Silicon isotopes in biogenic opal as a window into modern and ancient oceans

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Dissolved silicon, silicic acid, is an essential nutrient for several marine organisms that contribute to carbon uptake and cycling in the oceans. The major oceanic sink of silicic acid is the production of biogenic opal by diatoms, which are photosynthetic algae that make their intricate shells from amorphous silica. Diatoms contribute towards a significant proportion of the export of organic carbon out of the surface waters into the deep-ocean and marine sediments. Other organisms utilise silicic acid in order to construct skeletons, such as planktonic radiolarians and benthic sponges.

The development of silicon isotope analysis in seawater and biogenic opal has led to advances in our understanding of the silicon biogeochemical cycle over the last two decades. With the improvement in analytical capability and modelling efforts, there have been step changes in our understanding of water column processes, biogenic uptake of silicon, and the use of silicon isotopes, and other stable isotope systems, in opal to reconstruct past changes in nutrient cycling.

Here, I will be exploring some of the new developments in the use of silicon isotopes as archives of nutrient cycling including a new cases study from the last glacial termination. Combined downcore diatom-spicule records hold great promise for the reconstruction of water column silicon cycling in the past, constraining not only silicon input and availability but also uptake and utilisation in surface waters.