Cable bacteria create an FeOOH "firewall" against sulphide release from sediments

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Cable bacteria are long, filamentous bacteria that use long-distance electron transport to couple sulphide oxidation in deeper sediment horizon to oxygen reduction near the sediment-water interface ("electrogenic" sulphur oxidation). Recent studies demonstrate that cable bacteria are widely distributed in a variety of coastal habitats across the world, where they strongly influence the geochemical cycling. The spatial separation of the redox half-reactions over centimetre-scale distances leads to a substantial acidification of the pore water in the deeper sediment, which in its turn, stimulates the dissolution of iron sulphides (FeS) thus releasing large quantities of ferrous iron (Fe^{2+}) to the pore water. The Fe^{2+} subsequently partly diffuses upwards, and precipitates in the oxic zone to form a layer rich in iron(hydr)oxides (FeOOH).

Recently, a field study in a seasonally hypoxic system proposed that this FeOOH-layer induced by cable bacteria activity could act as a chemical "firewall" against euxinia (presence of toxic H_2S in coastal waters). The idea is that the FeOOH accumulates in the sediment in winter and spring, when the O_2 in the bottom water is high and the cable bacteria show intense metabolic activity. Due to its high affinity for H_2S, FeOOH subsequently prevents the release of H_2S from the sediment in summer, when the bottom water O_2 levels drop. Here, we tested the strength of the FeOOH firewall by collecting natural sediment at different times throughout the year in a seasonal hypoxic basin. Sediment cores were incubated under anoxic conditions, and the effluxes of H_2S and Fe^{2+} from the sediment were monitored at high temporal resolution over a long time period. Cores with recent cable bacteria activity revealed a high stock of FeOOH in the surface sediment and delayed the efflux of H_2S (euxinia) for up to 102 days, thus showing that the FeOOH firewall is highly effective. Our results demonstrate that the FeOOH firewall mechanism could exert an important control on the prevalence of euxinia in the modern coastal ocean, and so cable bacteria can be considered true microbial ecosystem engineers.