

Discussion of mollusc larvae and coral experiments

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Mollusc larvae experiment

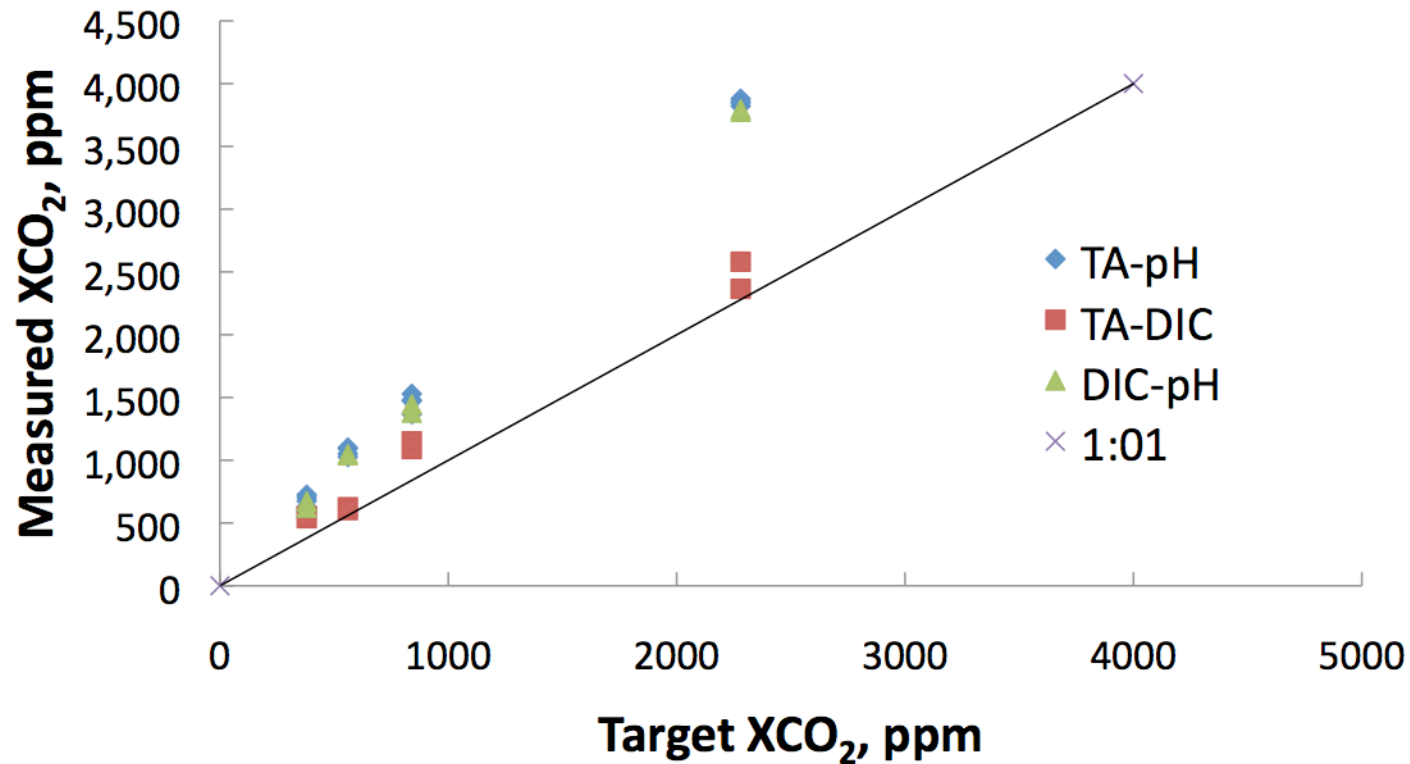
- ??? Larvae were placed in x containers that were then bubbled with ambient air, or air-CO₂ mixtures of 560, 840 and 2280 ppm for four days.
- On day 1 and 4 water samples for TA, DIC and pH (electrode method) were withdrawn to document the carbonate chemistry in each treatment.
- The calcification rate of the larvae was estimated from the change in TA.
- On day four the larvae, some of which had metamorphosized into ????, were observed under the microscope.

