Extended abstract

Brilliant Marine Research Idea 2022

This extended abstract is part of the full report which should be submitted no later than 28 February 2023 via filantropie@vliz.be. Data of this specific final report are under embargo and are therefore are not yet published online.

1. General information

Title of the idea	Response of marine microbial communities to an electrical highway shut
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2. Brilliant Marine Research Idea

Extended abstract

Cable bacteria are filamentous sulfide-oxidizing bacteria of which a single filament consists of tens of thousands of cells and may reach a length of up to 7 cm. Intriguingly, they are unique in their capacity to generate large electrical currents over centimetre-scale distances. These cable bacteria can be seen as ecosystem engineers that create an ‘electrical ecosystem’ and their unique ‘electrical’ metabolism has a large impact on the geochemistry of the sediment. Cable bacteria oxidize sulfide in the deeper sediment and spatially separate the redox reaction by reducing oxygen as an electron acceptor in the top layer of the sediment. This creates a flow of electrons or an ‘electrical highway’. In recent years, cable bacteria diversity has been studied in more detail revealing a high variety in the 16S rRNA gene and a large number of new species. However, the occurrence of possible interactions between cable bacteria and other members of the microbial community is still unclear.

Therefore we analysed the effect of the “shutdown of the electron highway”. This was done by cutting the sediment horizontally and thus physically cutting the cable bacteria. In addition to microsensor profiling to gain information on the geochemistry, we extracted DNA and RNA from above and below the cut. We analysed the full 16S rRNA genes in the sediment using the latest nanopore sequencing chemistry. This allows us to build a database and map the 16S rRNA V3-V4 amplicon sequences performed on the rRNA. Furthermore, we analysed the effect on the microbial community as well as the effect of cable bacteria activity.

Our results show that the cutting of cable bacteria decreases the activity in the lower parts of the sediment. Interestingly, in some cases, the top layer became more active after cutting compared to the control cores. Moreover, the microsensor profiles show a lower pH, indicating that cable bacteria are more active and V3-V4 amplicon data showed a higher abundance of cable bacteria 16S rRNA amplicons above the cut. Using the nanopore-generated full 16S rRNA gene sequences we were able to assign sequences up to species level, whereas amplicon sequencing variants are shorter and often do not provide sufficient resolution for this. Combining full 16S rRNA gene sequencing with V3V4 rRNA analysis can give us new information on the effects of cable bacteria on the activity of other members of the microbial community and can therefore help unravel interactions between cable bacteria and other microorganisms in the sediment. The data suggest that cable bacteria can become more active with disturbance and this might explain the boom and bust cycle of cable bacteria activity that we often see in both environmental and experimental set-ups.