



## **Carbon isotope tracing of CO<sub>2</sub> sequestration during CaCO<sub>3</sub> precipitation induced by ureolytic bacteria**

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The scientific interest in precipitation of calcium carbonate induced by ureolytic bacteria is increasing, owing to its potential use for decontamination of aquifers. So far, published studies have shown that contaminants are immobilized in calcite formed during bacterial hydrolysis of urea through coprecipitation. Still unexplored remains the application of ureolytic bacteria carbonation in the field of CO<sub>2</sub> sequestration. We undertook a pioneering isotope study on CO<sub>2</sub> sequestration into dissolved inorganic carbon (DIC) and calcite formed during hydrolysis of urea induced by *Bacillus pasteurii* in artificial groundwater (AGW). We run experiments of bacterial ureolysis under aerobic and anaerobic conditions and measured the  $\delta^{13}\text{C}$  values of DIC and calcite crystals formed in the course of the reaction. Precipitation of calcite starts immediately at the onset of ureolysis and ends when 50% of urea has been hydrolyzed. Calcite crystals collected at the end of precipitation exhibit  $\delta^{13}\text{C}$  values between -54 and -57 permil and result 1 to 3 permil heavier than DIC. No difference in  $\delta^{13}\text{C}$  values is shown between calcite crystals precipitated under aerobic conditions and those precipitated under anaerobic conditions. When 100% of urea has been hydrolyzed, the  $\delta^{13}\text{C}$  values of DIC formed during anaerobic ureolysis range between -42 and -44 permil, whereas the  $\delta^{13}\text{C}$  values of DIC formed aerobically are about 30 permil heavier. This significant <sup>13</sup>C enrichment of the DIC formed during aerobic ureolysis possibly reveals that atmospheric CO<sub>2</sub> (which has a typical  $\delta^{13}\text{C}$  value by -7.8 permil) was sequestered in the AGW solutions as DIC.