A 30ka Sponge-Diatom Silicon Isotope Record of Dissolved Silicon Concentration in Subantarctic Mode Water

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Here we present silicon isotope records for biogenic sponge ($\delta^{30}Si_{sponge}$) and diatom ($\delta^{30}Si_{diatom}$) silica from Southern Ocean sediments. For two cores located in Subantarctic Mode Waters (SAMW) on the Campbell Plateau, NZ, we observe a decrease in $\delta^{30}Si_{sponge}$ values from the late Holocene through to the mid-deglacial period. From the mid-deglacial $\delta^{30}Si_{sponge}$ values increase through to the LGM. $\delta^{30}Si_{sponge}$ results for a core located within Antarctic Intermediate Waters (AAIW) generally follow the same trend during the Holocene, but are consistently and expectedly more negative than the shallower SAMW values. During the deglacial period the difference between Intermediate Water and Mode Water depth $\delta^{30}Si_{sponge}$ is variable suggesting large changes in silicon utilisation within the Subantarctic Zone during this time. A diatom silicon isotope record ($\delta^{30}Si_{diatom}$) from the Macquarie Ridge, located further south and upstream of the sponge records, suggests a similar degree of silicon utilisation between the Holocene and the LGM and higher utilisation for a short period during the deglacial.

Modelling dissolved Silicon concentration ([DSi]) in SAMW from a comparison of the Macquarie Ridge $\delta^{30}Si_{diatom}$ and Campbell Plateau $\delta^{30}Si_{sponge}$ records we find that [DSi] in SAMW may have been 100-150% higher in the LGM compared to the Holocene, which is consistent with the Silicic Acid Leakage Hypothesis. This prediction however is not corroborated by a model using a more distal Indian Ocean $\delta^{30}Si_{diatom}$ record for the comparison, pointing towards significant regional differences in SO Silicon dynamics over this period.

Dynamics of chemical characteristics of solubilized organic matter in wetland soils under aerobic or anaerobic conditions.

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Soil organic matter plays an important role in the release and potential transport of metal(loid)s[1,2]. Wetlands are a large terrestrial carbon pool, thus understanding the chemical quality of dissolved organic matter (DOM) in wetland soils is crucial.

Controlled incubations of a wetland soil (Roselle catchment, France) were carried out under aerobic and anaerobic conditions (simulating temporarily and permanently flooded soil). Solubilized organic matter was quantified and characterized. Anaerobic incubation involved strong releases of dissolved organic carbon (DOC) to the soil solution (2 mg of C per g of soil), which was correlated with an increase of solution pH (from 6.0 to 7.3) and Fe reduction. In contrast, aerobic incubation (preventing soil reduction) at pH 6.0 induced a smaller DOM release (0.8 mg of C g per g of soil). Released DOM under both experimental conditions had an increasing trend in aromaticity* with incubation time. Indeed after 500 h of anaerobic incubation, DOM exhibited aromaticity of 60% whereas the aromaticity of DOM released in aerobic experiment was 40%. Using size exclusion chromatography coupled to UV and fluorescence detection, three main size fractions (labeled i, ii, iii) of released DOM were identified. The first fraction (i) with an apparent molecular weight (aMW) >10kDa was constituted of protein-like compounds and had a disappearance trend with incubation time. The second fraction (ii) with an aMW from 1kDa up to 10kDa, exhibited aromatic characters and was composed of a mixture of protein-like and humic substances-like compounds. The fraction (ii) had an increasing trend with incubation time with a higher release of humic substances-like compounds under anaerobic conditions. The third fraction (iii) with an aMW <1 kDa, composed of protein-like and humic substances-like compounds, had a decreasing trend with incubation time whatever experimental conditions.

In conclusion, evolution of DOM solubilization in reduced wetland soils comparing to DOM released under aerobic conditions is different in terms of chemical characteristics and of MW distribution.

[1]Frimmel and Huber, 1996; [2]Grybos et al., 2009; *calculated according to Weishaar et al., 2003

www.minersoc.org
DOI:10.1180/minmag.2013.077.5.18