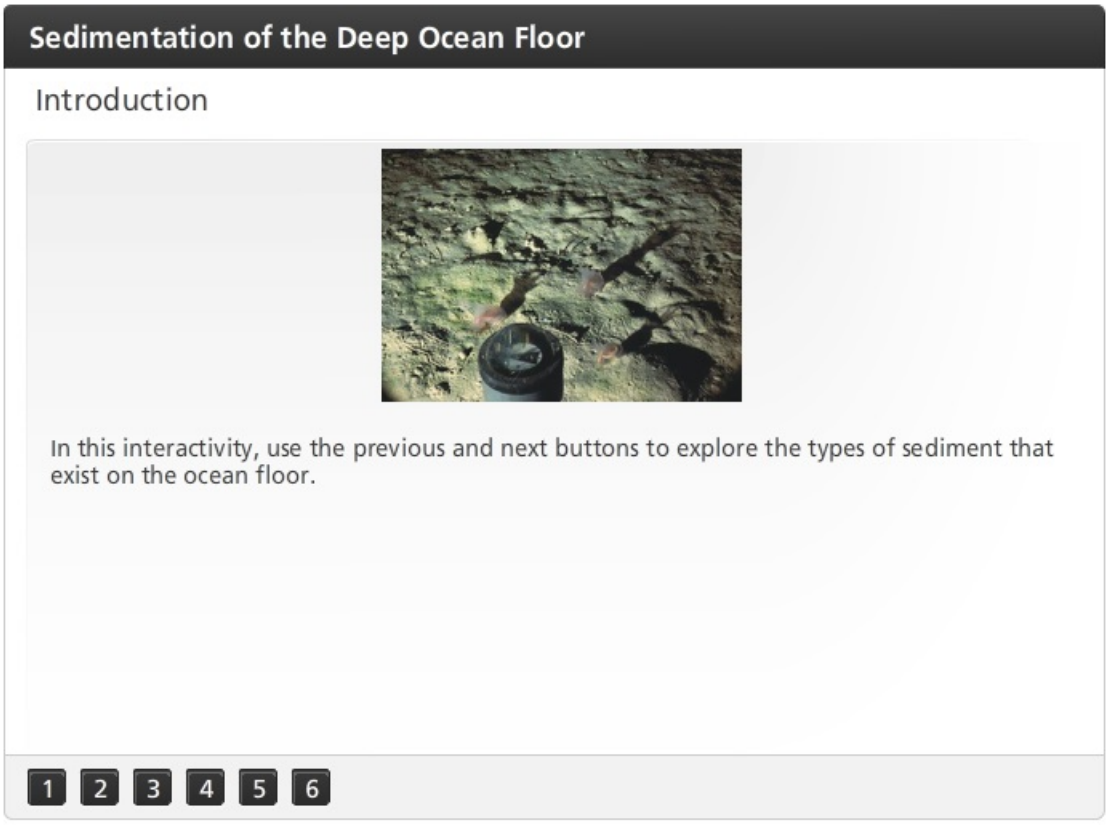
Module 5: Sedimentation
Topic 3 Content: Sedimentation of the Deep Ocean Floor Notes



In this interactivity, use the previous and next buttons to explore the types of sediment that exist on the ocean floor.

