosphere has three distinct layers: the crust, the mantle and the core.
Areas called discontinuities separate each layer.

The **crust** is the thin layer which covers the Surface of the Earth. This is the least dense layer:

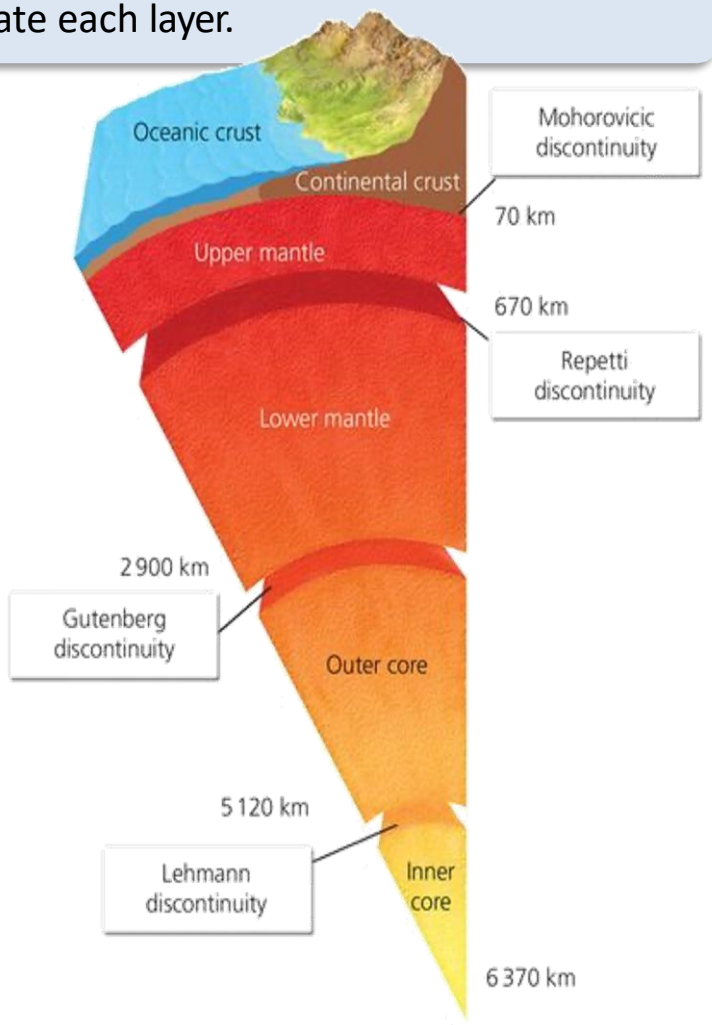
- Continental crust: 10-70Km thick: slate, clay and granite.
- Oceanic crust: basalt.

The **mantle** is made of peridotite.

- Upper mantle
- Lower mantle

The **core** is the inner and densest part of our planet. It's mostly made of iron and nickel.

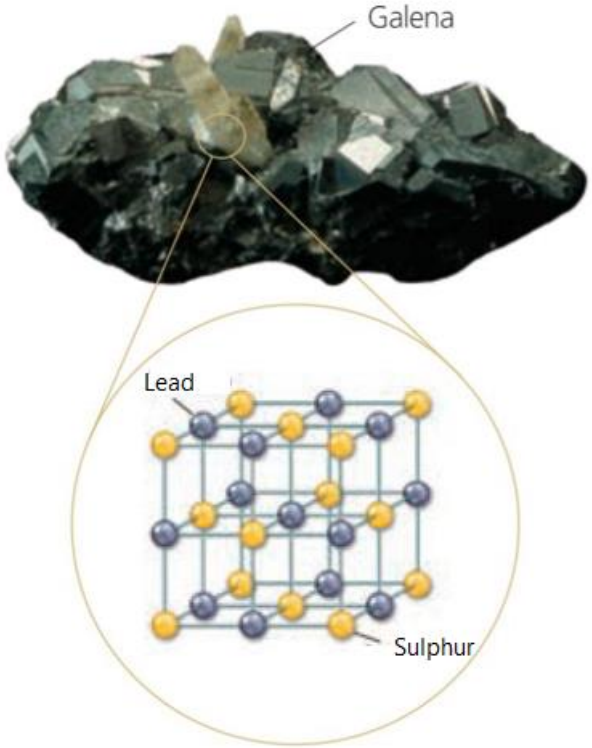
- Outer core
- Inner core



MINERALS

Rocks and minerals form part of the Earth´s crust. Minerals have some characteristics:

- Solid substances.
- Inorganic.
- Natural.
- Definite chemical composition.
- Crystalline structure.



