

## **LDEO Climate Center Proposal: Mono Lake CO<sub>2</sub> Exchange Rate**

David Ho, Wade McGillis, and Wally Broecker

### *Abstract*

Based on measurements of <sup>14</sup>C commencing in the late-1950's, the <sup>14</sup>C inventory of Mono Lake has increased about ten-fold faster than expected. A whole lake SF<sub>6</sub> tracer experiment conducted in the late-1980's confirmed that air-water gas exchange of inert gases was close to canonical estimates based on wind speed over the lake. The most plausible hypothesis for the rapidly increasing <sup>14</sup>C values is that air-water CO<sub>2</sub> exchange is enhanced due to either the high pH of the lake ( $\approx 9.8$ ) or the very high biological productivity measured in the lake. In particular, carbonic anhydrase released by the abundant brine shrimp and/or algae might be the culprit. Preliminary experiments were conducted in Mono Lake in August 2006 to determine the enhancement rate of air-water CO<sub>2</sub> exchange over inert gases (N<sub>2</sub>O and O<sub>2</sub>) in both Mono Lake (at low winds) and in a circular wind-wave tank shipped to the site and filled with Mono Lake water. These preliminary experiments yielded an enhancement factor of 3 to 4 at low and medium wind speeds. While the enhancements at low wind speeds are in accord with theory of chemical enhancement due to hydration reactions of CO<sub>2</sub> with OH<sup>-</sup>, the enhancement at intermediate winds is surprising and might point to biologically mediated processes. In November 2006, we will return to Mono Lake to conduct further experiments to cover a range of wind speeds. A total of nine experiments will be conducted in a three-day period. In each experiment, the CO<sub>2</sub> exchange rate will be compared with other gases (N<sub>2</sub>O and O<sub>2</sub>), while SF<sub>6</sub> will be used to leak test the apparatus. Also, by carrying out measurements at a different time of year, the roles of high pH and carbonic anhydrase may be determined.