DIVERSITY AND NATURAL DISTRIBUTION OF ELECTRICITY-GENERATING CABLE BACTERIA IN THE SEAFLOOR

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Background

Recently, novel long multicellular filamentous bacteria, so-called "cable bacteria", have been discovered in sulphidic marine and freshwater sediments [1,2]. Cable bacteria mediate electron transport over the length of the bacterial filament across centimeter-scale distances in the sediment [3,4]. These bacteria belong to the family Desulfobulbaceae and currently comprise six candidate genera [5]. Geochemical evidence and 16s rRNA genes sequences indicate that cable bacteria occur globally [6].

Electrogenic sulfur oxidation

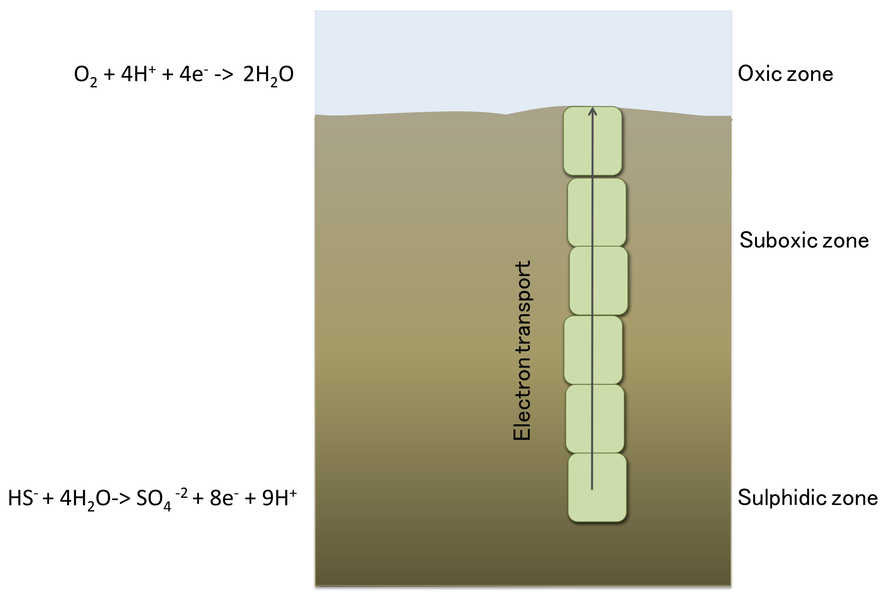

Figure 1. Mechanism of electrogenic sulfur oxidation with

- Spatial separation of two redox reactions
  - -The oxidation of sulfide in deeper layers (anoxic layers)
  - -Reduction of oxygen at the sediment surface
- Coupling of these reactions through long-distance electron transport

