

Marine Snow

Lesson 1

Marine snow formation

Objectives

Students will learn about:

- Ocean zones
- Marine snow formation, role in ocean carbon cycle and ocean ecosystem

Materials

Access to the marine snow formation graphic

Background

As plants and animals (micro to macroscopic) die and decay near the ocean's surface, the resulting particles begin falling toward the seafloor. The decaying material is referred to as "marine snow" because it looks like falling snow.

Marine snow is a generic term applied to all sorts of small particles in the ocean falling to the seafloor. The small particles usually are made from waste (decomposing plants, animals and fecal matter), silt and other organic items washed from the land into the sea.

These small particles are slightly sticky because of the material they are made from (bacteria, phytoplankton, jellyfish tentacles, larvae, etc) and as they begin to sink, they can clump together with other small particles creating the "flakes" of marine snow, some reaching several centimeters in diameter. Some particles make it to the bottom, some are eaten by zooplankton and begin their cycle all over again. Some flakes fall for weeks before finally reaching to ocean floor. The flakes that reach bottom are not alone. Scientists who study marine snow estimate hundreds of millions of tons of marine snow coat the seafloor every year and can build to six meters (over 19 feet) deep approximately every million years. This natural cycle provides a source of food for deep water animals and an important component of the Earth's carbon cycle.

Procedure

- 1) Access the marine carbon cycle and marine snow graphic. (Graphic from Oak Ridge National Laboratory)
- 2) Use the graphic as a "roadmap" to help guide the research for answering assessment questions.

Assessment

- 1) What are the processes that move carbon from one oceans zone to another?
- 2) What processes move carbon from the atmosphere to the ocean sediments?
- 3) Describe the formation of marine snow.

Extension

The Carbon Cycle Game

(<http://coseenow.net/blog/2011/04/the-carbon-cycle-game/>)

Materials:

- Carbon Cycle Game Dice (Color or black and white)
- Scissors
- Scrap paper (optional but recommended)
- Tape
- String or lanyard (at least an 8" length per student)
- Pony beads (white, light blue, dark blue, light green, pink, dark green, orange, purple, grey, and brown; if not necessarily these, you will need 10 distinctly different colors)
- Cups (at least one for each station)
- Carbon reservoir Station Markers (Color or black and white)
- Carbon Cycle Game Worksheet (1 per student)
- Pencils or pens
- Unopened undisturbed bottle of seltzer or clear soda (optional)

Lesson 2

Marine Oil Snow

Objectives

Students will learn about the:

- Impact of oil spills - Marine Oil Snow (MOS) creation, transport and fate
- Impact on the environment
- “natural” formation of marine snow
- “MOS” formation
- Comparison of the two and impact on environment

Materials

- Mason jars with lids (enough to provide each student/group with four jars)
- Water (enough for 600 ml per jar)
- Salt (enough to create 35 ppm salt water)
- Sediment (enough for 20 g of sediment per two of the four jars)
- Vegetable oil (enough for 5 ml of oil for each jar)
- Filter paper
- Balance

Background

Sometimes the marine snow falling in the ocean is not so “pure”, as the stickiness of the particles can allow for the incorporation of other materials. For example, during the Deepwater Horizon event in 2010, unprecedented amounts of oil and chemical dispersant entered the Gulf of Mexico waters near the wellhead blowout. The incorporation of oil, residue from surface oil burns, and dispersants in marine snow created large amounts of MOS (Marine Oil Snow). The marine snow formed in these surroundings consisted of more and larger particles than usual, causing the marine snow to sink faster than normal through the water column and settle to the seafloor. It is estimated that up to 14% of the oil released at the wellhead was trapped in MOS (marine oil snow) and settled.

This caused several issues. Larger amounts and increased stickiness of marine snow created a thick “carpet” of snow in areas of the Gulf seafloor and because this snow contained large amounts of hydrocarbons and other chemicals, benthic organisms and organisms which feed on benthic organisms were exposed to greater concentrations of hydrocarbons. Scientists are studying the impact of the Deepwater Horizon and other oil spills to determine the long term impact of oil spills, and how oil interacts with marine snow and how it effects the ecosystem.

Procedure

Normally what determines whether something floats or not is its density. Crude oil has a density of about 58 pounds per cubic foot, and so floats on seawater, which has a density of 64 pounds per cubic foot. Most oils will float in either riverine or ocean water, however some oils have a higher density can sink in freshwater. Sometimes the density of an oil is so close to that of river water that the oil moves along the river partly underwater. When such oil finally moves into the ocean at the river mouth, it can refloat.

- 1) Obtain four mason jars with lids.

- 2) Fill one jar fresh water (fill to the 600 ml mark).
- 3) Fill one jar with salt water (fill to the 600 ml mark).
- 4) Fill one jar fresh water (fill to the 600 ml mark) and add 20 g of sediment.
- 5) Fill one jar with salt water (fill to the 600 ml mark) and add 20 g of sediment.
- 6) Shake all four jars to agitate and suspend the sediment in the water.
- 7) Quickly add 5 g (5 ml) of vegetable to each of the four jars.
- 8) Time how long it takes for the vegetable oil to separate and float back to the surface in each of the jars.

Jar	Fresh water	Salt water	Fresh water w/sediment	Salt water w/sediment
Time				

- 9) After all jars have settled, decant 400 ml of water into a separate beaker and pour the balance of water and sediment through a filter.
- 10) Weigh each filter.

Assessment

- 1) Which jar settled first? Which jar settled last? Explain why.
- 2) Which jar appeared to have more oiled sediment? Explain why.
- 3) Which filter weighed the most? Explain why.
- 4) How do you think a large oil spill can impact the benthic environment?
- 5) How do you think a large oil spill can impact the ocean carbon cycle?

Resources

The Loop – C-IMAGE podcasts (<http://www.marine.usf.edu/c-image/resources/media-player>)

- Episode 3

Educational Standards

NGSS

<http://www.nextgenscience.org/pe/hs-ess3-6-earth-and-human-activity>
<http://www.nextgenscience.org/topic-arrangement/hshuman-sustainability>