Lithosphere

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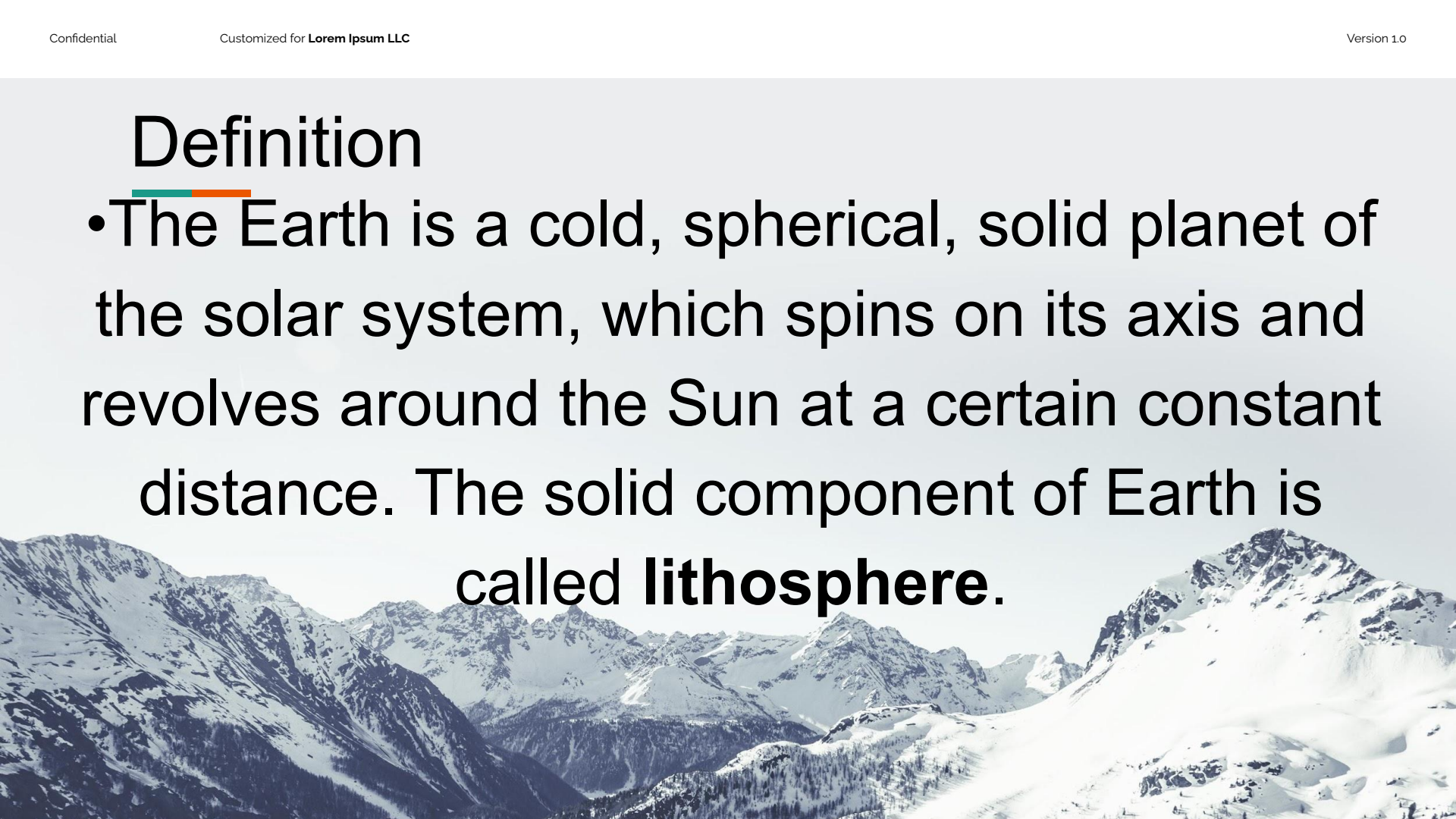
Definition

- The Earth is a cold, spherical, solid planet of the solar system, which spins on its axis and revolves around the Sun at a certain constant distance. The solid component of Earth is called **lithosphere**.



Internal Structure of Earth

The lithosphere is multilayered and includes following main layers-

(1) crust

(2) mantle and

(3) core.

The **core** is the inner most part, the layer next to the core is called mantle and the outer most part is called **crust**. The crust is very complex and its surface is **covered with the soil** supporting rich and varied biotic communities, for living organisms found in soil environment providing food, shelter and concealment from the predators.

