Terrestrial Relief

The Eruption of Popocatépetl Volcano (Mexico)

Popocatépetl, meaning "smoking mountain" in Nahuatl, is the second-highest peak in Mexico. It is located in the Neovolcanic Range, which spans from west to east across the central region of the country, the most populated and dynamic area.

At the end of the year 2000, the Mexican government declared a maximum alert and evacuated thousands of people living nearby. For some time, small and periodic explosions have occurred, accompanied by gas emissions, water vapor, and ash.

The eruption of Popocatépetl poses a serious danger, as it is located only 60 km southeast of Mexico City, one of the most populous cities in the world, with over 20 million inhabitants.

KEY POINTS OF THE UNIT

Task 1. The relief of the continents offers a great diversity of forms: mountains, plateaus, plains, and depressions, mainly. Submarine relief is formed by platforms, slopes, basins, and ridges. Which forms of relief do you think occupy the largest area? Reason your answer.

Task 2. The Earth's crust is divided into different plates. These plates collide with each other, causing internal forces, volcanoes, and earthquakes, which give rise to terrestrial relief. What do you think these internal forces obey? Why?

Task 3. Terrestrial relief changes slowly over time due to the action of temperature, water, wind, and humans, who shape it. What are the most important erosion agents? What role do humans play in this process?

Task 4. The map of the main relief units of the world highlights significant disparities between continents. Which continent, in your opinion, presents the most contrasting relief? Why?

MAPS

Topographic maps aim to provide the maximum information about relief, as well as population centers, communication routes, hydrographic networks, toponymy, and the situation of a given territory. These maps constitute the basis for creating a country's cartography. In Spain, the main organization responsible for their creation is the National Geographic Institute (IGN), established in 1870. The National Topographic Map (MTN) began to be developed in the 19th century and was completed in 1968. It is published at a scale of 1:50,000 and consists of 1,122 sheets. Additionally, since 1975, a series at a scale of 1:25,000 has been initiated, which will have more than 4,000 sheets and is still unfinished.

TO KNOW MORE

BOOKS

Jules Verne, Twenty Thousand Leagues Under the Sea
A group of castaways is rescued by the Nautilus, a strange submarine vessel.

LINKS

Santillana. Network Projects National Geographic Institute (www.geo.ign.es)
Geological and Mining Institute of Spain (www.igme.es) Spanish Institute of Oceanography (www.ieo.es) History of Cartography (www.cartograma.com)

FILMS

Earthquake, directed by Mark Robson, 1974
This film is based on a real earthquake that nearly destroyed Los Angeles.

Volcano, directed by Mick Jackson, 1997
Los Angeles firefighters try to cope with the eruption of a volcano.

Dante's Peak, directed by Roger Donaldson, 1997
It tells the catastrophic consequences of a volcano awakening in a town called Dante's Peak.

WHAT DO YOU KNOW?

1. Read the title of the unit and respond:
   a) What does the word "relief" mean? What do you think is the content of the unit?
   b) How is terrestrial relief? How do you think the ocean floor is?
   c) Do you think terrestrial relief has always been the same? Why?

2. Observe the initial photograph. Read the caption and answer:
   a) How does Popocatépetl look? What impression does it give you?
   b) What elements reflect Popocatépetl's activity? Do you know of any other active volcano currently? If so, say which one(s) and where they are located.

3. Explain what a volcano is and what it means for it to be erupting.

A PRACTICAL CASE

Respond:

a) Why was the Mexican government on alert? Do you think it is necessary to monitor volcanoes?
b) Do you consider it dangerous to live near a volcano? Why?
c) What other natural disasters do you know? What effects do they have?

YOUR OPINION

5. Respond:
   a) Do you think the information provided by topographic maps is important? Why?
   b) Do you know other ways to represent terrestrial relief? Say which ones.

6. Imagine you are a cartographer and need to make a topographic map of your locality.
   a) Which geographical features would you reflect in it?
   b) What other information would you include?

TASK 1. What is Terrestrial Relief?

We call relief the roughness and deformations present in the Earth's crust. Relief presents different forms on continents and ocean floors.

Continental Relief

Continental relief is very varied. The main forms of continental relief are mountains, plateaus, plains, and depressions.

- Mountains are elevated lands with steep slopes; they can appear isolated but generally form ranges, systems, and mountain ranges. They are present worldwide. The highest mountain range is the Himalayas in central Asia; it includes Mount Everest (8,846 m), the highest peak in the world. The longest mountain system extends along America, consisting of the Rocky Mountains, Sierra Madre, and the Andes.
- Plateaus are extensive flat surfaces located at some altitude above sea level. The highest plateaus in the world are Tibet in Asia and the Bolivian Altiplano in South America. They also cover large areas in Africa.
- Plains are low and flat areas. They are found along coasts and in the basins of major rivers, such as the Amazon in South America and the Mississippi in North America. In Europe, they cover a large area.

