calculated from DIC, Alk vs. measured pH
Saturation state (aragonite)
umol CaCO$_3$/day

sampling point

ambient
ambient control
HCO$_3$
HCO$_3$ control
Container effects

![Graph showing the relationship between date and alkalinity (umol/kg). The x-axis represents dates from 7/21 to 10/9, and the y-axis represents alkalinity values from 2120 to 2260.]
Ammonia

• At normal seawater pH values, ammonia exists predominately as \( \text{NH}_4^+ \), which does not contribute to Alk

• For example, at \( S=39.9, T=23.9, \text{Alk}=2468, \text{pH}=7.91 \)
  – \( \text{DIC}=2209.8 \) if no \( \text{NH}_3 \) is present
  – \( \text{DIC}=2208.3 \) if 38 umol/kg \( \text{NH}_4^+ \) present

• More significant at higher pH
Ammonia production

  – \((\text{CH}_2\text{O})_{106}(\text{NH}_3)_{16} + 106 \text{ O}_2 \rightarrow 106 \text{ CO}_2 + 90 \text{ H}_2\text{O} + 16 \text{ NH}_4^+ + 16 \text{ OH}^-\) - adds alkalinity
  – Nitrification may then reduce alkalinity

• Coral example
  – Measured alkalinity uptake 50umol/d
  – Ammonia increase 18umol/d
  – 25\% of total rate