Oxygen loss in coastal waters: impact on geochemical cycles

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Coastal waters throughout the world are rapidly losing oxygen due to human-induced eutrophication and global warming. This deoxygenation is dramatically altering microbial pathways and geochemical processes in waters and sediments with major consequences for marine life. Prominent examples of such anthropogenic coastal "dead zones" include the Gulf of Mexico at the mouth of the Mississippi River and the Baltic Sea.

In my talk, I will discuss the impact of low oxygen in bottom waters on the cycles of key bioactive elements such as iron, phosphorus and sulfur using examples from modern coastal environments. I will specifically focus on processes at redox interfaces in sediments and how microbial communities in such transition zones may interact with and impact their environment. Examples will include the role of microbes in driving mineral dissolution and precipitation reactions in sediments and their role in preventing the escape of the greenhouse gas methane, the nutrient phosphorus and highly toxic hydrogen sulfide from sediments to overlying waters. I will also highlight recent discoveries that were made by applying a range of microbial and geochemical analyses, including synchotron-based X-ray spectroscopy, at high spatial resolution to coastal sediments. The implications of these findings for our understanding of the controls on water quality in coastal dead zones and their potential for recovery from low oxygen will also be discussed.