Physical properties of minerals. Optical properties

Relate to how a mineral reacts to light.

Habit

- Some minerals have very characteristics shapes that reflect their crystalline structures.

Colour

- Characteristic colour.

Streak

- The colour of the powder produced when a mineral is scratched.

Lustre

- Describes how the mineral reflects light.

Metalic

Glassy.

Diamond-like.

Pearly.

Dull.

Physical properties of minerals: Mechanical properties

How a mineral behaves when a force is applied to its surface

Hardness

•Describes a mineral´s resistance to scratching.

Cleavage

•Related to the way a mineral breaks (flat surfaces maintaining crystalline structure).

Tenacity

•Describes how easily a mineral breaks.

Hardness	Mineral	Characteristics
1	Talco (Talc)	Soft minerals, because they can be scratched by another mineral.
2	Gypsum (Yeso)	
3	Calcite	Soft minerals that can be scratched by the point of a knife.
4	Fluorite	
5	Apatite	
6	Orthoclase (Ortosa)	Hard minerals
7	Quartz (cuarzo)	
8	Topaz (Topacio)	Very hard, cannot be scratched by any other mineral.
9	Corundum (Corindón)	
10	Diamond	

Physical properties of minerals: Magnetic properties

- Some minerals, such as magnetite, behave like a magnet. They attract objects that contain iron or nickel.

Other properties of materials

Transparency

- Describes how a mineral reacts to light (transparent- translucent- opaque).

Density

- Relation between mass and volumeof a mineral.

$$\rho = m / V$$

Structure and chemical composition

Minerals are solid, inorganic, natural substances made up of atoms.
The arrangement of the atoms determines each mineral's properties.

Minerals have a crystal structure.

There are two main groups of minerals:

- **Silicates** are the most abundant. They all contain silica. Their basic structure is silicon and oxygen combined with other elements.


quartz


olivine


biotite

- **Non-silicates** are a more heterogeneous group of minerals. They don't contain silica.


Sulfides


Phosphates


Oxides

The importance of minerals

Metal ores

These are minerals that metals are extract from.

Ore	Metal
Bauxite	Aluminium
Blende	Zinc
Chalcopyrite	Copper
Cassiterite	Tin
Cinnabar	Mercury
Galena	Lead
Hematite	Iron

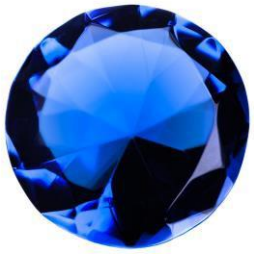
Raw materials for industry

- **Uraninite**: uranium used as fuel in nuclear power stations
- **Quartz:** manufacturing glass, computer components, solar panels.
- **Gypsum:** manufacturing plaster, alabaster, fertilisers o explosives.

Gems y precious stones

Emerald.

Ruby.



Shapphire.

Diamond.

Mining

A **mine** is a deposit from which we extract minerals.

The valuable minerals are called ores. The other valueless minerals found together with the ores, are known as gangue

There are **open-cast mines** and **underground mines**.

Obtaining minerals in an unregulated way can have negative consequences (contamination and health problems).

Recycling minerals and the products that contain them helps the environment.

Rocks

Rocks, like minerals, have properties that allow us to identify them, for example:

•**Composition** of the rock refers to the minerals that make up the rock: homogeneous y heterogeneous.

•**Texture** refers to the size and arrangement of the minerals in the rock.

Types of rocks:

•**Igneous:** these originate when magma from the Earth´s interior cools and solidifies.

•**Sedimentary:** sedimentary rocks form when sediments consolidate.

•**Metamorphic:** Formed by the transformation of other rocks subjected to high pressure conditions and/or temperatures, without reaching a melting state.

