Reconstructing past pCO_2 variability based on carbon isotope fractionation in dinoflagellate cysts

Single specimen $\delta^{13}C$ analysis of dinocysts using laser ablation-IRMS

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Project description

Laser ablation (LA) nano-combustion (nC) gas chromatography (GC) isotope ratio mass spectrometry (IRMS) (LA-nC-GC-IRMS) is a state-of-the-art IRMS technique that allows for stable carbon isotope ($\delta^{13}C$) analysis of individual palynomorphs, such as pollen and dinoflagellate cysts (dinocysts). Considering that different dinoflagellate species have specific seasonal affinities, and that substantial short-term changes in carbon cycling occur on seasonal timescales (summer blooms, winter deep mixing), these single-specimen measurements can provide insights into past short-term carbon cycling and enable investigations of past population structures based on carbon isotope ecology (e.g., distinguishing winter vs. summer or inner- vs. outer-neritic bloomers). Furthermore, stable carbon isotope fractionation (ε_p) in dinoflagellates is forced by pCO_2, which means the $\delta^{13}C$ measurements of dinocysts can be used to reconstruct past marine and atmospheric pCO_2.

In this Bright Minds Assistantship project you will sample individual dinocysts from sedimentary samples on species level, and assist in performing LA-nC-GC-IRMS measurements on dinocysts. You will work on modern samples (core-top and/or sediment trap) to help quantify the ε_p-pCO_2 relationship, and on geological samples (e.g., the early to middle Eocene transition, ~53 – 47 Ma) to aid in reconstructing past pCO_2 variability and dinocyst carbon isotope ecology.

Job requirements

-Student must have affinity for working in the lab (experience preferred but not required)
-Attention for detail
-Affinity with micropaleontology and microscope work
-A steady hand
-Sufficient knowledge on organic stable carbon isotopes and carbon isotope fractionation
-Knowledge on mass spectrometry (preferred)
-Knowledge (e.g. taxonomic) of dinoflagellate cysts (preferred)