Results –carbonate chemistry

Calculated at 25°C using Merhbach K1 and K2 and Dickson KHSO4

Treatment, ppm	HCO ₃ , umol/kg	CO ₃ , umol/kg	pH _T	Ω _a	pCO ₂ , uatm	XCO ₂ , ppm
Ambient	1756.6	146.5	7.92	2.37	530.9	556.5
560	1840.2	145.9	7.89	2.35	595.4	614.3
840	1936.8	91.6	7.65	1.46	1085.6	1119.9
2280	2077.7	47.4	7.34	0.76	2397.5	2473.4

Comparison of target and measured XCO_2 (partial pressure of CO_2 in dry air)



Mollusc calcification rate

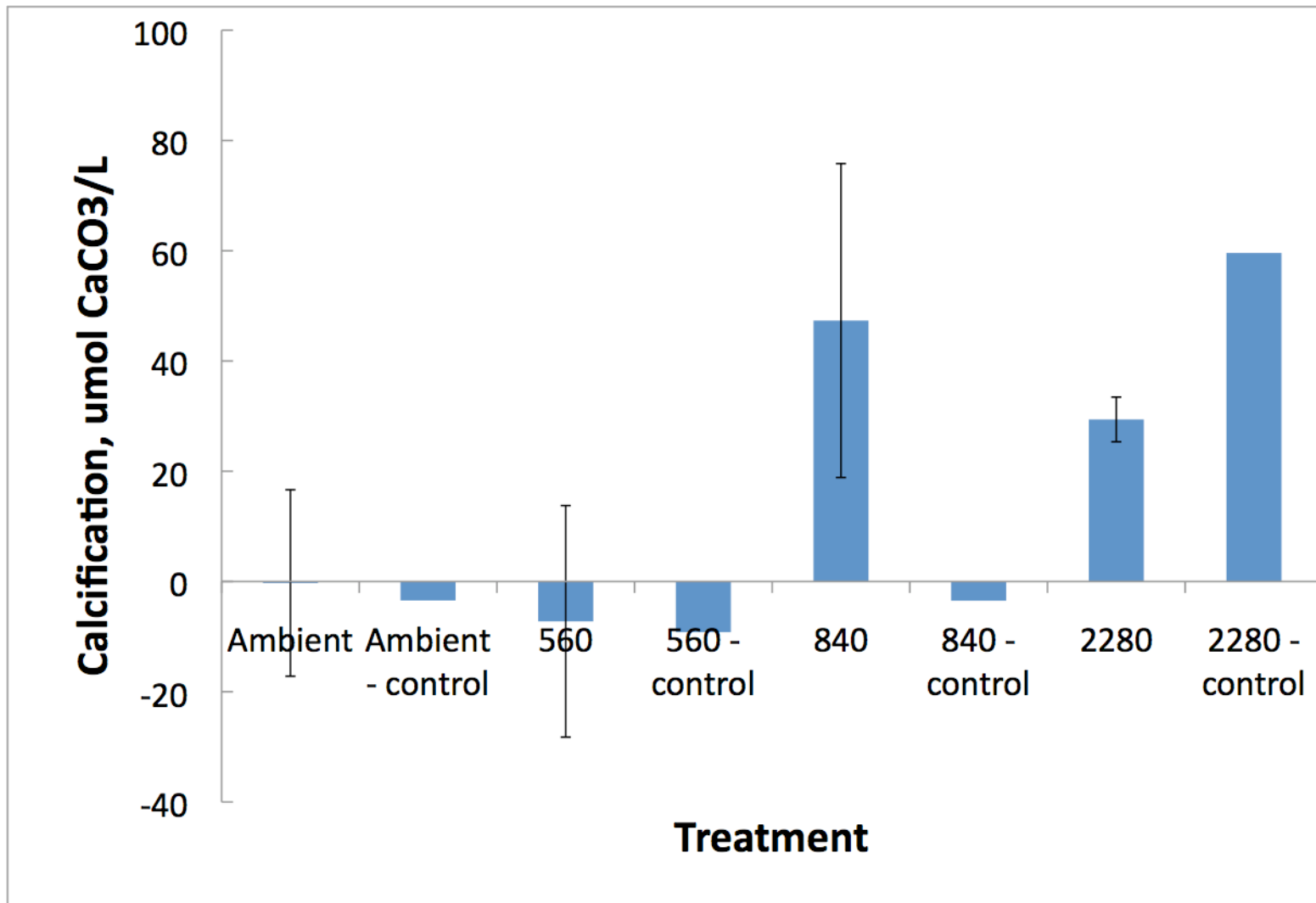
$$G = -0.5 * (\Delta nTA) \quad \text{Salinity normalized TA}$$

Treatment	Day 1 nTA	Day 4 nTA	Calcification, umol/kg/4 d	SD, umol/kg/4 d
Ambient	2337.6	2338.1	-0.3	16.9
Ambient-control	2336.6	2343.4	-3.4	
560	2340.6	2354.7	-7.2	21.0
560-control	2337.9	2356.3	-9.2	
840	2363.9	2269.2	47.3	28.5
840-control	2341.7	2348.6	-3.5	
2280	2349.1	2290.3	29.4	4.0
2280-control	2373.9	2354.7	59.6	

2360±44 2332±31
 -28±54 uEquiv/kg
 -14±27 umol CaCO₃/kg

Error propagation Uncertainty in $G = 0.5 * \sqrt{SD1^2 + SD2^2}$

Mollusc larvae calcification rates



Coral calcification experiment

- One small colony of *Astrangia poculata* was placed into 15 containers of seawater
- Containers 1-5 and 11-15 were controls
- Approx. 1000 μmol of NaHCO_3 was added to containers 6-10
- All containers were bubbled with ambient air
- Samples were taken from the containers four times over a two day period.

