"Garnet signature" systematics and the structure of oceanic lithosphere

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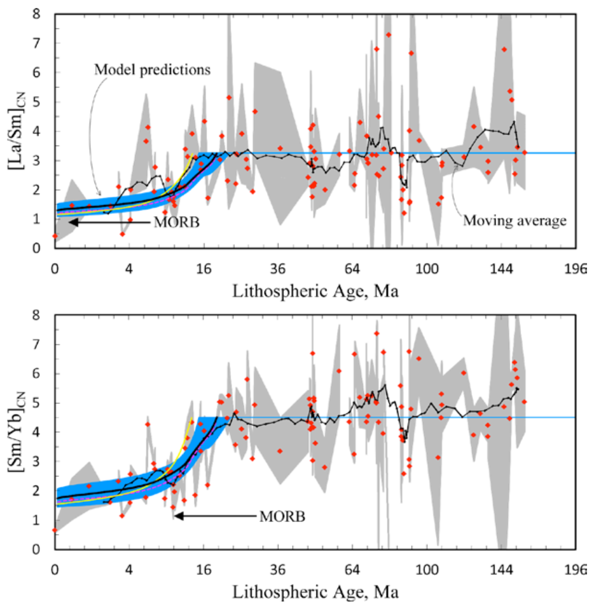
Humphreys and Niu [1] showed that a geochemical database of 115 volcanic islands revealed trends in elemental systematics following the thickness of oceanic lithosphere. After performing corrections to lithospheric age estimates for volcanic islands we find that the trend with age is substantially more apparent. Specifically, we focus on La/Sm and Sm/Yb systematics, elevated values of which are thought to be a function of the presence of garnet in the melt source. The trend is not a simple function of lithospheric thickness. Values of these ratios are low for young ages (<15 Ma) and abruptly jump to a higher value which is constant over older seafloor.

To explain this structure, we combining a new thermal plate model of the oceanic lithosphere with a thermodynamic assessment of garnet stability to estimate relative values of La/Sm and Sm/Yb as a function of lithospheric age. We hypothesize that the transition to high La/Sm and Sm/Yb at ~15 Ma occurs because the LAB intersects the garnet stability field at ~50 km depth at this age. Models are in excellent agreement with observations.



[1] Humphreys and Niu (2009) *Lithos* **112**, 118-136.

Effects of nutrients on compound specific carbon fixation in phytoplankton

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The coastal waters of the North Sea have been affected by eutrophication over the past decades and subsequent efforts to reduce riverine nutrient loads resulted in a major shift in N:P:Si nutrient ratios. The consequent changes in the limiting resource can alter the biochemical composition of phytoplankton and translate through the food web, affecting its structure, functioning, and consequently the carrying capacity of an ecosystem.

Stable isotope tracers are widely used to estimate primary production in many ecosystems. However, beyond total carbon uptake rates limited emphasis is given to investigate into which of the major cellular compounds (amino acids, fatty acids, carbohydrates and DNA/RNA) the fixed carbon is allocated. Since all these compounds have different C:N:P requirements resource limitations should affect their biosynthesis differently.

We combine GC-c-IRMS and LC-IRMS approaches to trace stable isotope incorporation into major cellular components, such as amino acids, fatty acids and carbohydrates, and determine their concentrations and biosynthesis rates. We applied these methods to stations in the North Sea, where different nutrients are limiting.

The contributions of macromolecules to total biomass as well as their synthesis rates differ substantially between stations and the phytoplankton communities respond differently to nutrient additions by re-allocating fixed carbon to other macromolecules on short timescales (24 hours). Though still preliminary, we hope that this work will allow us to infer changes in phytoplankton stoichiometry and consequent food web changes.

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