Catalysis of CO_2 sequestration by reaction with limestone can keep up with global anthropogenic emissions

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We have developed a new technique to sensitively measure the dissolution rate of carbonate minerals. 13C labeled solids are placed in undersaturated solutions and the rate of d13C increase of the dissolved inorganic carbon provides a direct meausre of mass loss with time. Adding the bovine form of Carbonic Anhydrase greatly increases the rate of carbonate dissolution indicating that direct attack of carbonic acid at the mineral surface is probably an important part of the dissolution mechanism.

The increased rate can be driven to the diffusion limit. If this works at the industrial scale, the reaction of CO2 and limestone can be used to neutralize anthropogenic emissions. Running the reaction in seawater provides a way to 'fix' CO2 before returning it to the environment. As the reaction produces alkalinity and total carbon in a 1:1 ratio, there will be minimal impact on the inorganic carbon chemistry of the surface ocean. We have built a prototype reactor that bubbles CO2 into either DI or seawater and passes the CA inoculated solution through a bed of calcium carbonate. Initial experiments show that this appartus opperates at the predicted rate increases determined from the 13C based lab experiments. Our new work provides a feasible way to safely store all of the human emited CO2 in the oceans and bring atmospheric CO2 levels down to preindustrial values.