Production and shedding of tissues in sponges found to be slower than believed

November 30 2016, by Bob Yirka

The freshwater sponge Spongilla lacustris. Credit: Wikipedia/Kirt L. Onthank/CC BY-SA 3.0

(Phys.org)—A pair of researchers with the University of Alberta in

Canada has found that shedding and production of new tissue in sponges is much more complicated and slower than has been thought. In their paper published in the journal *Royal Society Open Science*, the researchers describe their multi-year study of sponges, what they found and what their findings might mean for future ocean management.

As we humans spew carbon dioxide into the air, the ocean continues to absorb some of it—one of the creatures in the sea that helps make that happen is the sponge. They collectively move carbon in seawater from the water column to the sea floor. Prior research has suggested that sponges are primitive creatures that rapidly produce and shed tissue, which is the means by which they send carbon to the bottom of the sea—the carbon gets into their bodies through pores and channels that the sponges use to filter water. In this new effort, the research pair has found that sponges are more complicated than believed, but they do not move as much carbon to the sea floor as has been thought.

To learn more about the role sponges play in ocean carbon transfer, the researchers collected samples off the coast of Vancouver Island and in the Strait of Georgia from 2011 to 2015. They then subjected the samples to a variety of experiments designed to better understand the process by which new cells are produced and dead material is shed.

The researchers discovered that cell division, as expected, was part of cell production, but they were surprised to find that some tissue was replaced via stem cells. They found also that the sponges did not shed nearly as much material as other reports have suggested, which they propose was likely due to observers attributing discarded fecal or mucus waste to shedding. Even more surprising, the researchers found that the rate at which cells were produced and discarded was seasonal. During warm summer months, the process moved rather swiftly, but it came to a virtual halt during the cold winter months.

The findings suggest that sponges do not move nearly as much carbon as prior research has suggested, which the researchers note could have an impact on climate change models.

More information: Amanda S. Kahn et al. The role of cell replacement in benthic–pelagic coupling by suspension feeders, *Royal Society Open Science* (2016). DOI: 10.1098/rsos.160484

Abstract

Benthic–pelagic coupling through suspension feeders and their detrital pathways is integral to carbon transport in oceans. In food-poor ecosystems however, a novel mechanism of carbon recycling has been proposed that involves direct uptake of dissolved carbon by suspension feeders followed by shedding of cells as particulate carbon. We studied cell replacement rates in a range of cold-water sponge species to determine how universal this mechanism might be. We show that cell replacement rates of feeding epithelia in explants vary from 30 hours up to 7 days, and change during different seasons and life-history stages. We also found that feeding epithelia are not replaced through direct replication but instead arise from a population of stem cells that differentiate and integrate into epithelial tissues. Our results reveal a surprising amount of complexity in the control of cell processes in sponges, with cell turnover depending on environmental conditions and using stem cells as rate-limiting mechanisms. Our results also suggest that for species in cold water with high particulate organic matter, cell turnover is not the mechanism delivering carbon flux to surrounding communities.

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