Igneous rocks

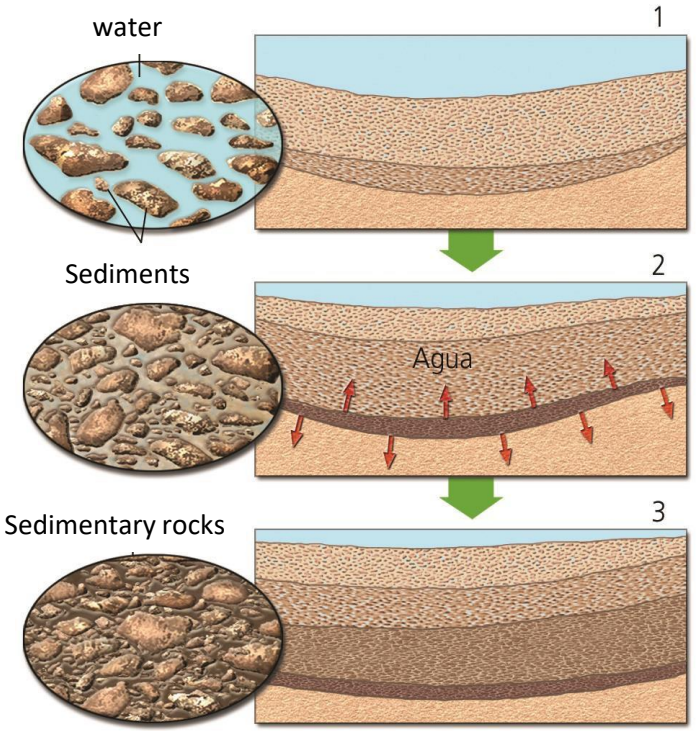
Volcanic igneous rocks	Plutonic igneous rocks
Extrusive rocks.	Intrusive rocks.
Magma rises and leaves the Earth´s crust as lava.	Magma cools slowly inside the Earth´s crust.
Lava cools quickly.	They had more time to form.
No mineral crystals.	Mineral crystals are easily visible.
Examples: obsidian, pumice and basalt.	Examples: granite, syenite and gabbro.

Other igneous or magmatic rocks form when magma solidifies in cracks inside the Earth's crust, forming dykes. This type of rock is called **phyllite.**

Sedimentary rocks

Diagenesis or lithification

The sediments transform into sedimentary rocks



Classification: we can distinguish various types:

Detrital sedimentary rocks	Non-detrital sedimentary rocks
They are made up of other rocks.	They are made up of sediments from skeletons of marine life, mineral salts or also from remains of livings things that have not descomposed.
Examples: conglomerates, sandstone and clay.	Examples: limestone, gypsum, coal y petroleum.

