Carbon cycling in benthic diatom mats: Novel applications of LC/IRMS

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Life on our planet is based on carbon and this life-sustaining element is essential in order to live, grow and reproduce. The cycling of carbon from the atmosphere, land and ocean into organisms, and back again needs to be in balance. If not, serious consequences, such as global climate disruption, may result. Benthic diatoms are main-contributors to the carbon cycle in coastal zones, and provide the basis of the marine food web and fix large amounts of the greenhouse gas CO₂. Understanding the function of benthic diatoms and their involvement in the carbon cycle will enhance our knowledge of ecosystems, and it will be important to predict effects of future environmental conditions (e.g. predicted sea level rise). Hence, the development of analytical methods to enable the study of carbon cycling in marine ecosystems in a detailed way is crucial.

Is there a methodology to track the production and fate of carbon fixed by benthic diatoms in specific biochemical pools (e.g. carbohydrates, amino acids, lipids, and nucleic acids)? Are there seasonal changes that affect the physiology of diatoms by a different partitioning of fixed carbon between major biochemical pools? Do associated heterotrophic bacteria benefit from the organic matter released by the diatoms? Does the seasonal variation of diatom exudates play a role in shaping the composition of the community of the associated heterotrophic bacteria? These questions and others are addressed in this PhD thesis.

The atmospheric CO₂ concentration has risen in the past century (mostly due to the use of fossil fuels) and the carbon cycle became unbalanced: climate disruption is a fact. In order to prevent worse, the society has to search for alternatives for fossil fuels and a sustainable use of natural resources. My wish is that this PhD thesis inspires to combine fundamental and applied research to develop sustainable alternatives. Marine microorganisms produce a huge diversity of molecules and even unique compounds (e.g. essential lipids and amino acids, enzymes, raw materials for polymers, and many others). Therefore, multidisciplinary research is urgently required in order to uncover marine organism specialties: the hidden treasures of the sea!