Glaciers as a missing source of silicon to the world's oceans

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Silicon is an essential nutrient for diatoms, who use it to build their cell frustule. These organisms play an important role in the fixation of atmospheric CO_2. They are responsible for ~40% of total oceanic primary production, and are thought to be one of the most efficient exporters of carbon to the deep ocean [1]. As a result, they are believed to have played a key part in controlling past climatic change [2]. Recent research indicates that glaciers may export significant quantities of nutrients to downstream ecosystems [3-5]. Enhanced silicate dissolution has been postulated to occur in ice sheet subglacial environments [6], therefore it seems logical that silicon export from ice sheets to near coastal regions may be high. Although a number of silica budgets have been constructed for the oceans [7] [8], only one includes potential ice sheet influence, and the data used is limited [9]. Here we discuss the importance of the Greenland and Antarctic ice sheets in the global silicon cycle. Presented is a detailed timeseries of dissolved and amorphous particulate silicon concentrations from subglacial meltwaters exciting two glacial catchments of the Greenland Ice Sheet. We highlight the importance of a labile amorphous silicon phase in meltwaters, with significant export of silicon across a salinity gradient. We also present the first concentrations of iceberg derived silicon, with large silicon export to the open ocean likely. Budgets for ice sheets reveal a new, large component of the global silicon cycle.

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