Cable bacteria and element cycling

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By conducting electrons through the sediment cable bacteria enable direct coupling between oxidation of sulfide at depth and reduction of oxygen at the sediment surface. Known cable bacteria are multicellular, filamentous Desulfobulbaceae and they appear to be widespread and often abundant in marine and freshwater habitats where they can influence element cycling strongly. Not only by their overall metabolism, but also by generation of large pH and electrical potential differences due to coupled oxidation and reduction processes being centimeters apart. The anaerobic anodic sulfide oxidation depletes porewater sulfide and may drive dissolution of iron sulfides with implications for transport and speciation of iron and possibly many trace elements. Observed deviations from conventional textbook expectations of sediment-water fluxes of oxygen and inorganic species of carbon, nitrogen and phosphorous have also been ascribed to cable bacteria activity in a variety of environments. For freshwater environments it has been proposed that cable bacteria may drive cryptic but intense sulfur cycles by rapid regeneration of sulfate within the sulfate reduction zone. The electric fields induced in the sediment influences the transport of all ions, resulting in skewed distribution of chemically inactive ions and enhanced or impeded turnover of reactive ions.

New tools and models have been developed to study and understand element cycling in sediments where cable bacteria might be active. It remains difficult, however, to forecast where and when they abound.