Metamorphic rocks

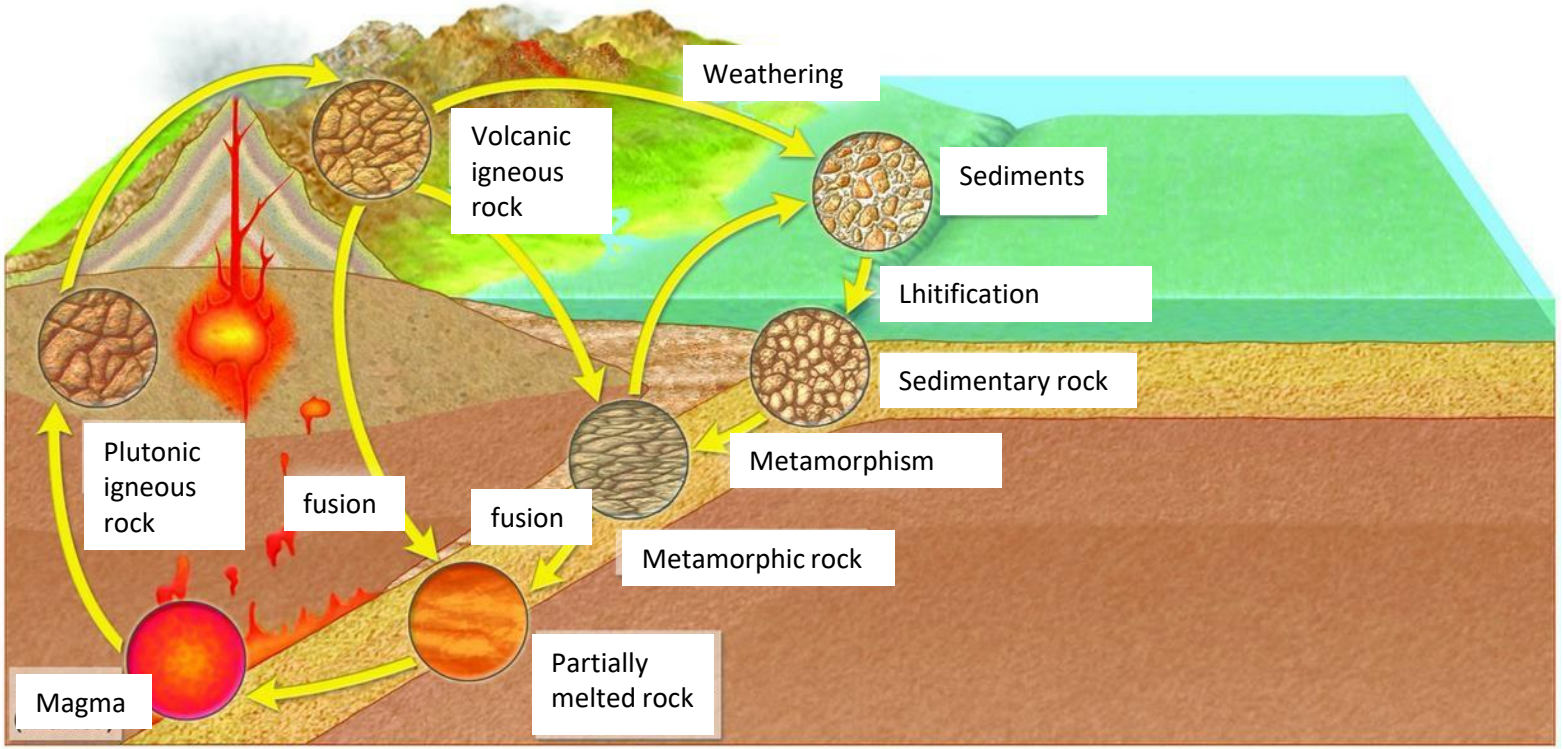
High temperatures and pressure cause changes in the minerals that compose a rock and a new rock forms , without reaching a melting state.

- Classification:

Foliated metamorphic rocks	Non-foliated metamorphic rocks
The minerals are arranged to form parallel layers.	The minerals are not arranged in layers.
Examples: slate, schist, gneiss, migmatite.	Examples: marble, quartzite

The rock cycle

The rock cycle is a series processes that a rock goes through to transform into another type of rock.



The use of rocks

Building materials

•Cement, concrete, ceramics and glass.

Ornamental rocks:

•Marble, granite, slate are often used in decoration.

Source of fossil fuel

•Coal and fuel are used because they produce a lot of energy when burnt.

Source of minerals for technological use:

•Quartz are a source of silicon to make computer processors, photovoltaic solar panels. Aluminium is used to make planes, soft drink cans or kitchen utensils.

Rock extraction

A **gravel pit** is a deposit from which gravel is extracted.

The term gravel refers to a group of varied rock with size ranges between 2 mm and 64 mm. They are usually found in or near the riverbeds of large rivers.

A **quarry** is a deposit from which we extract very heavy rocks. The rock is extracted as blocks or slabs.