Effect of adding HCO_3 on carbonate chemistry

Treatment	TA, $\mu\text{mol/kg}$	DIC, $\mu\text{mol/kg}$
Control	2104.3 ± 15	1883.0 ± 17
+ HCO_3	3015.6 ± 17	2603.6 ± 6
Difference	911.3 ± 23	720.6 ± 18

Measured changes in TA and DIC are less than expected from the addition of $1000 \mu\text{mol/kg HCO}_3$

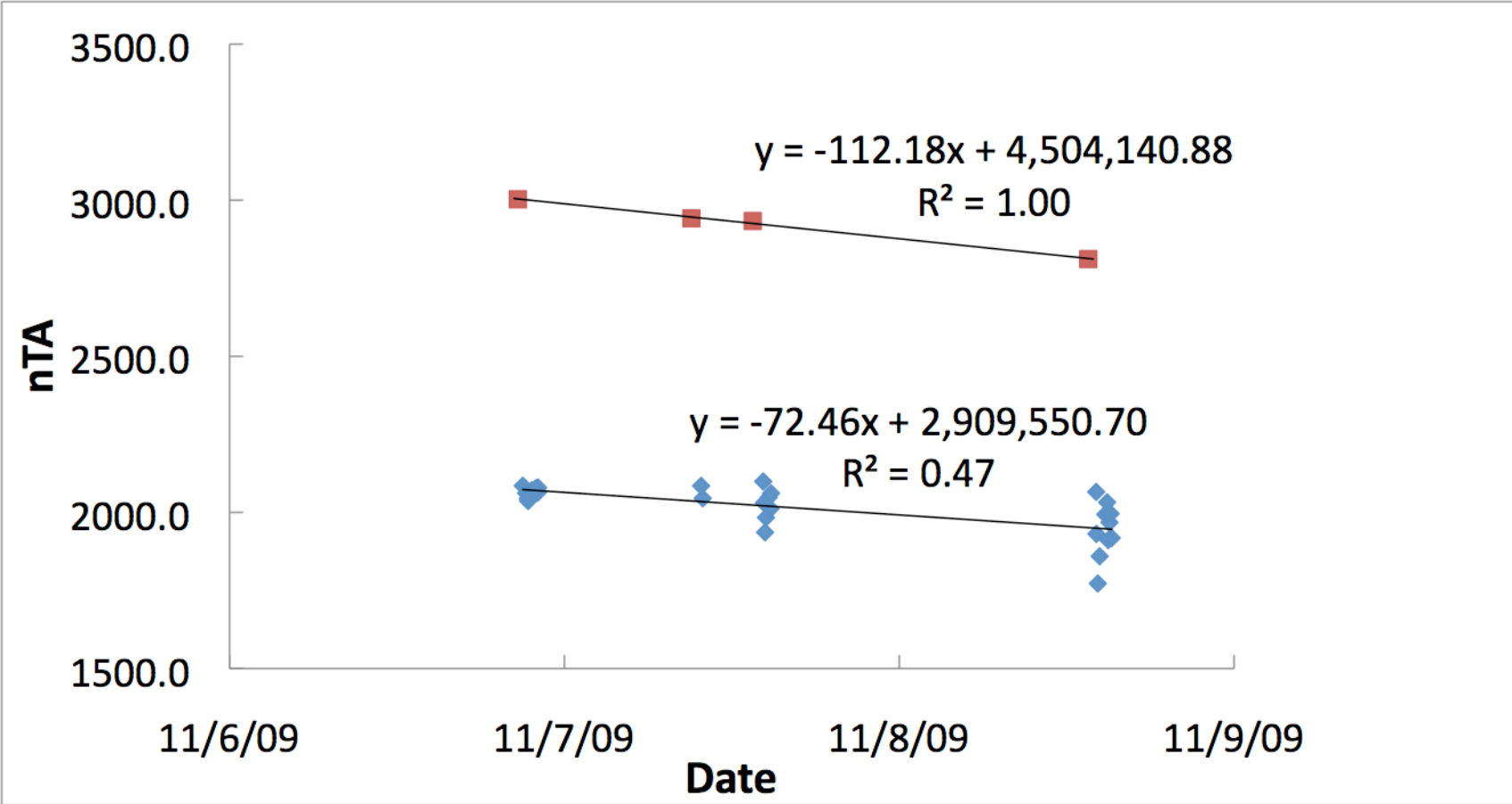
Comparison control and treatment chemistries on Day 1