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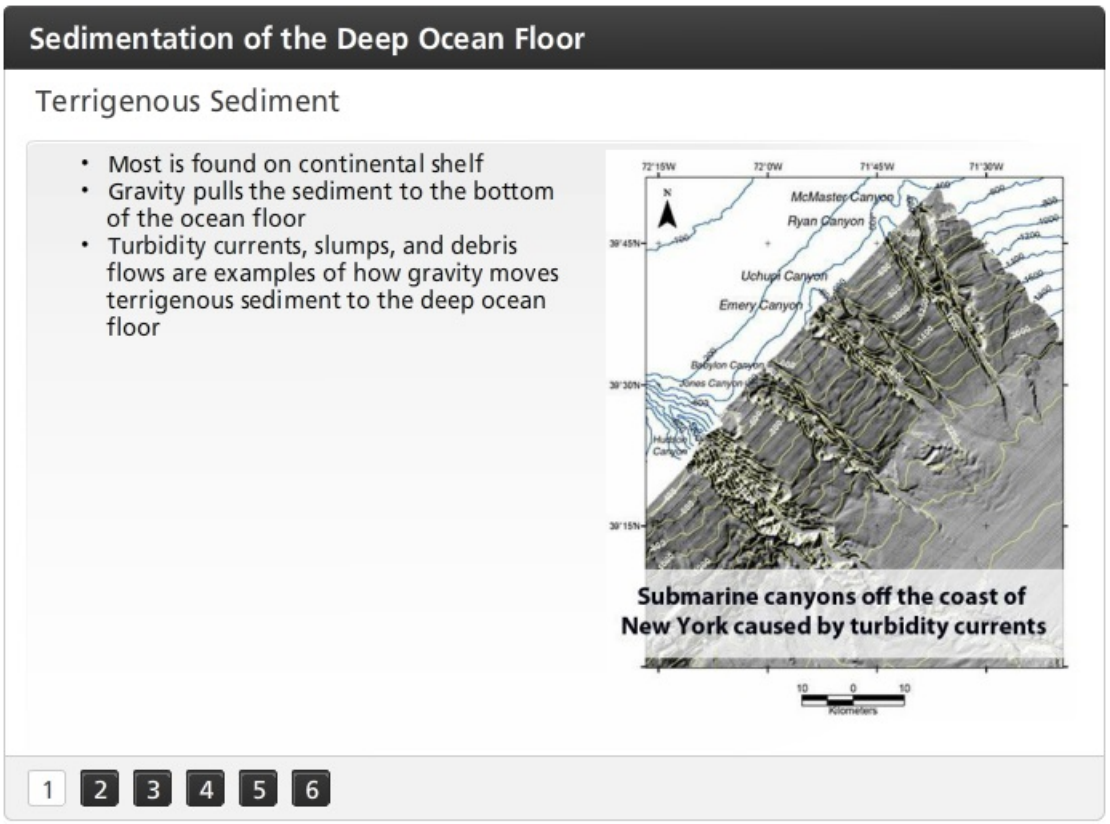

- Most is found on continental shelf
- Gravity pulls the sediment to the bottom of the ocean floor
- Turbidity currents, slumps, and debris flows are examples of how gravity moves terrigenous sediment to the deep ocean floor

Narration Script

Most terrigenous sediment is found near the continental shelf, since it originates on land; however, it does make up a significant portion of the sediment found in the deep ocean. The main force that moves this sediment to the bottom of the ocean is gravity-induced transport, also known as bulk emplacement.

Turbidity currents cause the bulk emplacement of sediment when avalanches of sediment fall from the continental shelf to the bottom of the ocean. These avalanches may be slow, or they may occur very quickly. Slumps occur when rocky sediment move short distances through bulk emplacement. No matter the term, the process is essentially the same, as sediment moves down a slope due to gravity, eventually coming to rest on the ocean floor.

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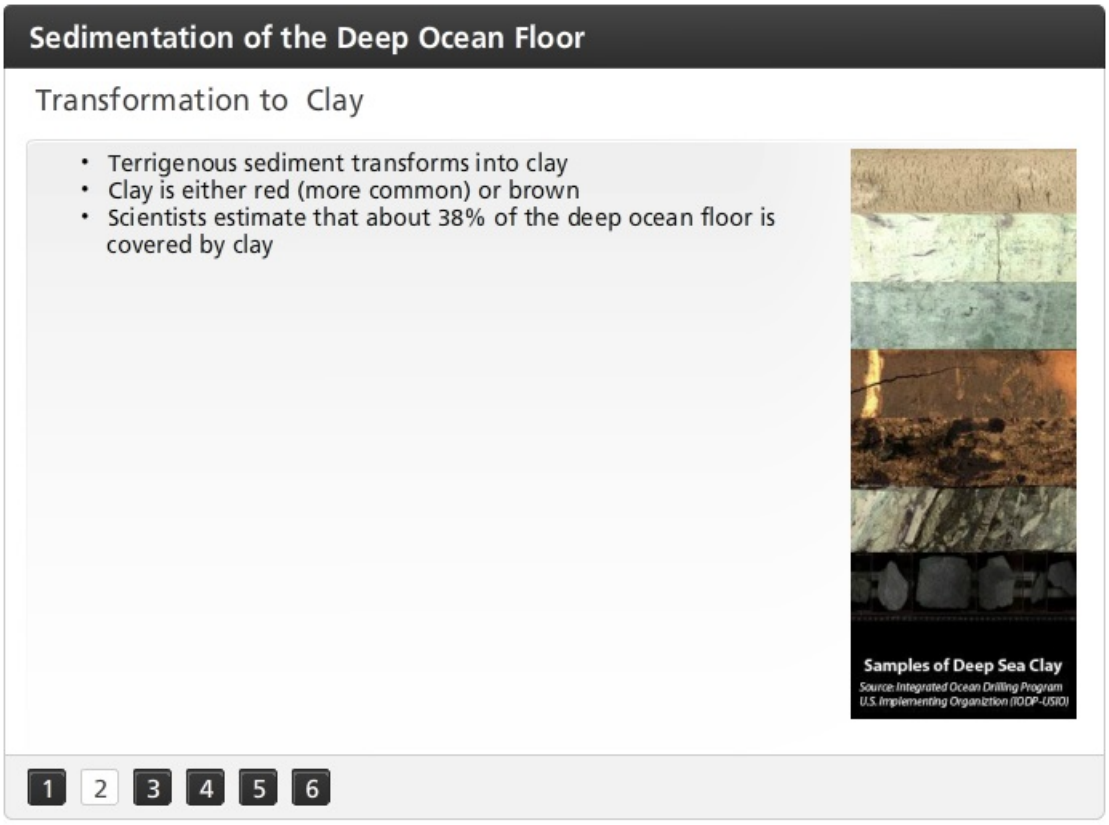

