

Geomorphology

1. General information

1.1 Introduction

The biosphere is, above all, the evolution and diversification of species. It is almost impossible to separate the flora and fauna of the Earth from its climate, as the characteristics of organisms are the result of a long history of interactions between the genetic heritage of a population and its environment. But it is above all the physical transformation of the planet Earth, its environment, its climate and its relief that causes the drift of the continents, geological upheavals and glaciation.

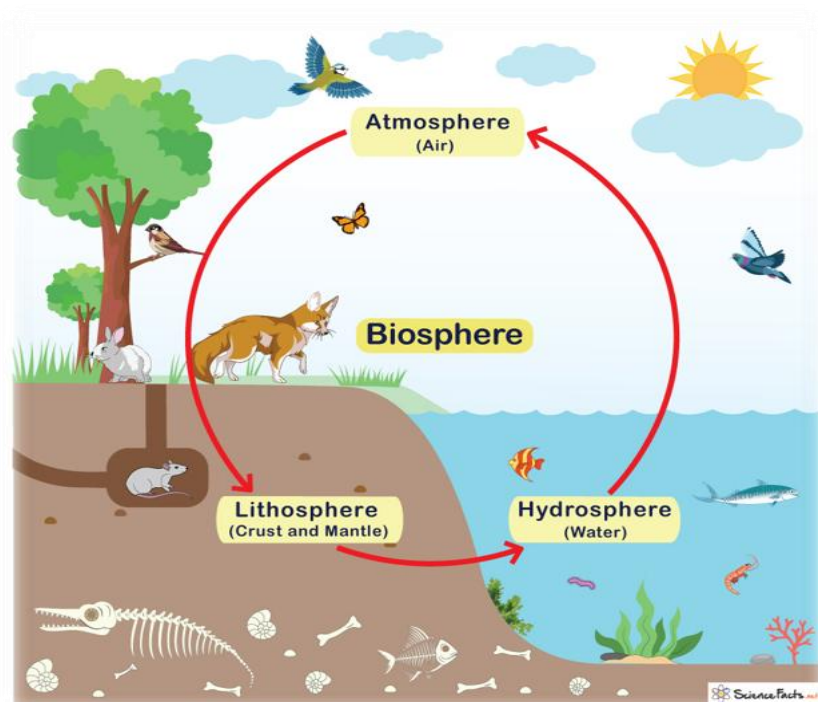


Figure 1 : The Biosphere

Evolutionary Geomorphology

Geomorphology: ('geo' meaning earth, "morpho" meaning form, and 'logy' from the Greek logos meaning science) is the science that studies the forms of the Earth's relief and their evolution, the internal and external mechanisms that shape them, and the factors that control them. The starting point for the geomorphological approach is the observation of forms (de Martonne, 1909); the term implies not only a description but also an interpretation of landforms.

The biosphere does not have a uniform structure; the aim of geomorphology is to describe and understand terrestrial volumes. To better understand the evolution of concepts regarding the

genesis of relief and its consequences, it is preferable to provide a geomorphological description by means of:

Structural geomorphology studies the relationships between landforms and geological structure (lithology and tectonics). These relationships can be observed at different scales (from plate tectonics to basic structural forms); some forms can be observed on a metre scale (a fault escarpment produced by an earthquake), while others are on a planetary scale (the differentiation between oceans and continents). Geomorphologists have been particularly interested in the differentiation of relief within large geological structures (François Saur, 2012).

Dynamic geomorphology (formerly zonal or climatic geomorphology) studies the effects of current or recent erosion and the external processes that contribute to the formation and evolution of landforms (erosion, weathering, ablation, transport and deposition), as well as the appearance of landforms depending on climate.

Relief (Landforms) Relief refers to all the irregularities in the Earth's surface. These irregularities are measured in relation to sea level. There are generally two types of relief: continental relief (29% of the Earth's surface) and oceanic relief (71% of the Earth's surface).