Computed at 25°C using Merhbach K1 and K2 and Dickson KHSO_4

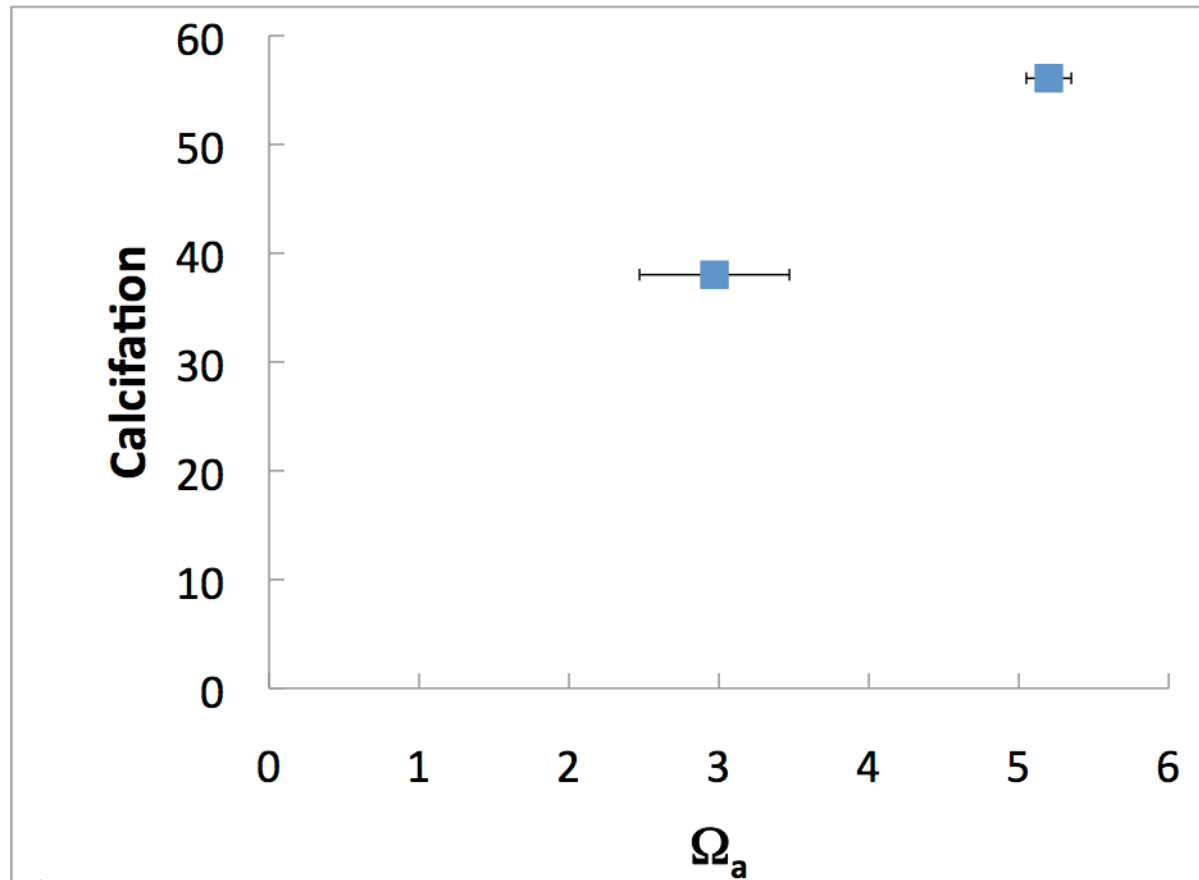
Treatment	HCO_3^- , umol/kg	CO_3^{2-} , umol/kg	pH_T , computed	pH_T , Spec method	Ω_a	XCO_2 , ppm	DIC, umol/kg
Ambient	1713.4	156.0	7.96	7.99	2.52	488.5	1883
+HCO3	2271.0	321.1	8.16	8.14	5.21	413.1	2604
Difference							721

Note that spec and pH computed from TA and DIC agree to 0.02 pH units

Changes in nTA in the control and HCO_3 spiked containers



Coral calcification as function of saturation state



$G = -0.5 \cdot \text{slope of nTA vs } t$