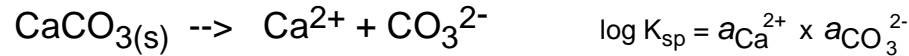


## Reactions for the dissolution of CaCO<sub>3</sub>

The ultimate fundamental chemical expression of the dissolution of CaCO<sub>3</sub> is this reaction:

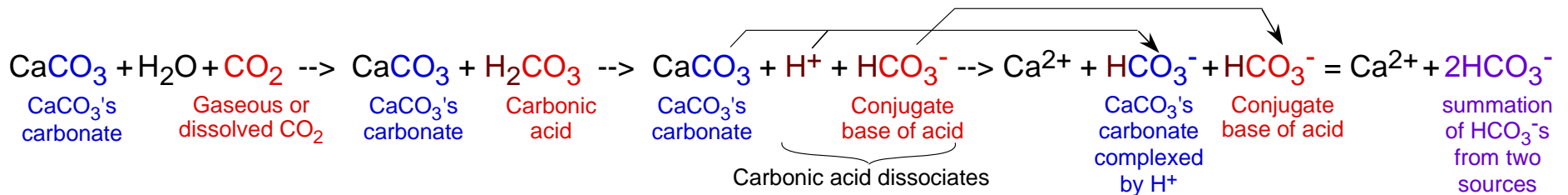


However, the most abundant form of inorganic carbon in most natural waters is HCO<sub>3</sub><sup>-</sup> rather than CO<sub>3</sub><sup>2-</sup>. Thus, to understand natural processes, the better chemical expression for the dissolution of CaCO<sub>3</sub> is this reaction:

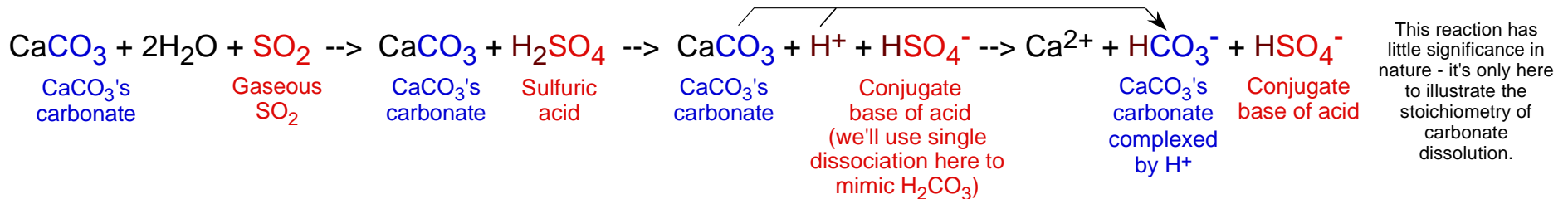


This reaction helps explain why CO<sub>2</sub> drives dissolution of CaCO<sub>3</sub> in karst settings or on the abyssal sea floor.

One should realize the two bicarbonate ions produced have very different origins. One comes from the CaCO<sub>3</sub> and one comes from the CO<sub>2</sub>:



The reaction above is sometimes perplexing, because addition of C as a reactant in CO<sub>2</sub> helps destroy another C-bearing reactant, CaCO<sub>3</sub>. CO<sub>2</sub> destroys the CaCO<sub>3</sub> because the CO<sub>2</sub> makes carbonic acid. Consider this hypothetical alternate reaction with SO<sub>2</sub> rather than CO<sub>2</sub>:



In the reaction just above, we can keep track of the calcite's anion and the acid's conjugate base because they are different (HCO<sub>3</sub><sup>-</sup> and HSO<sub>4</sub><sup>-</sup>). On the other hand, in the carbonic acid reaction above, the two are stoichiometrically

indistinguishable. However, the two sources of carbon may be very different isotopically, especially if the gaseous CO<sub>2</sub> comes from plant respiration or decay of plant litter and if the CaCO<sub>3</sub> is a marine limestone.