Sea Floor Spreading Answer Key

Unlocking the Secrets of the Ocean Floor: A Deep Dive into Seafloor Spreading

Understanding the Earth's dynamic processes is crucial for comprehending our planet's history, its current state, and its future. Plate tectonics, a cornerstone of geology, explains the movement of Earth's lithospheric plates, leading to earthquakes, volcanic activity, and the formation of mountain ranges. Central to this theory is seafloor spreading, a fascinating process that continuously reshapes our oceans and provides vital clues about Earth's internal workings. This article serves as your comprehensive guide to seafloor spreading, providing answers to common questions and equipping you with a deeper understanding of this fundamental geological phenomenon.

1. What is Seafloor Spreading?

Seafloor spreading is the process by which new oceanic crust is formed at mid-ocean ridges, pushing older crust outwards. Imagine a giant conveyor belt at the bottom of the ocean. Molten rock, or magma, rises from the Earth's mantle at these mid-ocean ridges, a system of underwater mountain ranges that stretches for tens of thousands of kilometers across the globe. As this magma cools and solidifies, it forms new oceanic crust, adding to the edges of the plates. This continuous addition of new crust forces the older crust to move away from the ridge, like a widening crack in a sidewalk. The process is driven by convection currents within the Earth's mantle, where hotter, less dense material rises and cooler, denser material sinks.

2. Evidence Supporting Seafloor Spreading: A Multifaceted Approach

The theory of seafloor spreading wasn't readily accepted at first. However, several lines of compelling evidence solidified its position as a crucial part of plate tectonics. These include:

Magnetic Stripes: As magma cools and solidifies, tiny magnetic minerals within it align themselves with the Earth's magnetic field. Crucially, the Earth's magnetic field periodically reverses its polarity. This creates a pattern of alternating magnetic stripes on the ocean floor, symmetrically arranged on

either side of the mid-ocean ridges. These "magnetic anomalies" act like a tape recorder, documenting the history of seafloor spreading.

Ocean Floor Age: Rock samples collected from the ocean floor reveal a clear age progression. The youngest rocks are found at the mid-ocean ridges, while the oldest rocks are located furthest away. This pattern directly supports the idea of new crust forming at the ridge and spreading outwards.

Sediment Thickness: The thickness of sediments accumulating on the ocean floor also increases with distance from the mid-ocean ridge. This is because the older the crust, the longer it has been exposed to sedimentation.

Heat Flow: Higher heat flow is measured near mid-ocean ridges, indicating the presence of underlying magma. This supports the idea of magma rising and creating new crust.

Earthquake Distribution: Earthquakes are frequently observed along mid-ocean ridges, confirming the ongoing tectonic activity and movement of plates.

3. The Role of Seafloor Spreading in Plate Tectonics

Seafloor spreading is integral to the theory of plate tectonics. It explains how oceanic plates are created and destroyed. As new crust forms at mid-ocean ridges, the plates move apart, a process called divergent plate boundary. This movement can lead to the formation of rift valleys on land, as seen in the East African Rift Valley. Conversely, at convergent plate boundaries, where oceanic plates collide with continental plates or other oceanic plates, the older, denser oceanic crust is subducted (forced beneath) the less dense continental crust or another oceanic plate. This subduction process leads to volcanic activity and the formation of trenches and island arcs.

4. Seafloor Spreading and the Formation of Ocean Basins

The continuous process of seafloor spreading directly contributes to the formation and expansion of ocean basins. Over millions of years, the creation of new oceanic crust at mid-ocean ridges and the movement of plates result in the widening of ocean basins. For example, the Atlantic Ocean continues to widen due to the ongoing seafloor spreading at the Mid-Atlantic Ridge. Conversely, the Pacific Ocean is shrinking as plates converge and subduction occurs.

5. Seafloor Spreading and Earth's Geochemical Cycles

Seafloor spreading plays a crucial role in Earth's geochemical cycles. The release of hydrothermal fluids from the mid-ocean ridges introduces significant amounts of dissolved minerals and gases into the oceans, influencing ocean chemistry and the global carbon cycle. The subduction of oceanic crust carries these minerals back into the mantle, where they can be recycled and eventually reintroduced into the system through volcanic activity.

Summary

Seafloor spreading is a fundamental geological process responsible for the creation of new oceanic crust, the movement of tectonic plates, and the formation and evolution of ocean basins. The evidence supporting this process is multifaceted and compelling, ranging from magnetic stripes to sediment thickness and heat flow patterns. Understanding seafloor spreading is essential for comprehending plate tectonics, Earth's history, and its ongoing dynamic changes.

Frequently Asked Questions (FAQs):

1. How fast does seafloor spreading occur?

Seafloor spreading rates vary, ranging from a few centimeters to over 10 centimeters per year. This means that the ocean floor is constantly, albeit slowly, changing.

2. Can seafloor spreading cause earthquakes and tsunamis?

Yes, the movement of plates at mid-ocean ridges can cause earthquakes, although they are generally less powerful than those occurring at convergent plate boundaries. However, undersea earthquakes near mid-ocean ridges can potentially trigger tsunamis.

3. Is seafloor spreading happening everywhere in the oceans?

No, seafloor spreading is primarily concentrated at mid-ocean ridges. There are also areas where plates are converging or moving laterally past each other.

4. What is the difference between seafloor spreading and continental drift?

Continental drift is the earlier hypothesis that continents were once joined together and have since drifted apart. Seafloor spreading provides the mechanism explaining how continents move apart – through the creation and movement of oceanic crust at mid-ocean ridges.

5. How does seafloor spreading contribute to the rock cycle?

Seafloor spreading is a key component of the rock cycle. It creates new igneous rocks (basalt) at mid-ocean ridges. These rocks are then subjected to weathering and erosion, forming sediments that eventually become sedimentary rocks. Subduction recycles these rocks back into the mantle, where they can melt and reform igneous rocks, completing the cycle.