Global distribution of cable bacteria

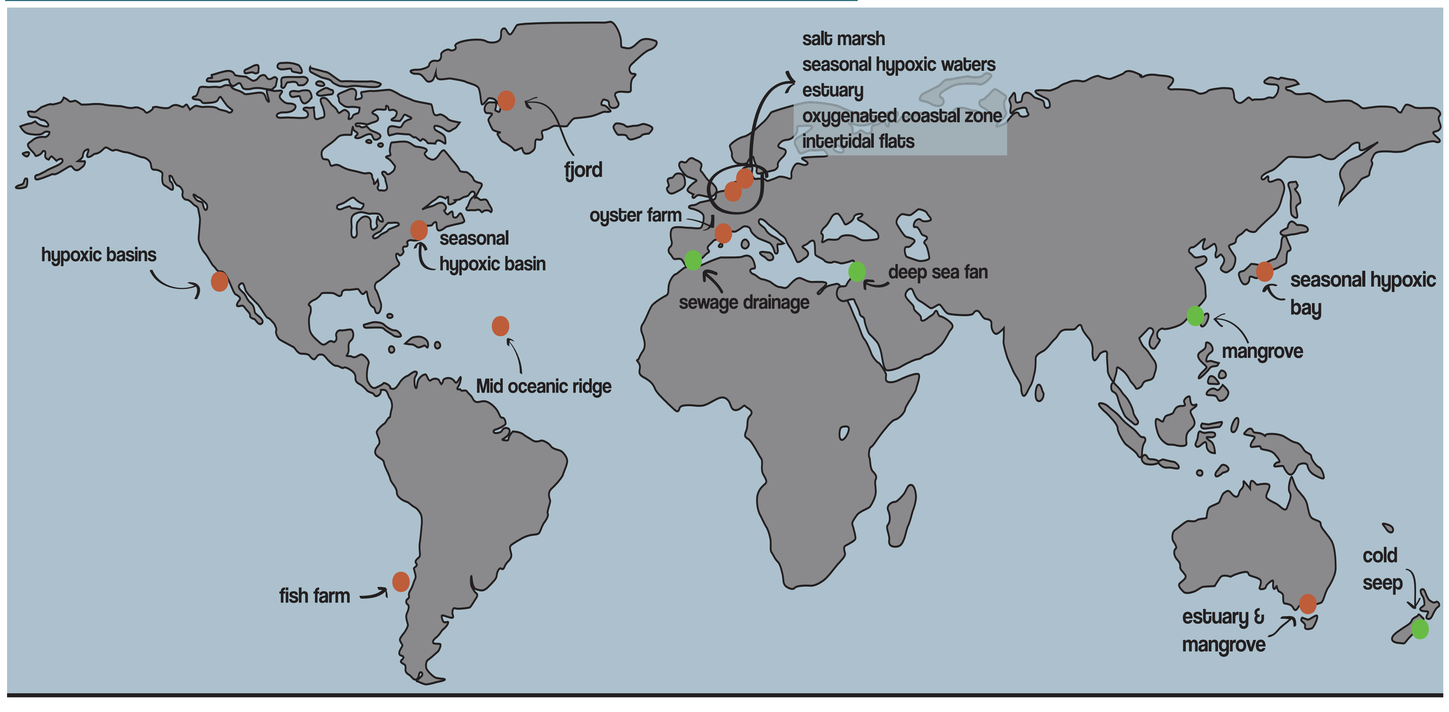

Figure 2. Cable bacteria have been found worldwide in sulphide-rich sediments [6].
- Presence based on geochemical evidence
- Presence based on 16s rRNA gene sequences retrieved from the NCBI database

This study

- To investigate cable bacteria phylogenetic diversity and affiliation to uncover evolutionary and biogeographic relationships
  - Sequencing of the 16s rRNA gene of cable bacteria detected at different locations
- To gain a better understanding of cable bacteria distribution in the natural environment
  - Observing the growth of cable bacteria over time and space in sediment from an estuary in Melbourne, Australia.

Methods

Fluorescence in situ hybridization

To detect and quantify the abundance of cable bacteria

- Using a probe for the family Desulfobulbaceae
- Evaluating if the cells have the filamentous growth form of the cable bacteria

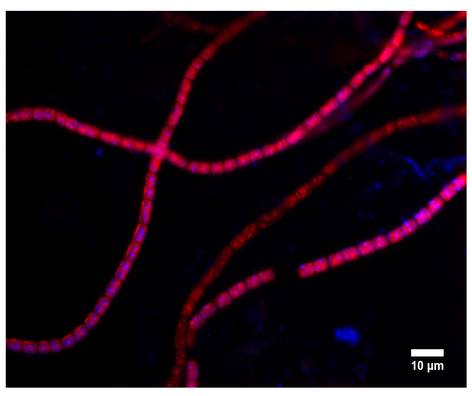

Figure 3. FISH image of cable bacteria

Implementing New protocol quickHCR-FISH [7].

Why?

- Difficulties with the detection of microorganisms in sediments
- Increased fluorescence signal
- Multiple fluorescent labels hybridized per cell

Sequencing of 16s rRNA gene

- Full-length sequences
- Phylogenetic affiliation and relationships
- Taxonomic delineation

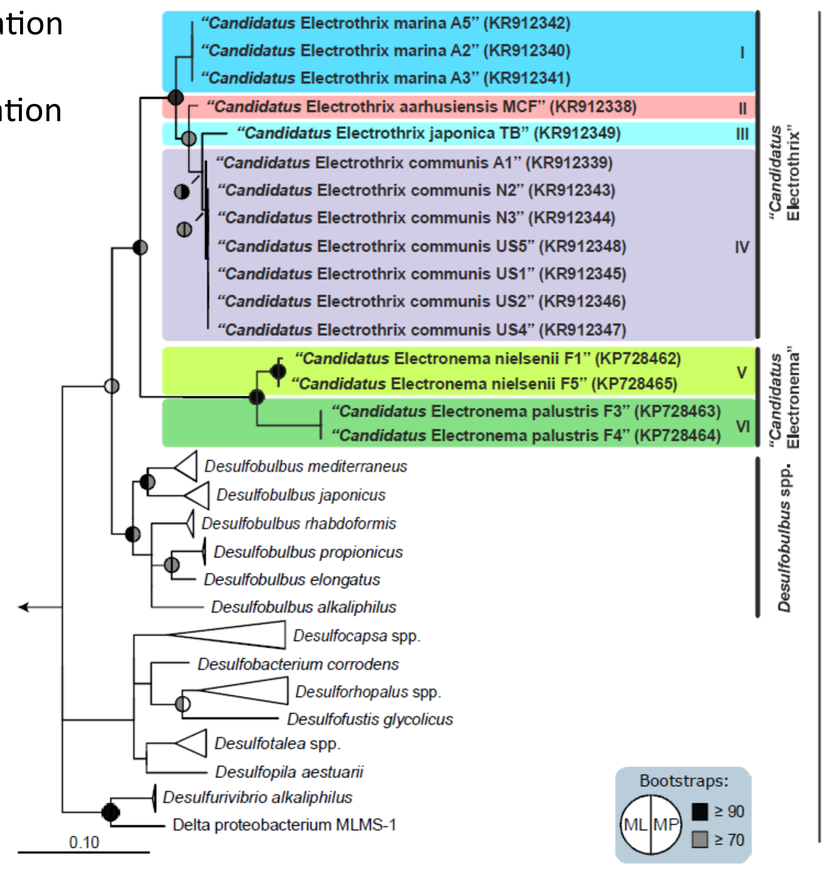

Figure 4. Consensus tree of full-length 16s rRNA gene sequences of the cable bacteria [5]. Proposed candidatus species are indicated with different colors.

Expected results

- Phylogenetic diversity of cable bacteria
  - -Extending the current number of full-size 16S rRNA gene sequences
  - -Better insight in the phylogenetic affiliation and evolutionary relationships of cable bacteria
- Abundance quantification at different depths
  - - Distribution profiles in the sediment from an estuary in Melbourne, Australia

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