- Terrigenous sediment transforms into clay
- Clay is either red (more common) or brown
- Scientists estimate that about 38% of the deep ocean floor is covered by clay

Narration Script

After terrigenous sediment arrives on the deep ocean floor in bulk, it eventually turns into clay. This clay is either red, or brown. Red clay is more common, and it receives its color through iron that has oxidized. Scientists estimate that about 38% of the deep ocean floor is covered by clay resulting from terrigenous sediment.

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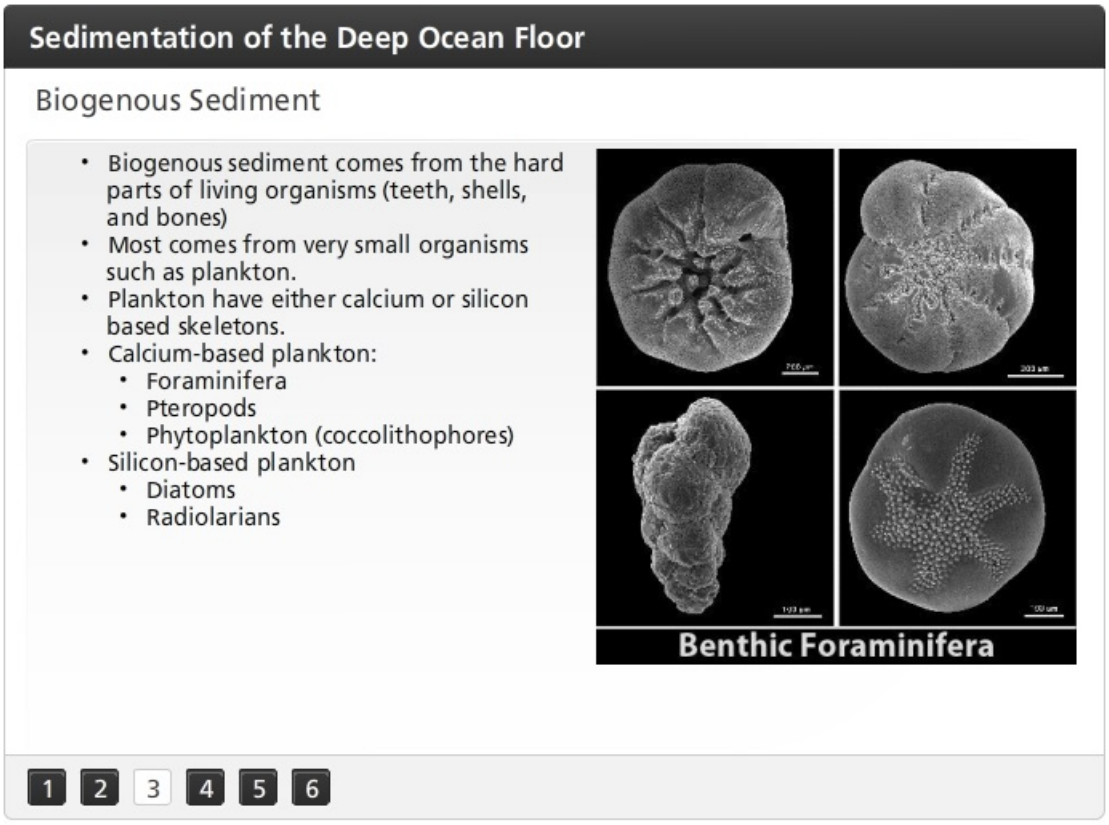