Crust

The crust is composed of varying rocks that are relatively tough. It has **thickness** ranging between **64 to 96 km**. The crust of the Earth is rich in silica (Si) and aluminum (Al) and known as **Si Al layer**. Mainly **granite** rocks are available here. Below the Si Al layer there is another zone which is rich is silica (Si) and magnesium (Mg). This layer is known as Si Ma. Mainly basalt rocks are available here. The basalt rock has **specific granites** of **3.2** compared to **2.9** of the granites rock and this is the reason why SiAl (granites) placed above the Si Ma (basalt). There is an **imaginary line** in between SiAl & SiMa layers. This line called **‘corned discontinuity’**.

Below the ‘SiMa’ layer, the density increases with depth; such difference in density causes the constituting layers floating on others. The floating segments of Earth’s crust appear as tentonic plates.

Mantle

The next layer after the crust is known as mantle. The **thickness is** estimated to be **about 2800 km**. The mantle is divided into two parts – **upper mantle** and **lower mantle**. The upper mantle is known as '**asthenosphere'** and the lower mantle is ' mesosphere'. The **specific gravity** of upper mantle is 3.5 while the specific gravity of lower mantle is 4.5. The imaginary line between crust and mantle is '**Mohorovicic discontinuity'** or '**Moho discontinuity'**.

Core

The most interior of the Earth is known as **core**. Minerals, mostly by **Fe, Ni and Co**, form the core mixed with **sulpher** and **silica**. Sometime, core is known as '**Ni Fe**' layer. The **thickness** of core is about **3500 km**. Out of which 1250 km is inner core and 2250 km is the **outer core**. The **inner core** appears to be **solid** and outer core as **molten metallic core**. The **specific gravity** of core may be as high as ***13***. The temperature of the core is also high ranging between 5000°C to 5500°C.

The line between mantle and core meet each other, called '**Gutenberg discontinuity**'.

Internal Structure of Earth

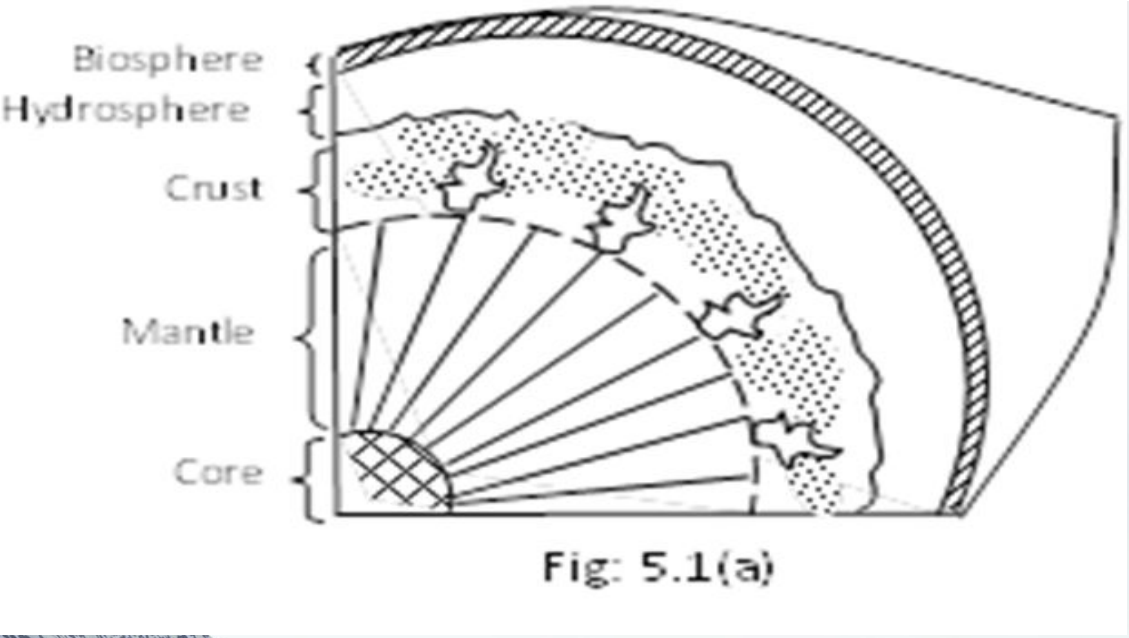
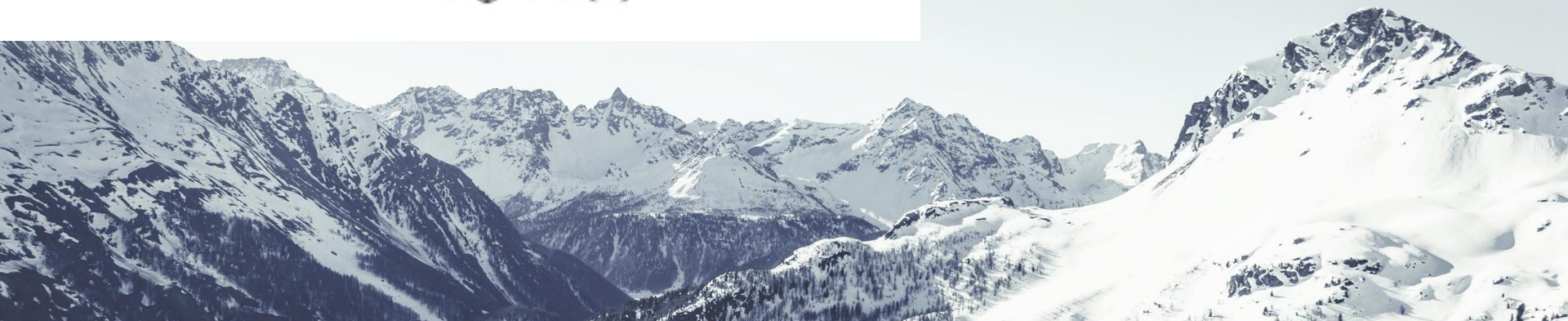


