Cable bacteria enhance iron driven dissimilatory nitrate reduction to ammoium in estuarine sediments

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The recent discovery of electrogenic sulfur oxidising bacteria ('cable bacteria') has fundamentally changed how we view many redox reactions within sediments. One of the most conspicuous impacts of these organisms is the generation of acidiy within the anoxic zone of the sediment leading to the dissolution of FeS, resulting in high concentrations of dissolved Fe^{2+} within the sediment porewater. To date, however, it is unclear how the bacteria influence the nitrogen cycle. We hypothesised that the presence of cable bacteria is likely to increase dissimilatory nitrate reduction to ammonium (DNRA) through two possible mechanisms. 1. Through direct reduction by cable bacteria themselves, or 2. Through an indirect mechanism where DNRA is driven by Fe^{2+} oxidation. We undertook experiments with repacked sediments to investigate how cable bacteria influenced the relative rate of NO_3^- reduction to NH_4^+ (DNRA) and N_2 (denitrification). The results showed that 1. DNRA was significantly higher in sediments with cable bacteria present compared to a control with no cable bacteria. 2. There was no difference in DNRA in the presence of live cable bacteria and those with their metabolism inhibited (by cutting the sediment). This suggests that the effect on the nitrogen cycle was through an indirect mechanism related to the presence of cable bacteria rather than direct metabolism by the cable bacteria themselves. Furthermore, it was found that the proportion of nitrate reduced to ammonium was significantly related to the dissolved Fe^{2+} content of the sediment, supporting the hypothesis that the observed enhancement of DNRA was due to increased concentrations of Fe^{2+}.