

Effect of Ocean Acidification on the Speciation of Metals

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The continued production of CO_2 from the burning of fossil fuel is estimated to increase the pCO_2 in the atmosphere to 2000 μatm by the year ~2300. About 40% of the CO_2 put into the atmosphere is adsorbed by the Oceans. The equilibration of the CO_2 in the atmosphere with surface ocean waters will decrease the pH from the present value 8.1 to 7.4 (this is called Ocean Acidification). A number of workers have examined how this decrease in pH can affect the production and dissolution of calcareous organisms in ocean waters. This decrease in the pH of seawater will decrease the concentrations of OH^- and CO_3^{2-} in surface waters, respectively by as much 82 and 77%. One would also expect that the concentration of reactive organic ligands will also decrease as the pH is lowered. Since these anions form strong complexes with divalent and trivalent metals, their decrease will increase the concentration of the free or uncomplexed metals in seawater. This increase in the concentration of free metals in seawater will affect chemical equilibrium and kinetic reactions in the oceans. Metals like Cu^{2+} will be more toxic to plankton and bacteria. Fe^{3+} will be more soluble and Fe^{2+} less reactive to oxidation with O_2 and H_2O_2 . These two effects will make iron more available to phytoplankton. This paper will examine the effect of the decrease of pH on the speciation of a number of metals in ocean waters and speculate on how this will affect processes in the oceans.