Denitrifying bacterial mats and their carbonate precipitation capacity

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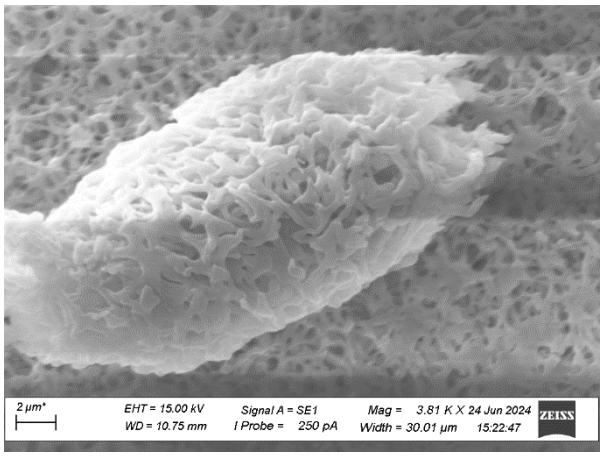
Project description

Bacterial denitrification involves the oxidation of organic carbon by reduction of nitrate, allowing carbonate precipitation when an alkaline pH and dissolved inorganic carbon (DIC) are accumulated. Denitrification is typically encountered in terrestrial and marine ecosystems, and in engineered settings for Microbial-Induced Calcium Carbonate Precipitation (MICP) generation, it has been explored as a nature-based alternative for soil reinforcement, self-healing concrete applications, and calcium removal in wastewater technologies.



In this project, we explore the fundamentals of MICP occurring in denitrifying bacterial mats (biofilms). We will be examining if the growth of carbonates can be steered while we manipulate the development of bacterial biofilm at the same time. To do so, experiments using pure cultures of *P. denitrificans* will be developed where bacterial growth and the accompanying changes will be monitored by regular sampling. Measured parameters will include concentrations of nitrate, DIC, and calcium; along with measurements of pH and optical density (OD). The growth of biofilm will be inspected using optical microscopy. The produced carbonates will be investigated using scanning electron microscopy (SEM) coupled to energy-dispersive X-ray spectroscopy (EDS), X-ray diffraction (XRD), and Fourier-transform infrared spectroscopy (FTIR). In this project, we expect to gain fundamental knowledge of the biofilm influence in carbonate nucleation.

The assistant will be involved in research discussions, and primarily, in experimental development during the setup, sampling, and microscopy observations. The activities will be mostly developed at the GeoLab located in the Vening Meineszgebouw, and sporadically at the David de Wiedgebouw. At the end of this project, the assistant will gain knowledge and lab skills at an interdisciplinary level which can be applied in diverse disciplines such as bioengineering, environmental science, geochemistry, geology, etc.

Job requirements

- *Fundamental laboratory skills (preferred knowledge: sampling and preparation of samples, this can also be gained during lab training)*
- *Background or interest in bioscience / bioengineering*
- *Interdisciplinary ambitions*