NO PREP

Marine Sediments

Terrigenous, Biogenous, Hydrogenous, and Cosmogenous

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

Name: Period: Date:

Marine Sediments: Terrigenous, Biogenous, Hydrogenous, and Cosmogenous

What Are Marine Sediments?

The seafloor may appear empty, but it is covered in layers of marine sediments—particles of rock, minerals, and organic material that accumulate over time. These sediments provide scientists with a record of Earth's climate, ocean circulation, and biological history. By studying sediment layers, researchers can reconstruct how Earth's systems have changed over millions of years. Marine sediments are classified into four main types: terrigenous, biogenous, hydrogenous, and cosmogenous. Each type has its own source, composition, and

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Terrigenous Sediments

Terrigenous sediments come from land. They are made up of eroded rock, transported by rivers, wind, glaciers, or volcanic eruptions into the sea. The Amazon River, for example, delivers billions of tons of sediment into the Atlantic Ocean each year. These sediments cover large portions of the continental margins and abyssal plains, influencing the shape of the seafloor. Terrigenous material is usually coarse near its source but becomes finer the farther it travels. Sands and silts settle near shorelines, while clays can drift thousands of miles before settling. Terrigenous sediments are essential because they record the history of Earth's landscapes and provide nutrients to coastal ecosystems.

Biogenous Sediments

Biogenous sediments are formed from the remains of living organisms. Microscopic plankton, such as foraminifera (with calcium carbonate shells) and radiolarians (with

silica skeletons), die and fall to the seafloor, creating deposits called oozes. These oozes are important for paleoclimatology because the chemical makeup of shells records past ocean conditions. Over millions of years, biogenous sediments can form chalks, limestones, or siliceous rocks. The famous White Cliffs of Dover in England are made of ancient biogenous deposits. These sediments are key indicators of biological productivity and past environmental change.

Hydrogenous and Cosmogenous Sediments

Hydrogenous sediments form directly from chemical reactions in seawater. Examples include manganese nodules, phosphorites, and evaporite salts. These deposits can be economically valuable, containing metals like nickel, copper, and cobalt. However, extracting them poses environmental challenges. Cosmogenous sediments come from space. They include microscopic dust from meteorites and occasional larger fragments that survive entry into Earth's atmosphere. Though rare compared to other sediment types, cosmogenous material provides unique insights into planetary science and the history of the solar system.

Key Information: Table: Types of Marine Sediments

Type	Source	Examples	Importance
Terrigenous	Land erosion (rivers, wind, glaciers)	Sands, clays, volcanic ash	Records Earth's surface changes
Biogenous	Remains of organisms	Foraminifera, radiolarians, chalk	Tracks climate and biological productivity
Hydrogenous	Chemical reactions in seawater	Manganese nodules, salts	Potential resources, chemical cycles
Cosmogenous	Space dust and meteorites	Micrometeorites	Evidence of solar system history

Case Study: The White Cliffs of Dover

The White Cliffs of Dover, towering over the English Channel, are a striking example of biogenous sediments. They are composed mostly of chalk, a soft, white form of limestone created from the microscopic remains of plankton that lived in a warm, shallow sea about 70 million years ago. Over time, these remains accumulated into thick layers, which were later uplifted by geological forces to form cliffs. The cliffs have not only geological importance but also cultural significance as a symbol of England. Their formation shows how microscopic life in the ocean can leave behind massive structures that last millions of years.

1. How were the White Cliffs of Dover formed?

2. Why are biogenous sediments important to scientists studying past climates?

Multiple Choice

1. What type of sediment comes from land erosion?
    a) Biogenous
    b) Terrigenous
    c) Cosmogenous
    d) Hydrogenous

2. Which type of sediment forms from microscopic plankton shells?
    a) Biogenous
    b) Cosmogenous
    c) Terrigenous
    d) Hydrogenous

3. What are manganese nodules an example of?

a) Hydrogenous sediment

b) Biogenous sediment

c) Cosmogenous sediment

d) Terrigenous sediment

Matching

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

Term	Definition
1. ___ Terrigenous	A) Remains of plankton forming chalk and oozes
2. ___ Biogenous	B) Dust and fragments from space
3. ___ Hydrogenous	C) Famous example of biogenous deposits
4. ___ Cosmogenous	D) Minerals formed by seawater reactions
5. ___ White Cliffs of Dover	E) Sediment carried by rivers and glaciers

Fill-in-the-Blank

1. Sediments from eroded rocks on land are called _____.

2. Shells of microscopic plankton form _____ sediments.

3. Dust from meteorites that reaches the ocean is an example of _____ sediments.

Short Answer

Answer each question in 2-4 complete sentences.

1. Why do terrigenous sediments become finer the farther they travel from land?

_____

_____

_____

2. What makes hydrogenous sediments economically valuable, and what challenges exist in using them?

3. How do biogenous sediments help scientists understand past climates?