- Biogenous sediment comes from the hard parts of living organisms (teeth, shells, and bones)
- Most comes from very small organisms such as plankton.
- Plankton have either calcium or silicon based skeletons.
- Calcium-based plankton:
  - Foraminifera
  - Pteropods
  - Phytoplankton (coccolithophores)
- Silicon-based plankton
  - Diatoms
  - Radiolarians

Narration Script

The ocean floor is teeming with life, including creatures both big and small. When these creatures die, many of them leave behind hard parts, like shells, teeth or bones, which cannot be broken down any further. As these fall to the ocean floor, they build up to form layers of biogenous . Most of the biogenous material comes from very small organisms such as plankton. Almost all plankton have either calcium- or silicon-based skeletons. The calcium-based plankton are called foraminifera, pteropods, and phytoplankton. The silicon-based plankton are called diatoms, and radiolarians.

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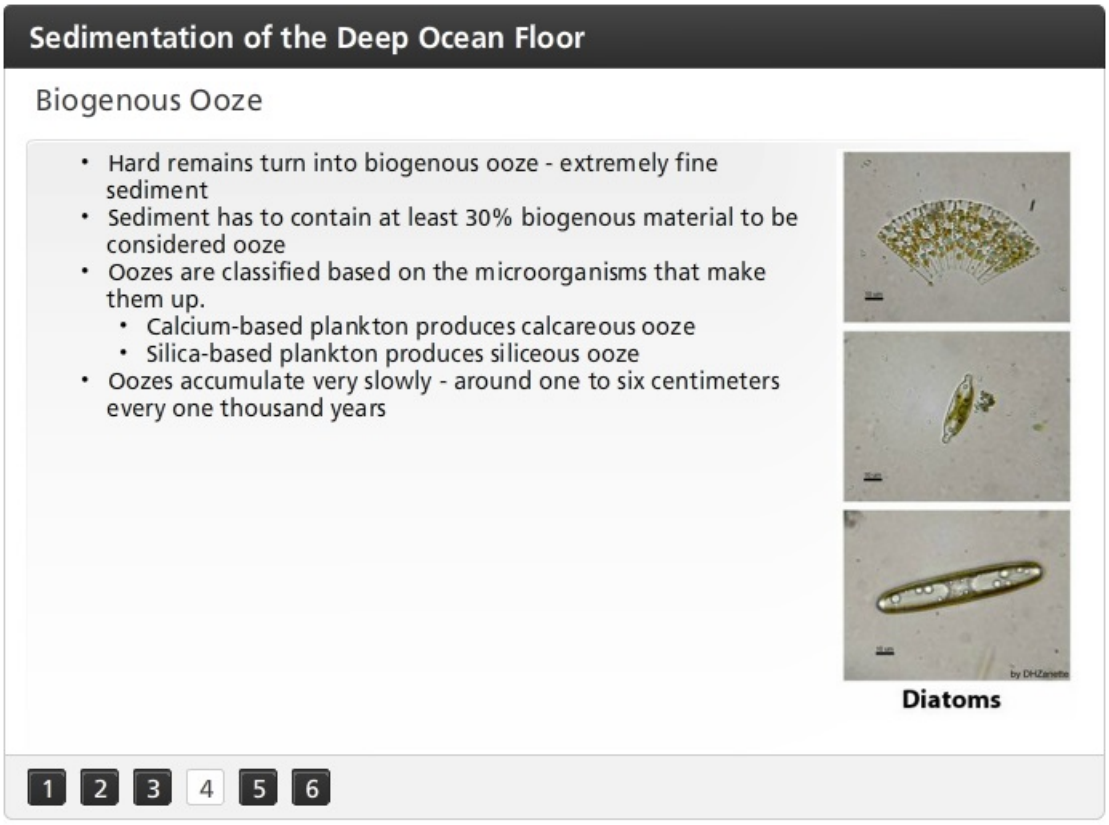

- Hard remains turn into biogenous ooze - extremely fine sediment
- Sediment has to contain at least 30% biogenous material to be considered ooze
- Oozes are classified based on the microorganisms that make them up.
  - Calcium-based plankton produces calcareous ooze
  - Silica-based plankton produces siliceous ooze
- Oozes accumulate very slowly - around one to six centimeters every one thousand years

Narration Script

After the hard remains of these organisms fall to the bottom of the ocean, they eventually turn into biogenous ooze. This ooze is similar to very watery mud that is made up of extremely fine sediment left over from these organisms. In order to be classified as ooze, sediment has to contain at least 30% biogenous material. This material comes primarily from calcium-based or silica-based skeletons.

