Clastic coasts: an overlooked term of the geochemical Si cycle?

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Abstract

Batch experiments were conducted to simulate the weathering of quartz grains submitted to the wave agitation of the beach surf zone. Static and dynamic experiments (W/R from 0.8 to 1.75, and speed rotation from 170 to 230 rpm), sized in order to reproduce the energy communicated to the sediment by the waves, were performed. Chemical and mineralogical data collected during the course of the experiments permit to decipher the two simultaneous steps of the weathering phenomena: lifting and dissolution of the particles mediated by the water agitation. The dissolution rate in agitated media is between 4 and 9 times more rapid than in the static one. A physico-chemical model allowed the calculation of the quartz mass transfer coefficient, which is related to the wave dissipation energy. This new Si flux, named "lithogenic input", which designate the contribution of the clastic coasts to the Si ocean budget could be as important as 6 Tmol/yr. Consequently, the residence time of Si in the ocean (estimated ca 10 000 yrs) could be considerably reduced.