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Si isotopic constraints on the Si cycle in a watershed under high anthropogenic pressure (Scheldt, Belgium)

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The Scheldt watershed represents an extreme case of surface water and groundwater pollution. Ecosystem perturbations result from changes in the nutrient balance with N and P being in excess with respect to Si. Contrary to N and P, the terrestrial Si cycle is poorly constrained. Recent studies show evidence of a complex cycle involving soil-plant-water as well as non-negligible anthropogenic sources. In order to better understand the Si cycle in such watershed we analysed the Si isotopic compositions (d30Si) in the Scheldt freshwater estuary and its main tributaries sampled in winter and summer 2003. Between Ghent and Antwerp (only 80 km apart), winter d30Si signatures exhibit a large shift from + 1.4 up to + 0.7 pmil while dissolved Si (DSi) vary only from 250 to 220 μM. The Dender, a tributary 25 km downstream Ghent, exhibits a d30Si of 1.3 pmil close to the Scheldt signature in the area. The other tributaries, in the eastern zone, bear lighter d30Si (0.4 – 1 pmil) and are probably at the origin of the d30Si measured downstream at Hemiksen and Antwerp (0.7-0.8 pmil). Overall the winter d30Si data set displays an unusual negative correlation with DSi, similar to a pelagic or lake ecosystem, likely resulting from a major biological imprint. But such large isotopic variations in a relatively small area are unexpected, especially in winter. Indeed no significant diatom blooms have occurred before the winter sampling as evidenced by the monitoring of biogenic Si content in contrast to what is observed in summer. These results will be confronted with anthropogenic pressures, soil-plant and river processes and, with water signatures in pristine areas of the upper watershed (forests). They will be compared with other watersheds and discussed in a more global

view on changes of continental Si fluxes and d30Si signature supply to the ocean.