Oozes are classified based on the microorganisms of which they are composed. Calcium-based plankton produce calcareous ooze, while silica-based plankton produce siliceous ooze. These oozes accumulate very slowly, at a rate of around one to six centimeters every one thousand years.

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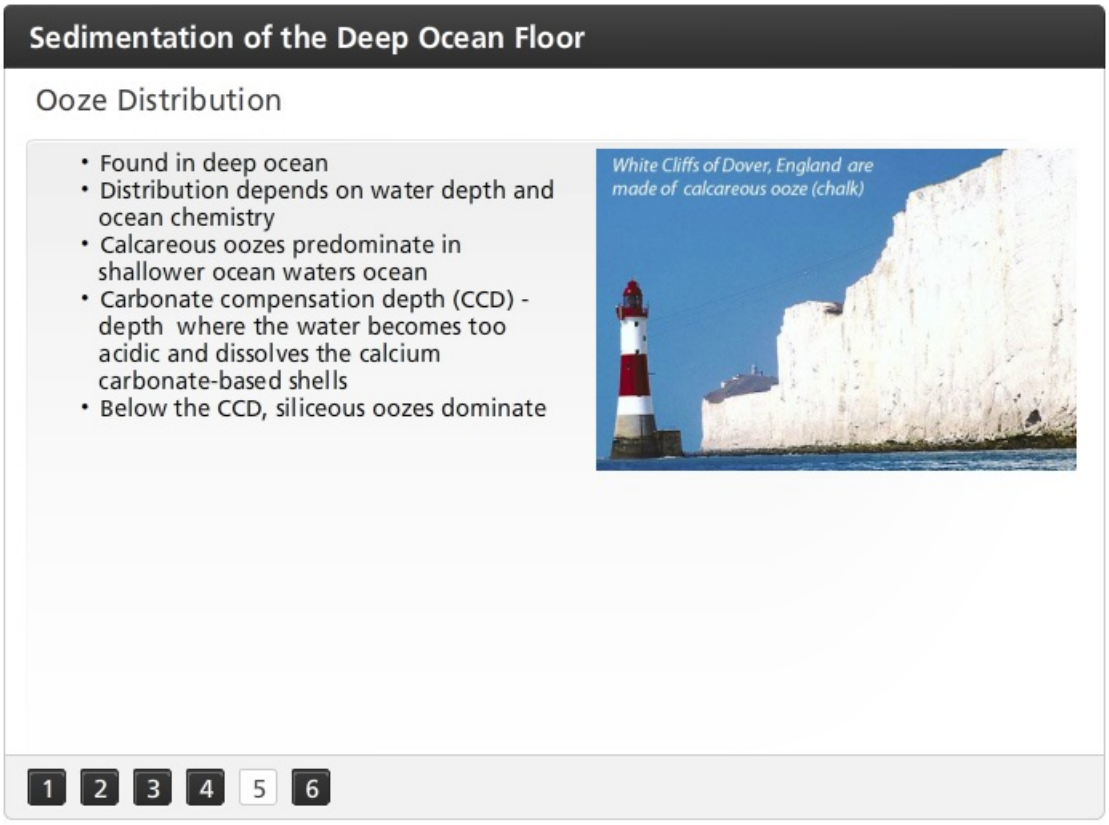

- Found in deep ocean
- Distribution depends on water depth and ocean chemistry
- Calcareous oozes predominate in shallower ocean waters ocean
- Carbonate compensation depth (CCD) - depth where the water becomes too acidic and dissolves the calcium carbonate-based shells
- Below the CCD, siliceous oozes dominate

Narration Script

Since most biological productivity is found on or around the continental shelf, you might expect these areas to be dominated by biogenous oozes. This is not the case because terrigenous sediments are deposited in much greater abundance in these regions.

The deep ocean contains most of the biogenous oozes, but they are not evenly distributed, even though the plankton that produce them are. Water depth determines whether calcareous or siliceous ooze predominates on the ocean floor. Calcareous oozes predominate in the shallow waters of the ocean, but beyond a certain depth, the water becomes too acidic and dissolves the calcium carbonate-based shells. The depth this occurs varies depending on the chemistry of the ocean, but is generally around fifteen thousand feet below sea level. The name for this depth is the carbonate compensation depth or CCD. Beyond the CCD, siliceous oozes dominate.