- Depressions are surfaces below sea level. The most significant ones are in Asia. The deepest depression in the world is the Dead Sea, which is 395 meters below sea level.

Submarine Relief

The relief of the ocean and sea floors is as rugged and diverse as continental relief. Four major forms of relief are distinguished:

- Continental platforms are vast submerged plateaus that generally extend from the edge of continents to a depth of about 200 meters.
- Continental slopes form the boundary of the platforms, have steep slopes, and lead to great depths.
- Oceanic basins are immense bowls located between the slopes and ridges. Trenches are narrow grooves situated in these basins. The deepest trenches are located in the Pacific Ocean, where the Challenger Deep in the Mariana Islands stands out (11,033 m).
- Oceanic ridges are submerged mountain ranges that can exceed 3,000 meters. The highest points of these reliefs protrude from the water and form islands.

QUESTIONS

1. What are the two main features that define terrestrial relief, both continental and submarine?
2. What are the fundamental forms of continental relief? Which one(s) are defined by their horizontality?
3. What four major forms of relief are distinguished on the ocean and sea floors?

INVESTIGATE

1. Observe and compare the photographs. Respond:
    - What forms of relief do these images reflect? Reason your answer.

- Do you know other examples of these forms of relief? If so, say which ones.

2. Analyze document 4 and answer:
    - How is submarine relief: flat or rugged, homogeneous or varied?
    - What fundamental forms of relief exist on the ocean and sea floors?
    - In which areas are the greatest depths reached?
    - What are the submarine mountain ranges called?
    - What is the origin of some islands?

TASK 2. How is Relief Formed?

The Earth changes. Over time, mountains and islands have formed where there were once plains, and vice versa; lands that are now on the surface were once submerged under the oceans.

The Theory of Plate Tectonics

In 1912, the German scientist Alfred Wegener outlined his theory of continental drift. According to it, the current continents emerged from a single block of land, Pangea, which broke apart over millions of years. The almost identical shape of the coasts of Africa and America seems to support this idea. However, he could not explain why each fragment moved.

A few decades ago, the theory of plate tectonics emerged. According to this theory, the lithosphere is divided into several plates, called tectonic plates. These plates move slowly over the mantle. For example, the North American and Eurasian plates separate by about four centimeters each year.

Occasionally, the plates collide with each other, causing intense internal forces of horizontal and vertical direction.

- If the impact forces act on plastic materials, the Earth's surface undulates, forming folds.

- If these forces act on rigid materials, the crust fractures into blocks, forming faults; in this case, some blocks rise and others sink.

The largest folds and the most elevated faulted blocks can form mountains.

Volcanoes and Earthquakes

The movement of the plates also gives rise to two other phenomena: volcanoes and earthquakes.

- Volcanoes are openings or cracks in the Earth's crust through which materials from the Earth's interior are expelled at very high temperatures. The hot materials form magma. The magma is pressured by the Earth's internal forces, moves through the chimney, and exits through the crater. The expelled materials can be solid, such as ash, liquid, such as lava, and various gases. Sometimes the materials accumulate outside and form volcanic cones; other times volcanic eruptions can create islands, like the Canary Islands.
- Earthquakes are sudden underground movements that occur in the Earth's crust due to the fracture and displacement of rocks inside the Earth. These shocks cause very destructive seismic waves, capable of changing the landscape of an area.

Both volcanoes and earthquakes have disastrous consequences for the local population.

INVESTIGATE

1. Observe document 2 and respond:
    - What are the major plates existing on Earth? List them.
    - On which plate is the Iberian Peninsula located? And the Canary Islands?
    - In which areas do the great mountain ranges originate? Where are most volcanoes located, and where do earthquakes frequently occur? What does this similar distribution of both phenomena indicate?
2. Analyze document 3 and answer:

- How is a fold formed? And a fault?
- What effects can they have on relief?

TASK 3. Why Does Relief Change?

Shaping the Earth's Surface

Terrestrial relief changes slowly due to the action of external forces (temperatures, water, wind, and humans). External changes occur in three phases. Erosion is the wear, fragmentation, and dissolution of rocks. Transport is the dragging of materials removed by erosion. Sedimentation is the deposition of previously eroded and transported materials.

The most important erosion agents are temperatures, water, wind, and humans.

Temperatures

Abrupt temperature changes break rocks into numerous fragments. This occurs in mountains and deserts, where there is a large temperature difference between day and night. Sometimes water seeps into rock cracks, freezes, acts as a wedge, and breaks the rocks.

Water

Water constantly acts on the terrain.

Si necesitas algo más específico o tienes alguna pregunta sobre el contenido, no dudes en preguntar.

Citations:

1. https://ppl-ai-file-upload.s3.amazonaws.com/web/direct-files/11155233/99fbe733-f8d3-469a-a93d-80bc3d3dbbb0/El-relieve.pdf

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