Fig: 5.1(a)



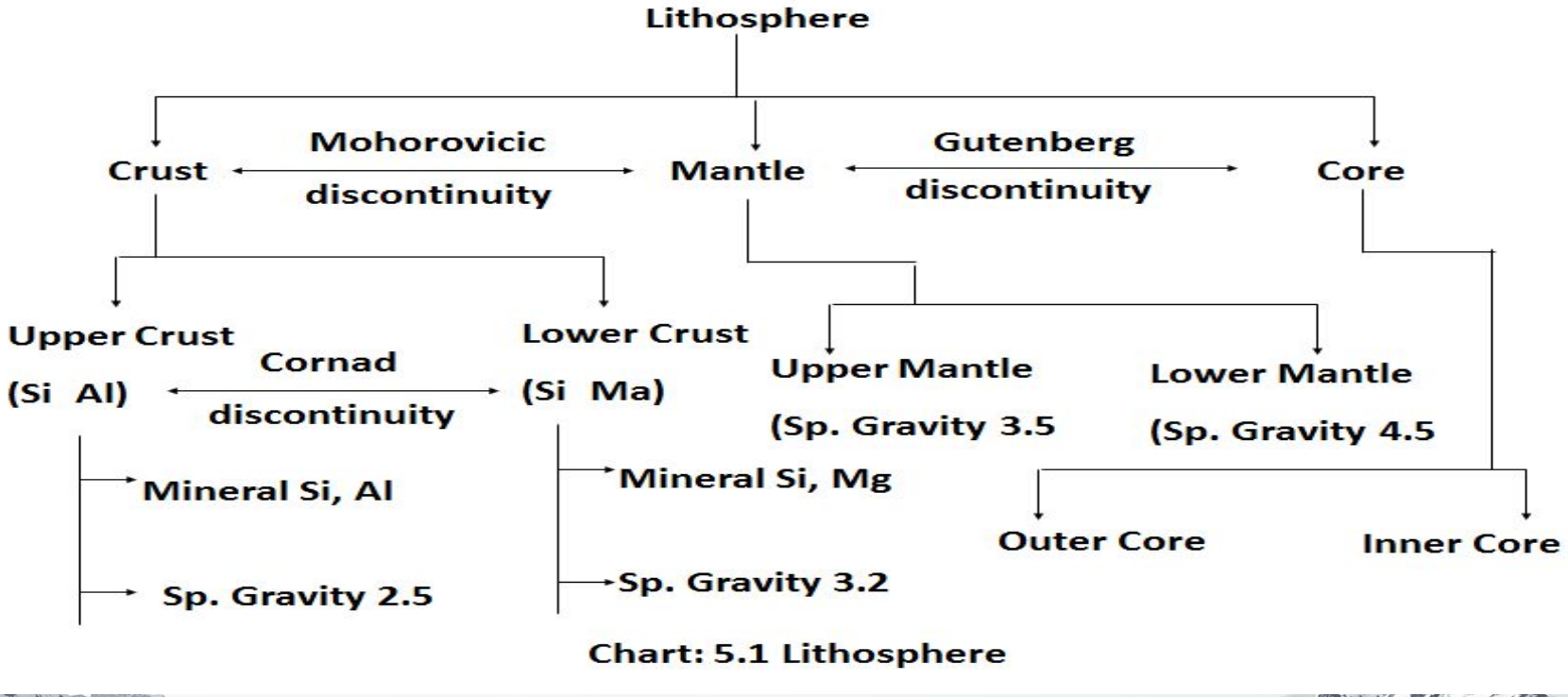


Chart: 5.1 Lithosphere

Rocks

The rocks are aggregate of minerals. The grains of two or more minerals are held in combination by any cementing material that particularly fills the spaces between adjacent mineral particles. The minerals in turn are constituted of varying chemical elements. Generally **eight different minerals are** available in rocks. These are oxygen, silica, aluminum, iron, calcium, sodium, potassium and magnesium.

Rocks cover 70% of the Earth's crust and so sometime this is called the '**mineral skin**' of the Earth.