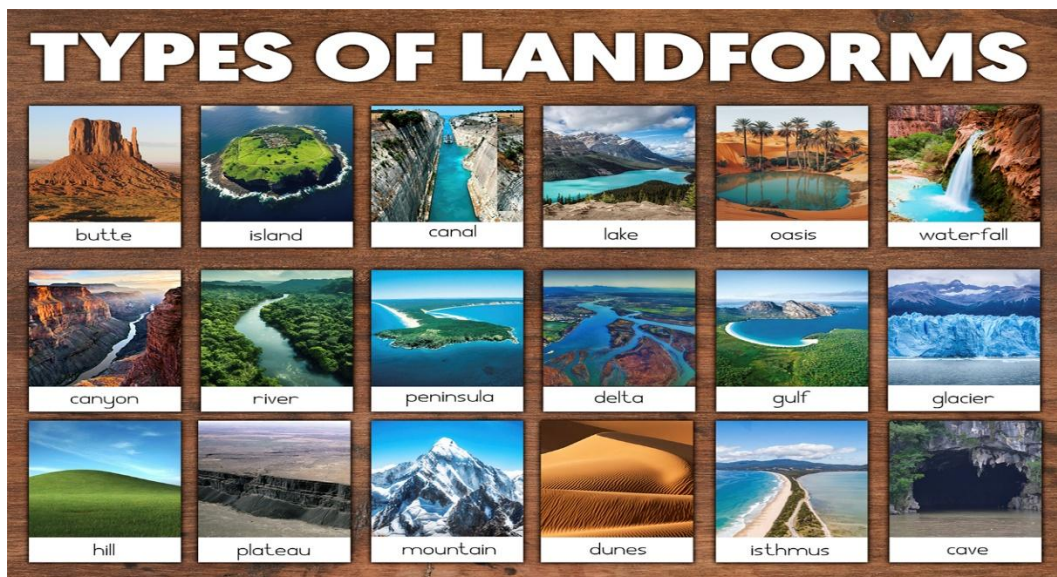


Figure2 : Types of Landforms

1.2 Relationship between geomorphology and ecology

Relief plays a role in the distribution of living beings. Geomorphology is an important field of landscape ecology. Landscape forms and structures are decisive for flora, fauna and their functions within ecosystems, particularly with regard to biological corridors and certain points such as islands, lakes, rivers, passes, straits, hollows, etc., which naturally control the movement of genes, species and populations. Continental land masses play an important role in climate change, as relief can alter temperature, wind patterns and surface water temperature. These changes in climate cause changes in sedimentary deposits, flora, fauna and plant distribution and ecology (biodiversity).

1.3 Thalwegs and interfluves

Talweg: From the German Talweg, composed of Tal ('valley') and Weg ('path'). Corresponds to the lowest points of a watershed. Talwegs are mostly shaped by river erosion and frequently occupied by the hydrographic network.

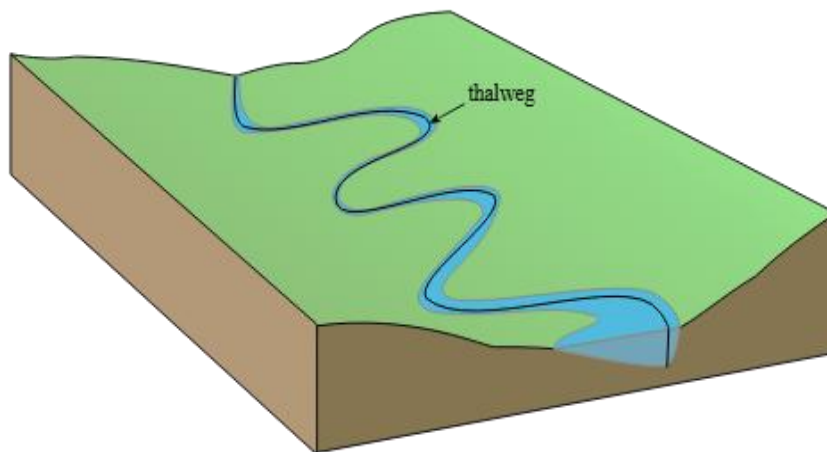


Figure3 : Talweg

Interfluve: is a landform between two talwegs, consisting of slopes that may or may not be separated by a flat surface. The interfluve ridge refers to the line where rainwater divides. Interfluves represent the majority of the Earth's landforms and come in various shapes since talwegs are relatively narrow.

