NO PREP

Methods of Studying the Seafloor

Drilling, Coring, and Sonar Mapping

Includes: Student reading, case study, differentiated questions, teacher key

Name: Period: Date:

Methods of Studying the Seafloor: Drilling, Coring, and Sonar Mapping

The Challenge of Exploring the Ocean Floor

The ocean floor is one of the least explored regions of our planet, even though it covers most of Earth's surface. Unlike land, which can be studied directly, the seafloor lies hidden beneath miles of water, extreme pressure, and complete darkness. To overcome these obstacles, scientists use specialized technologies to study its structure, history, and resources. Three major methods include deep-sea drilling, sediment coring,

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Drilling and Coring the Seafloor

One of the most direct ways to study the seafloor is by drilling into it. Large oceanographic ships, such as the JOIDES Resolution, can lower drilling equipment thousands of meters below the ocean surface to recover samples of rock and sediment. By studying these samples, scientists can learn about the composition and age of the crust, confirming processes such as plate tectonics. Coring is a related method in which long tubes are pushed into sediment to collect vertical samples called cores. These cores provide a timeline of sedimentation, much like tree rings record climate history on land. By analyzing sediment layers, researchers can reconstruct Earth's past climates, volcanic eruptions, and even asteroid impacts.

Sonar Mapping the Seafloor

While drilling and coring provide direct samples, sonar mapping allows scientists to map the shape of the ocean floor. Sonar, short for Sound Navigation and Ranging, works by sending sound waves downward. These waves bounce off the seafloor and return to the ship, allowing computers to calculate depth. Early sonar revealed surprising discoveries, such as the Mid-Atlantic Ridge. Modern multibeam sonar can map wide swaths of the seafloor in high resolution, producing detailed 3D maps. Sonar has uncovered underwater mountains, volcanoes, and trenches that were once completely unknown. These maps are essential for navigation, resource exploration, and understanding geological hazards like earthquakes and tsunamis.

Key Information: Table: Methods of Studying the Seafloor

Method	Description	Example/Use
Drilling	Extracting rock/sediment with drilling ships	JOIDES Resolution, IODP
Coring	Collecting sediment layers for study	Climate history, volcanic ash records
Sonar mapping	Using sound waves to map seafloor topography	Mid-Atlantic Ridge, trenches, seamounts

Case Study: The Deep Sea Drilling Project

Launched in 1968, the Deep Sea Drilling Project (DSDP) was one of the most ambitious marine science missions of its time. Using the ship Glomar Challenger, scientists drilled into the ocean crust to collect cores. These samples provided crucial evidence for seafloor spreading, as sediments became progressively older farther from mid-ocean ridges. The project's findings confirmed the theory of plate tectonics and revolutionized geology. Later projects, including the Ocean Drilling Program (ODP) and Integrated Ocean Drilling Program (IODP), continued this work, recovering thousands of cores worldwide. These cores revealed information about past ice ages, ocean circulation, and biological evolution, making deep-sea drilling one of the most important tools in modern Earth science.

1. What evidence from the Deep Sea Drilling Project supported the theory of seafloor spreading?

_____

_____

2. Why are sediment cores valuable for studying Earth's past climate?

_____

_____

Multiple Choice

1. What did the Deep Sea Drilling Project confirm?
    a) Subduction of oceanic plates beneath deep trenches
    b) Origin of hydrothermal vents
    c) Seafloor spreading and plate tectonics
    d) Existence of abyssal plains

2. What does a sediment core provide?
    a) A sample of hot hydrothermal vent fluids from the seafloor
    b) A sonar-generated image of the seafloor
    c) A record of seismic activity only
    d) A vertical timeline of sediment deposition

3. What technology is used to create 3D maps of the ocean floor?
    a) Satellite photography
    b) Sonar mapping
    c) Radar imaging
    d) Drilling platforms

Matching

Write the letter of the correct definition on the line next to each term.

Term	Definition
1. ___ Drilling	A) High-resolution maps of ocean topography
2. ___ Coring	B) Samples of crust proving seafloor spreading
3. ___ Sonar mapping	C) Vertical samples showing climate history
4. ___ Glomar Challenger	D) Advanced technology for detailed seafloor mapping
5. ___ Multibeam sonar	E) Ship used in Deep Sea Drilling Project

Fill-in-the-Blank

1. The _____ Resolution is a famous drilling ship used for ocean research.

2. Sonar works by sending _____ waves to the seafloor and recording their return.

3. Sediment _____ act as timelines of Earth's climate history.

Short Answer

Answer each question in 2-4 complete sentences.

1. How did sonar mapping change scientists' understanding of the seafloor?

_____

_____

_____

2. Why is ocean drilling considered one of the most important tools in Earth science?

3. What role do seafloor cores play in studying past global events like ice ages?