On the basis of mode of formation of rock, it is classified as –

- **Igneous Rock.**
- **Sedimentary Rock.**
- **Metamorphic Rock.**
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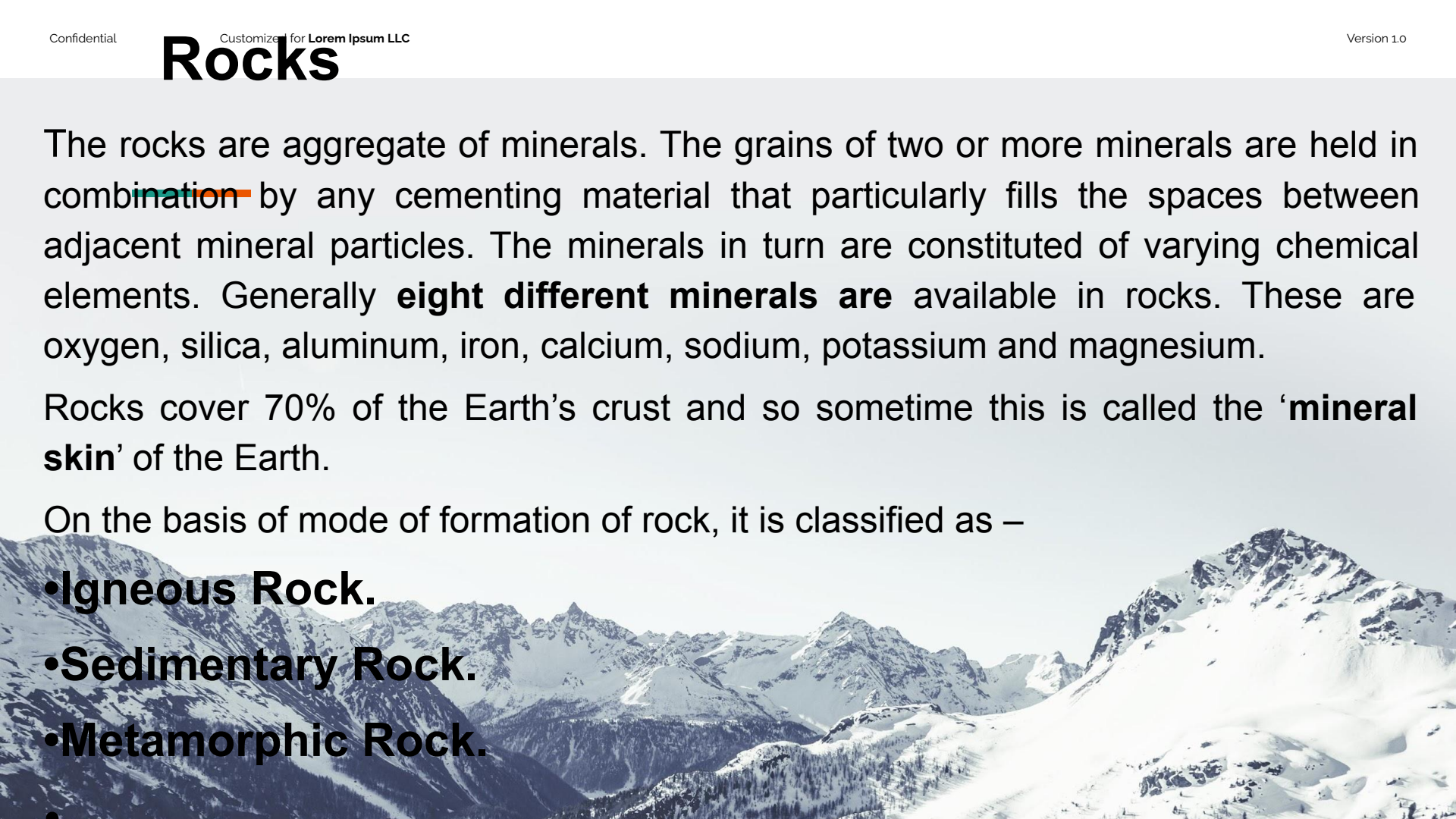
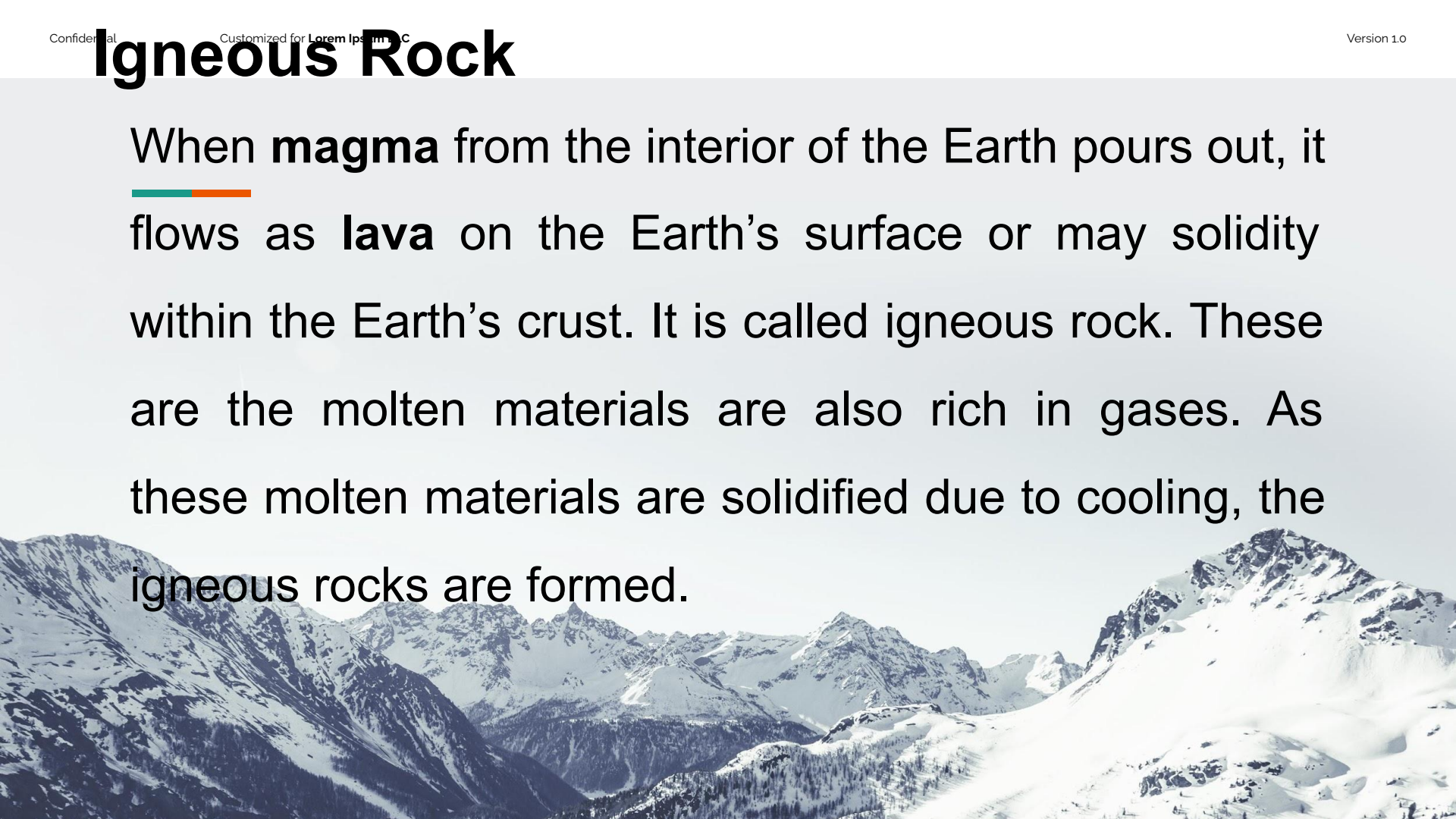


Igneous Rock

When **magma** from the interior of the Earth pours out, it flows as **lava** on the Earth's surface or may solidity within the Earth's crust. It is called igneous rock. These are the molten materials are also rich in gases. As these molten materials are solidified due to cooling, the igneous rocks are formed.

