Cable bacteria activity in Mn/Fe depleted marine carbonate deposits

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Filamentous cable bacteria can conduct long-distance electron transport between oxygen reduction and sulfide oxidation over centimeter scales in marine, salt marsh and freshwater sediment. The electron donor sulfide can be derived from iron sulfide dissolution and/or sulfide diffusion from remote anoxic zones. In this work, we demonstrate that cable bacteria can also occur in Mn/Fe depleted carbonate sediment from Florida Bay. Carbonate sediment obtained from Florida Bay was homogenized and incubated for three weeks at 22°C. The distribution dynamics of oxygen, pH, and H_2S in the sediment were quantified by using planar optical sensors, and cable bacteria filament abundances were evaluated with microscopy. Our results showed that sulfide contacted the sediment surface where it was directly oxidized by oxygen on day 1, and the elevated H_2S moved downwards with time. Oxygen and sulfide were separated by ~1.5 cm at day 7, while a pH maximum band developed just below the sediment surface, implying a redox reaction of oxygen and sulfide coupled by long-distance electron transport. Because there is no Fe or Mn- sulfides available in the sediment, sulfide diffusion from depth was the main sulfide source. Microbe counting also showed that cell filament abundances were maximum at 1.5-2 cm depth while the pH band was maximally elevated. However, the pH maximum band disappeared after 18 days incubation, cable bacteria abundances decreased and H_2S distribution moved upwards. Our results demonstrated that the cable bacteria can be elevated in sediment in the absence of redox sensitive Mn and Fe, with response and duration times of 1 – 3 weeks.

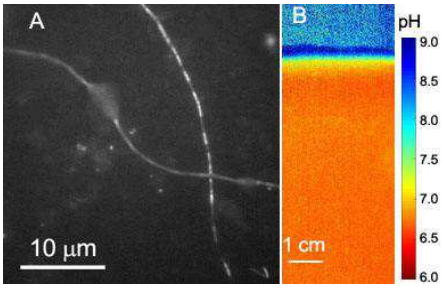

Fig. 1. 7 days incubation: (A) cable bacteria filaments. (B) 2-dimensional pH distribution.