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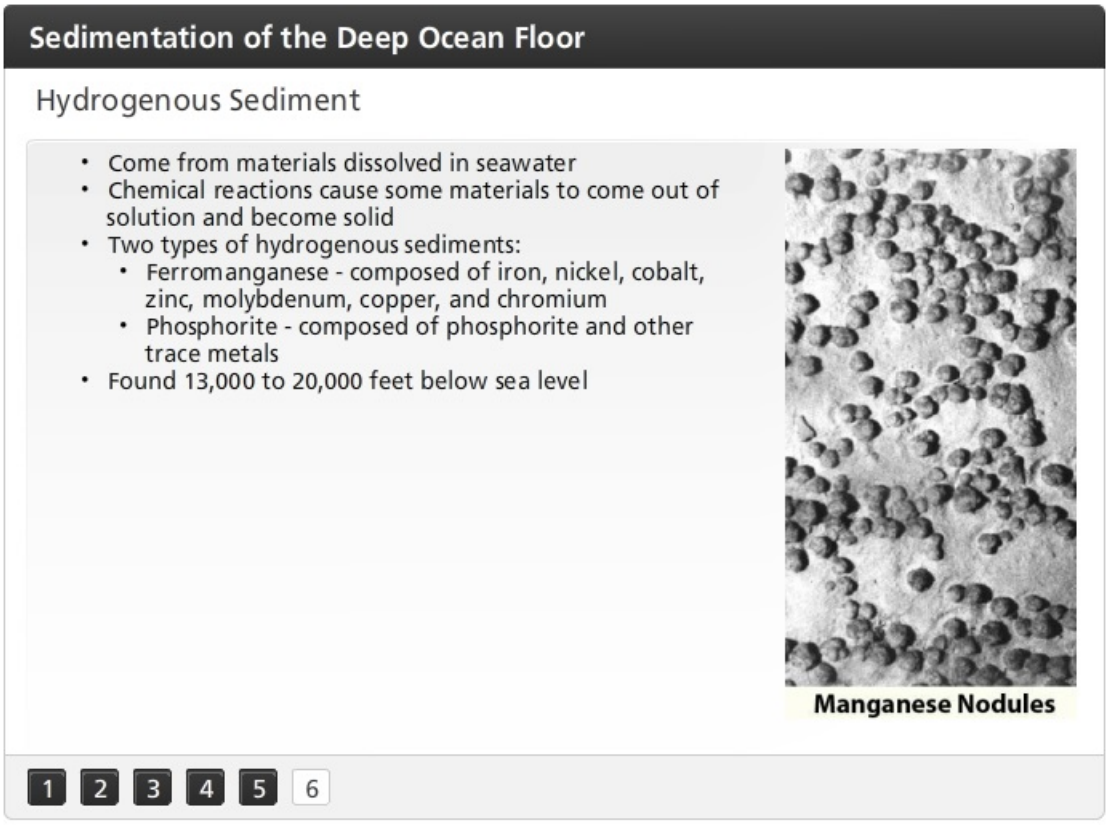

- Come from materials dissolved in seawater
- Chemical reactions cause some materials to come out of solution and become solid
- Two types of hydrogenous sediments:
  - Ferromanganese - composed of iron, nickel, cobalt, zinc, molybdenum, copper, and chromium
  - Phosphorite - composed of phosphorite and other trace metals
- Found 13,000 to 20,000 feet below sea level

Narration Script

Ocean water contains many dissolved materials. Chemical reactions can cause some of these materials to come out of solution and become solid. When this happens, the solid materials fall to the ocean floor and, over time, form hydrogenous sediment. These sediments form into nodules, most about the size of a baseball.

There are two types of hydrogenous sediments, ferromanganese and phosphorite named after the minerals of which they are composed.

Ferromanganese nodules are composed of iron, nickel, cobalt, zinc, molybdenum, copper, and chromium. Phosphorite nodules are made up of phosphorite and other trace metals. These nodules are found in deep water ranging from around 13,000 to 20,000 feet below sea level. They are very common in all oceans, although only at these depths. Scientists do not know how these nodules form and why they are not buried by biogenous sediment. Although they contain precious metals, the cost of recovering them from the ocean floor is currently too high to be profitable.