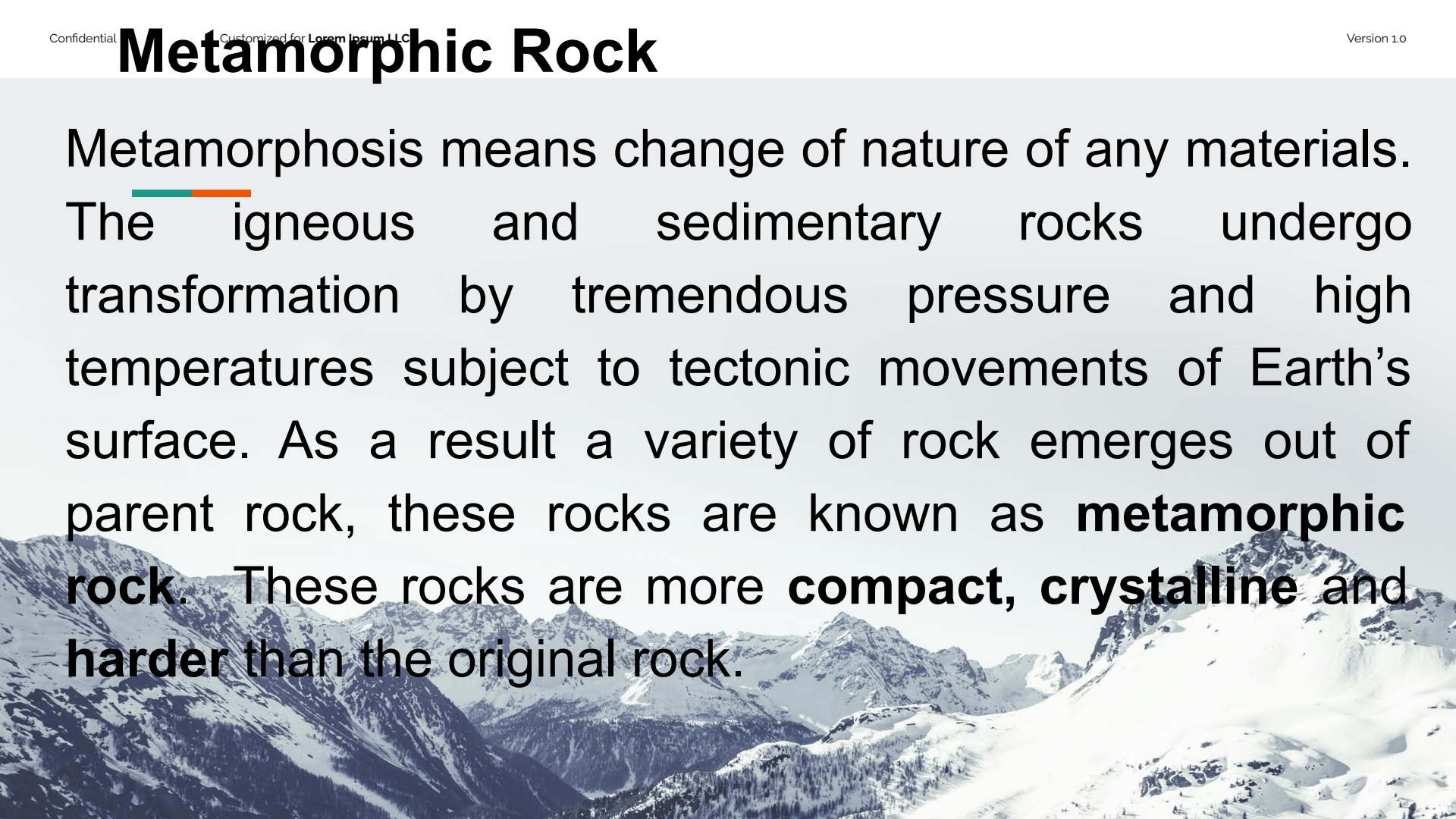


Sedimentary Rock

The igneous rocks had been subjected to erosion since their formation. The land formed by these rocks had been denuded and detritus materials carried over by different agents of erosion like river, glacier, wind etc. to sea and lakes, where these ‘sediments’ were deposited. Over long period of time, these sediments had undergone physical and chemical changes or had become compacted hardened to form rocks, called **sedimentary rocks**.

