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Biogeosciences Discussions

Interactive comment on "Silicon stable isotope distribution traces Southern Ocean export of Si to the eastern South Pacific thermocline" *by* G. F. de Souza et al.

Anonymous Referee #2

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The manuscript by G. F. de Souza et al. (bg-2012-172) is the first presentation of delta 30 Si (d30Si) along a meridional section through the southeast Pacific Ocean, from the Southern Ocean to about 1000km south of the equator. So far only few d30Si observations exists in the ocean and the paper is doing a good job in introducing the data set and exploring possible interpretations of the observed signals. They pay sufficient attention to analytical aspects of the data set as well as in discussing accuracy/reproducibility of the data.

The interpretation focuses on the possible transport pathways (advection, mixing) of water masses that could potentially explain the d30Si distribution. This discussion

incorporates recent literature in a sufficient way. One focus is on the transport of d30Si associated with the formation and spreading of SAMW/AAIW and the homogeneity of d30Si in the deep water of the Pacific. The lack of data in the equatorial region gives a certain part of the discussion a more preliminary character, but this shortcoming can not be solved unless more d30Si samples in key regions, such as the equatorial regions, are collected. The authors sufficiently discuss this problem. I have a question regarding the interpretation of the effect of the seasonal mixed layer cycle on the d30Si distribution that should be clearified.

I would hope that future studies will for example utilize the potential of d30Si in combination with Si and dissolved nutrients, e.g. to learn more about the contribution of remineralization on the Si distribution.

Some specific comments:

Abstract line 7 to 9: “The efficient....” - what do you mean by “annual winter convection” - is it the maximum convection depth in winter? (also section 5.1.1.) I have problems in following the logic here. I would assume that entrainment from below during the winter convection will dilute the high d30Si that was established during the productive seasons. Interannual variability in mixed layer depth will modify the dilution effect (more diluted for deeper mixed layers). With the re-stratification in spring the water is exported to the interior (as is the d30Si signature). The spreading along isopycnals communicates the signal equatorwards, in alignment with the subtropical gyre circulation. The problem with the mixed layer model is that it requires a source of lower d30Si that compensates in the annual mean for the “enrichment” for incorporating high d30Si – otherwise the mixed layer d30Si would increase asymptotically towards the high d30Si values.

Page 6418, line 3: “isopycnal control” - the isopycnals do not control the distribution but the physical processes that act preferentially along the isopycnals such as lateral transport or advection along isopycnals

BGD

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Table 1 – longitudinal range is wrong, should be 103°W (not 130°W)

Interactive comment on Biogeosciences Discuss., 9, 6409, 2012.