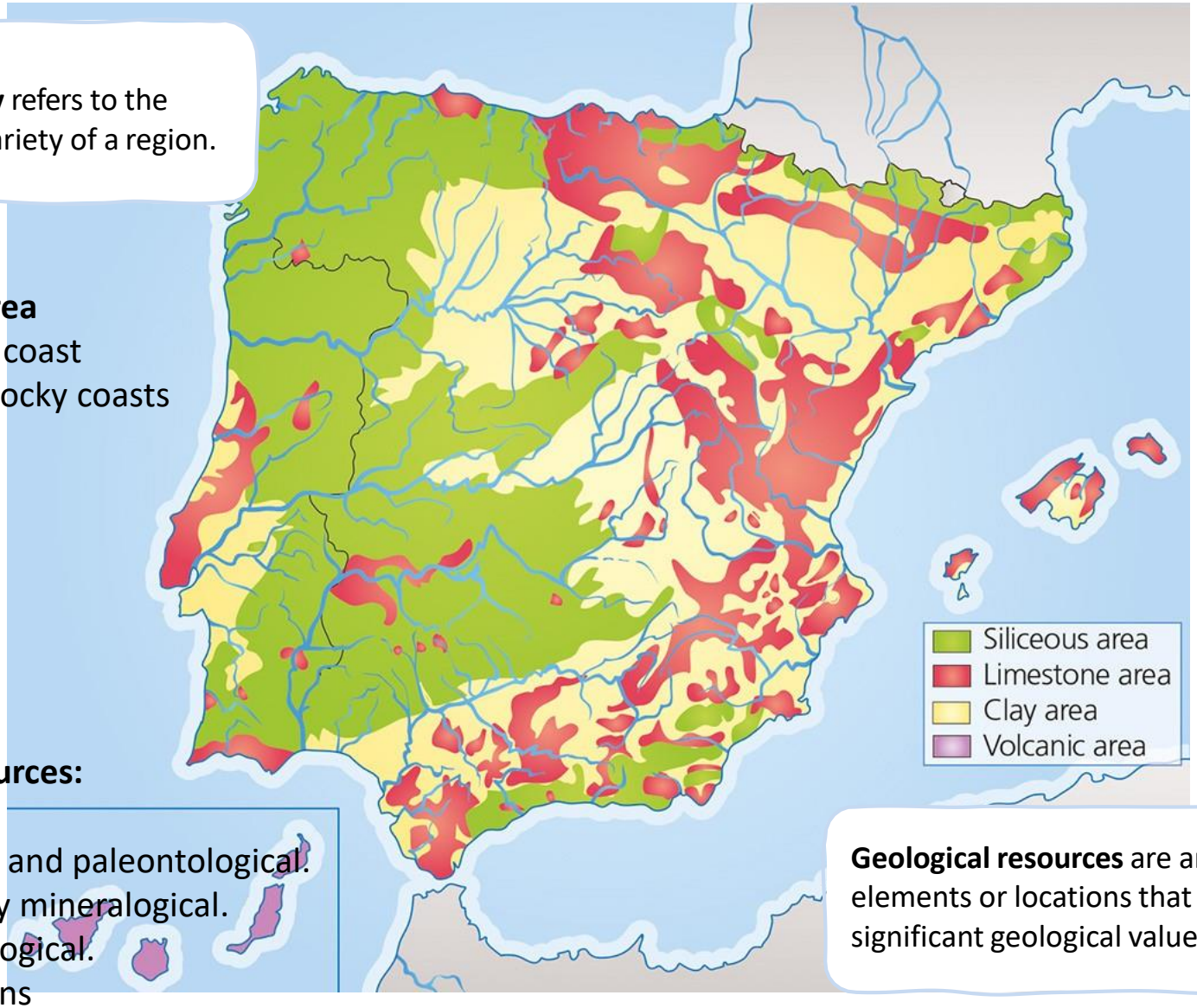
Open air quarries				**Underground**
Pit quarries with crane extraction	Pit quarries with access by ramp	Hillside quarries	Quarries in mountainous areas	**Underground quarries** have a horizontal underground passage which connects the extraction area to the outside
				

Geological areas and resources in Spain

Geodiversity refers to the geological variety of a region.

Coastal area

- Lower coast
- High, rocky coasts



Geological resources:

- Cavities.
- Stratigraphic and paleontological.
- Petrological y mineralogical.
- Geomorphological.
- Mining regions

Geological resources are any elements or locations that have a significant geological value.