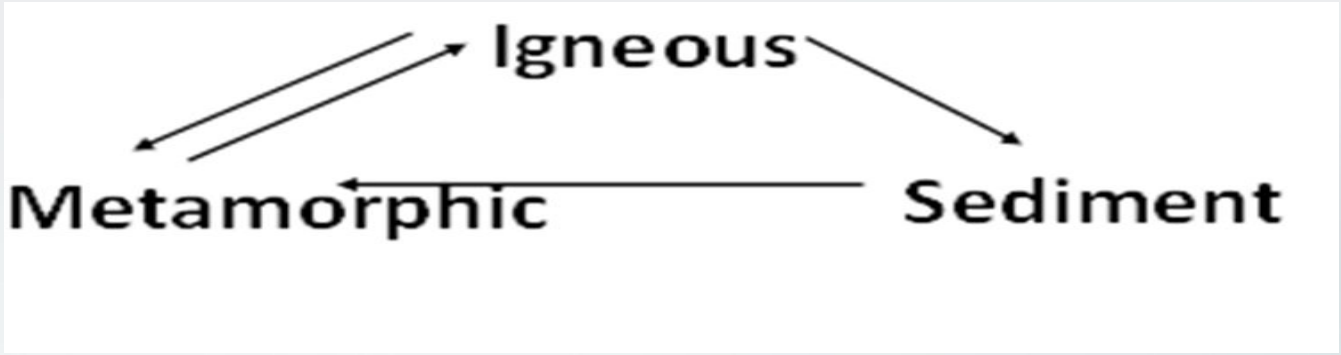
Metamorphic Rock

Metamorphosis means change of nature of any materials. The igneous and sedimentary rocks undergo transformation by tremendous pressure and high temperatures subject to tectonic movements of Earth's surface. As a result a variety of rock emerges out of parent rock, these rocks are known as **metamorphic rock**. These rocks are more **compact, crystalline** and **harder** than the original rock.



Rock cycle

The rock cycle is a form of geologic cycle related to the **formation of rocks in the lithosphere**. The sequential change of rocks from one type to another is called the **rock cycle**. The Earth's crust was initially formed **igneous rock** or primary rock. These igneous rocks were subject to weathering and erosion for a long time and the detritus materials were generated and carried over by rivers, winds and deposited in shallow seas and lakes. These deposited sediments were later cemented and compacted to form **sedimentary rocks**. Both igneous and sedimentary rocks were again transformed into **metamorphic rocks** due to excess pressure and high temperature. Metamorphic rocks penetrating inside the Earth were again subjected to very high temperature and melted. Such melting would result in flow of magma, which being cooled form **igneous rocks**. The process repeats and cycle is completed.


Igneous
Metamorphic
Sediment

Soil

Soil is the upper most part of the Earth's crust, and is a mixture of organic as well as weathered rock and materials. Soil is a **store house** of minerals, a **reservoir** of water, a **conserver** of soil fertility, **producer** of vegetative crop and home of wild life and life stock. Besides being the source of **nutrients** and **water** to plants, then soil is also the medium of **detritus** food chain. A number of soil microbes such as **bacteria, algae, fungi, protozoa** etc. bound in or on soil particles decompose the nutrients released in detritus and taken back to the plants through their roots. Soil or mud is also a source of nutrients for all aquatic plants, rooted or sub merged or free floating. **Soil** is the means of all terrestrial organisms.

Type of soil

There are **different types** of soil:

- ***Sandy soil:*** These are coarse and allow water to seep through easily.
- ***Late rite soil:*** This type of soil is usually reddish as it has iron and aluminum oxide. They are formed by the disintegration of **basalt rock**.
- ***Alluvial Soil:*** This type of soil is available at the flood plains and valleys of rivers.

Process of weathering

The disintegration of parent rocks by some agents to the smaller parts of it, called **weathering process**. The **process of weathering** starts soil formation. As a result of weathering, rocks are broken down in small particles called **‘Rigolith’** which under the influence of various other **predogenic processes** get converted to mature soil.

