Response of marine microbial communities to an electrical highway shut down

Van Dijk Jesper[1] and Meysman Filip[2]

[1] Geobiology, Department of Biology, University of Antwerp, Universiteitsplein 1, 2610 Antwerpen
E-mail: jesper.vandijk@uantwerpen.be

[2] Department of Biology, University of Antwerp, Universiteitsplein 1, 2610 Antwerpen

Cable bacteria are filamentous sulfide-oxidizing bacteria of which a single filament consists of up to 10,000 cells and reaches lengths 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 a '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 have been investigated in closer detail revealing a high variety in the 16S genome with new species. However, the effect of the changes in geochemistry and possible interactions are unclear.

Therefore we analysed the effect of the "shutdown of the electron highway". This was done by cutting the sediment sideways 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 using the latest nanopore sequencing chemistry for better quality. 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 control cores. Moreover, the microsensor profiles show that cable bacteria are more active, due to a lower pH and higher count in 16S activity. Using the nanopore we were able to assign up to species level, whereas ASV often lack this information. This can give us new information on the effects on microbial community. This suggests that cable bacteria can become more active with any disturbance and might explain the boom and bust cycle we often see in both environmental and experimental set-ups.

Keywords
Cable Bacteria; Nanopore; Amplicon Sequencing; Microbial Community; Electrical Ecosystem