

# SEMINAR

Research Talks from the Resnick Fellows



**RESNICKINSTITUTE**  
science + energy + sustainability



Adam  
Subhas

Resnick Grad. Research Fellow

## Catalysis and Chemical Mechanisms of Calcite Dissolution in Seawater

Near-equilibrium dissolution of calcite in seawater contributes significantly to the regulation of atmospheric  $\text{CO}_2$  on thousand-year timescales.

Despite the large number of studies on far-from-equilibrium dissolution, little is known about the detailed mechanisms responsible for dissolution in seawater. In this talk, I will show results from an isotope tracer-based approach to measure dissolution rates across a range of saturation states. The most surprising result from these experiments is that the enzyme carbonic anhydrase (CA) increases the dissolution rate by almost 2.5 orders of magnitude, and the effect is most pronounced close to equilibrium. CA can be a catalyst for carbonate dissolution through several different potential reaction mechanisms, not only equilibrating  $\text{CO}_2$  and  $\text{H}_2\text{CO}_3$ , but also through its catalytic protolysis of water. Speciation modeling leads us to believe carbonate ion sites are significantly more complexed in seawater than freshwater, and could play a major role in the chemical dissolution mechanism in seawater.

I also describe briefly results of a new flow-through reactor system aimed at engineering catalyzed carbonate dissolution to become an effective carbon storage technology.



Michael  
Haibach Ph.D.

Resnick Postdoctoral Scholar

## Sustainable Catalysis with Late Transition Metal Complexes: Asymmetric Dehydrogenation and Template Pincers

I will discuss the development of a non-symmetrical catalyst capable of asymmetric dehydrogenation of alkyl groups, a reaction with significant potential for the sustainable production of fine chemical intermediates. I will also present recent work on a new catalyst design which seeks to combine the advantages of pincer and pendant amine ligands for heterolytic  $\text{H}_2$ -activation catalysis.

3:00 to 4:00 pm | Wednesday, 11/2/16  
Guggenheim 101, Lees-Kubota Lecture Hall  
Caltech Campus | [resnick.caltech.edu](http://resnick.caltech.edu)

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