Types of Weathering Process

On the basis of agents, weathering process is classified as

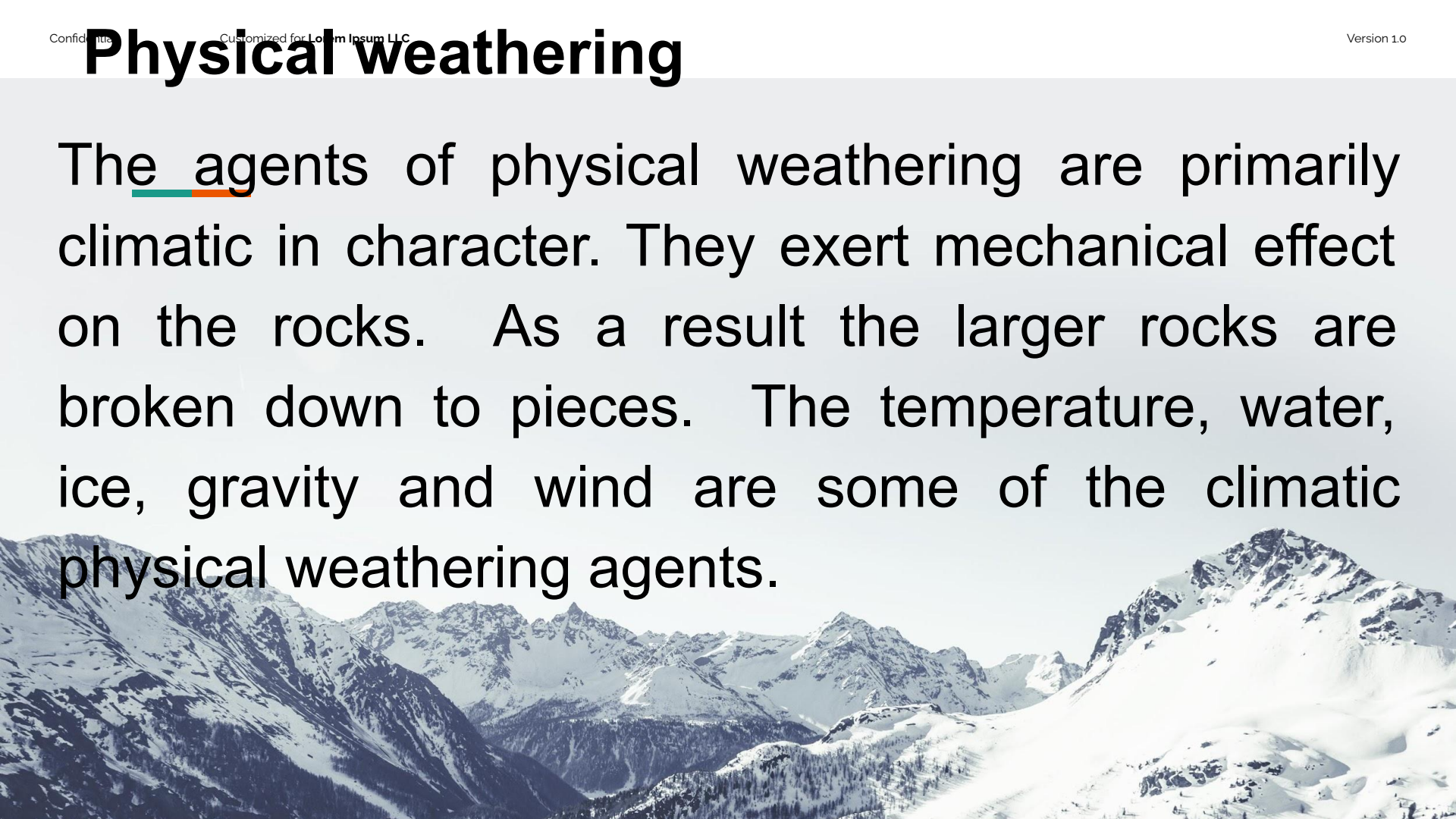
–Physical weathering process.

–Chemical weathering process.

–Biological weathering process.

Physical weathering

The agents of physical weathering are primarily climatic in character. They exert mechanical effect on the rocks. As a result the larger rocks are broken down to pieces. The temperature, water, ice, gravity and wind are some of the climatic physical weathering agents.



Chemical weathering

When different chemical reactions are involved in the weathering process, then it is called **chemical weathering**. The physical weathering produces a larger surface area of rock and this increases the rate of the chemical reactions i.e. **chemical weathering**. Chemical weathering takes place simultaneously with physical weathering and continues much beyond that. The chemical weathering consists of chemical **decomposition** or **transformation** of parent mineral materials to new mineral materials. Moisture and air are essential for chemical weathering.

Chemical weathering takes place through the following chemical reactions –

(i) Dilution, (ii) Hydrolysis, (iii) Oxidation, (iv) Reduction, (v) Carbonation, (vi) Hydration etc.

Biological weathering

A number of microorganisms extract energy from the rock. As a result, physical structures as well as mineral composition of the rock undergo some change. Some time these rocks are broken down into number of pieces, which leads to **weathering process**. This is called **biological weathering**.

Thank you.