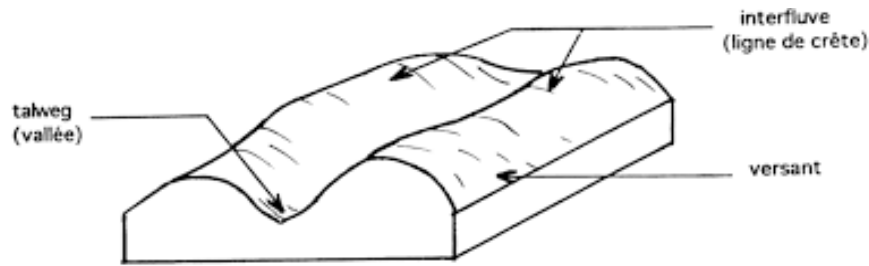


Figure4 : Interfluve

1.4 Erosion, Lithology, Structure

Erosion

is the process of degradation and transformation of the landscape, and therefore of rocks, caused by any external agent (i.e. other than tectonics). It is the combination of physical and chemical sediment transport mechanisms on the Earth's surface, under the effect of water and gravity.

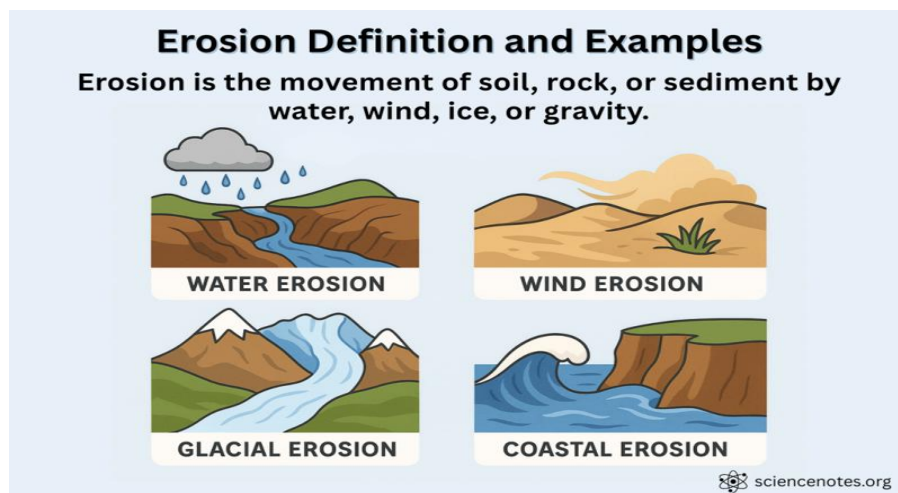


Figure5 : Erosion

Lithology

From the ancient Greek ‘collection of stones’, composed of (lithos) “stone” and (logos) ‘study’. Lithology is the branch of geology that studies the nature of the rocks forming an object, a geological whole or layer. It is essential to understanding landforms and erosion. The lithology of the bedrock can influence vegetation in two main ways: through direct contact with the plant, in scree for example, or through its influence on soil properties.