How the layers of the Earth interact

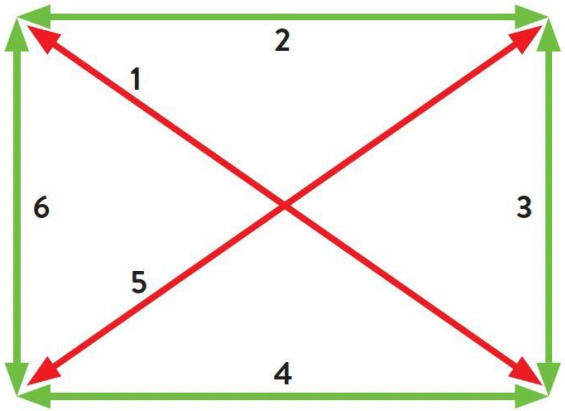
The layers of the Earth have their own composition and structure and they interact with each other, exchanging matter and energy in the process.

5. Water is present in the atmosphere in a gaseous state and falls back onto land as precipitation.

6. Living things need water to live, but they eliminate excess water through respiration, transpiration and the production of urine.

1. Living things and the Earth's crust exchange inorganic material.

2. Living things exchange gases with the atmosphere when they breath or photosynthesise.



4. The Earth's crust allows the collection, filtration and redistribution of water.

The action of water helps to sculpt the geosphere and modify the landscape.

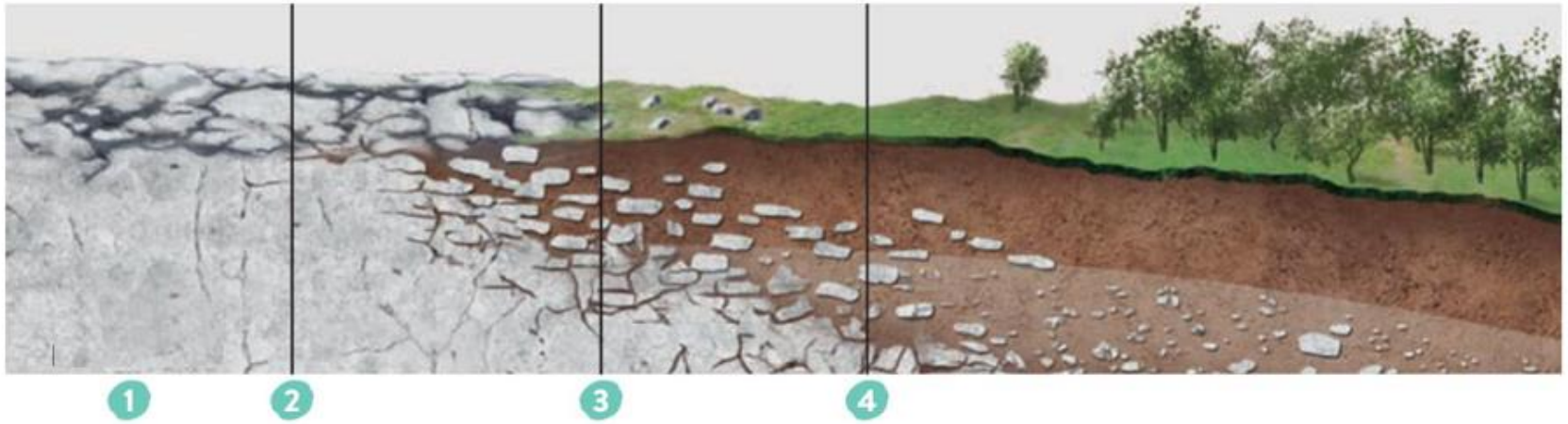
3. The action of atmospheric processes, such as the wind and precipitation, sculpts the Earth's surface.

At the same time, the Earth's crust liberates gases into the atmosphere through the actions of volcanoes.

Where the layers of the Earth interact

Soil. In terrestrial ecosystems, all livings things inhabit the outermost layer of the geosphere, the Earth´s Surface. This is where plants, animals and microorganisms live.

Pedogenesis: Soil formation. Stages:



1. **Initial stage:** soil originates from bedrock due to atmosphere, water
2. **Subsoil:** weathering of the bedrock: bacteria, lichens and fungi.
3. **Young soil:** mosses, herbaceous plants, invertebrates. Humus.
4. **Mature soil:** all the components of the soil are present. Horizons and community of living things.