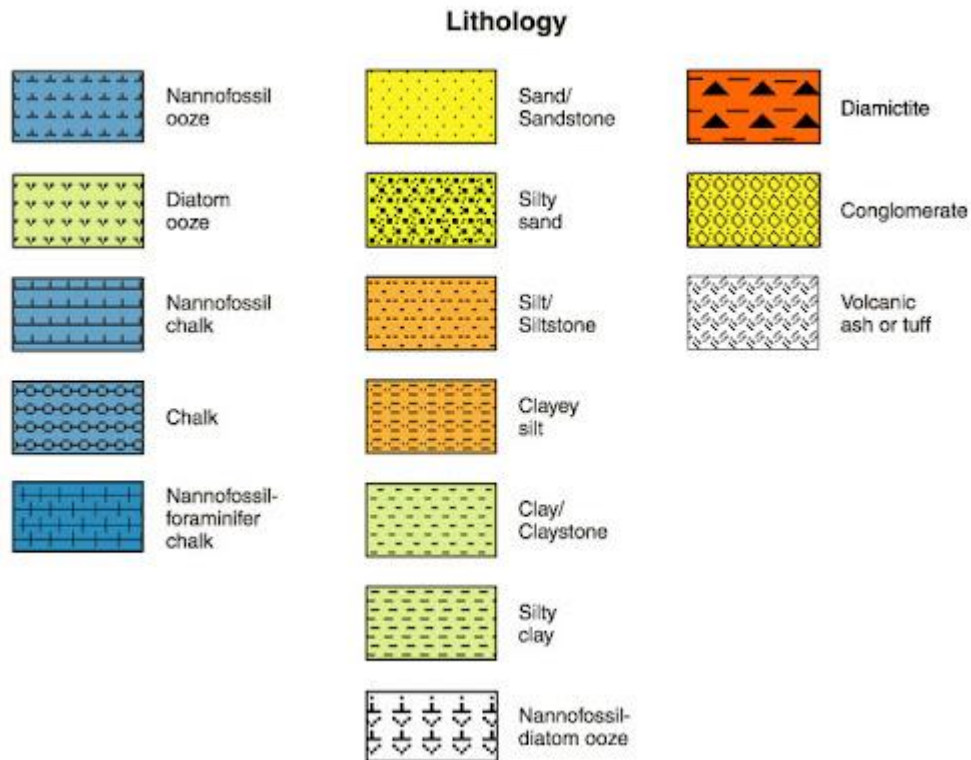


Figure 6 : lithology symbols

Structure

Structural geomorphology is the relationship between relief and rock structures ; structure is the essential driver of relief formation.

Structural forms refer to all aspects that define the geometric structure and any tectonic features of a given formation. Structural and tectonic forms are very important in erosion resistance.

Structures are an important indicator of sediment transport and deposition conditions, with certain structures being characteristic of a particular environment (glacial, desert) for the interpretation of palaeoenvironments.

For example:

Pre-sedimentary structures : these are observed on the upper surface of banks and are most often related to erosion processes. Example: traces of objects sliding along the bottom. Many of these structures provide clues about the direction and sense of currents.

Synsedimentary structures : these form during sediment deposition and provide evidence of the speed, nature, direction and orientation of the transport agents.

Post-sedimentary structures : these develop in the sediment after it has been deposited. These include hydrostatic rearrangements, structures caused by lateral displacement of sediment masses, and processes related to the physico-chemical modification of sediments under subsurface pressure and temperature conditions. Finally, it should be noted that certain sedimentary structures are used in folded series to determine the polarity of the layers .

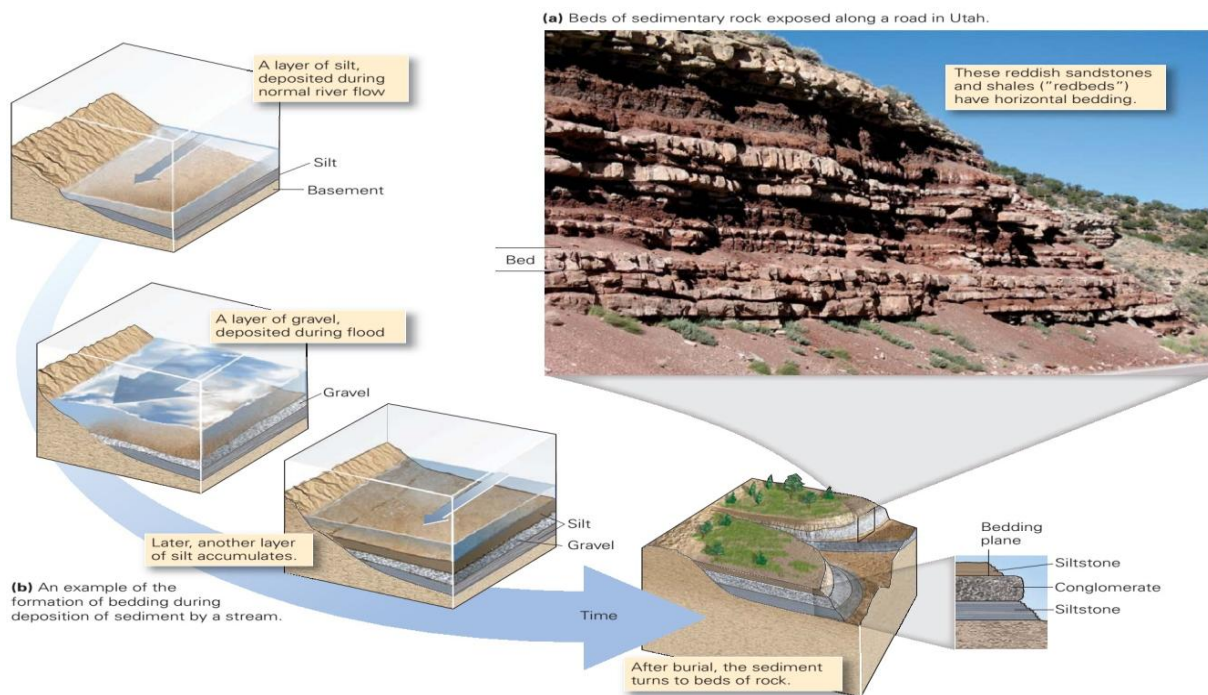


Figure7 : Sedimentary structures