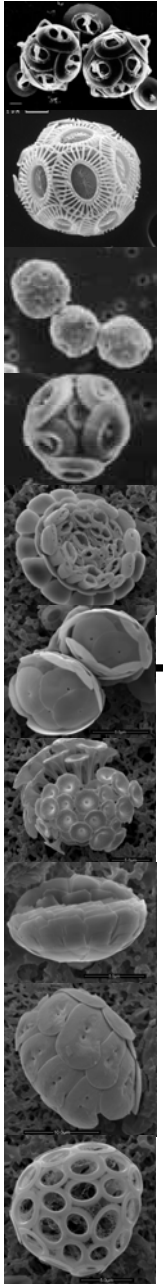
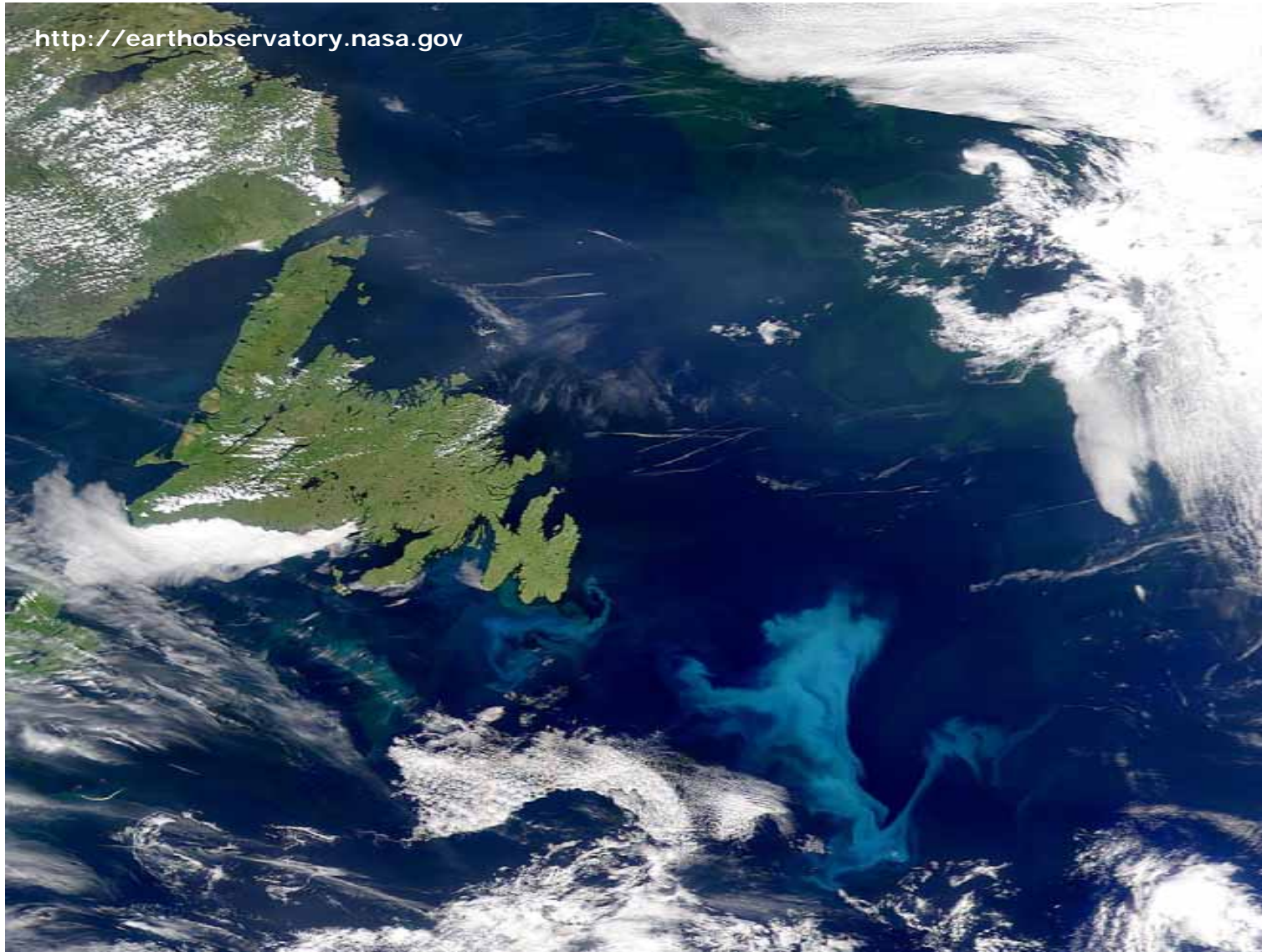


Influence of high CO₂ on coccolithophores under long-term cultivation

M. N. Müller, K. G. Schulz and U. Riebesell

Introduction



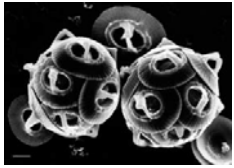
~ 280 species

Introduction

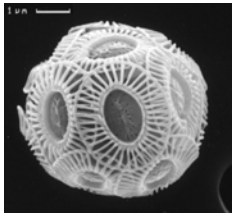
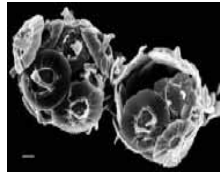
ambient
 $p\text{CO}_2$



high
 $p\text{CO}_2$



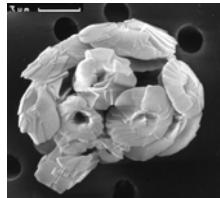
G. oceanica



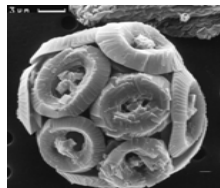
E. huxleyi



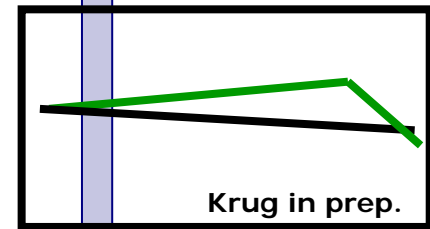
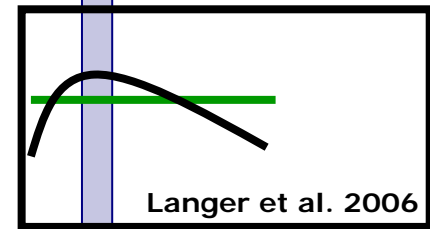
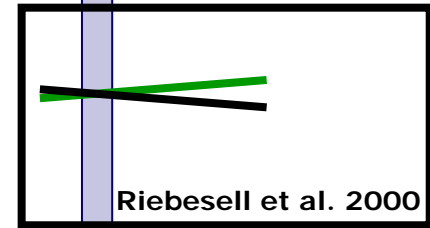
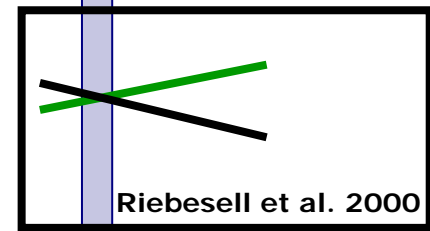
C. quadriperforatus



C. braarudii



ambient
 $p\text{CO}_2$

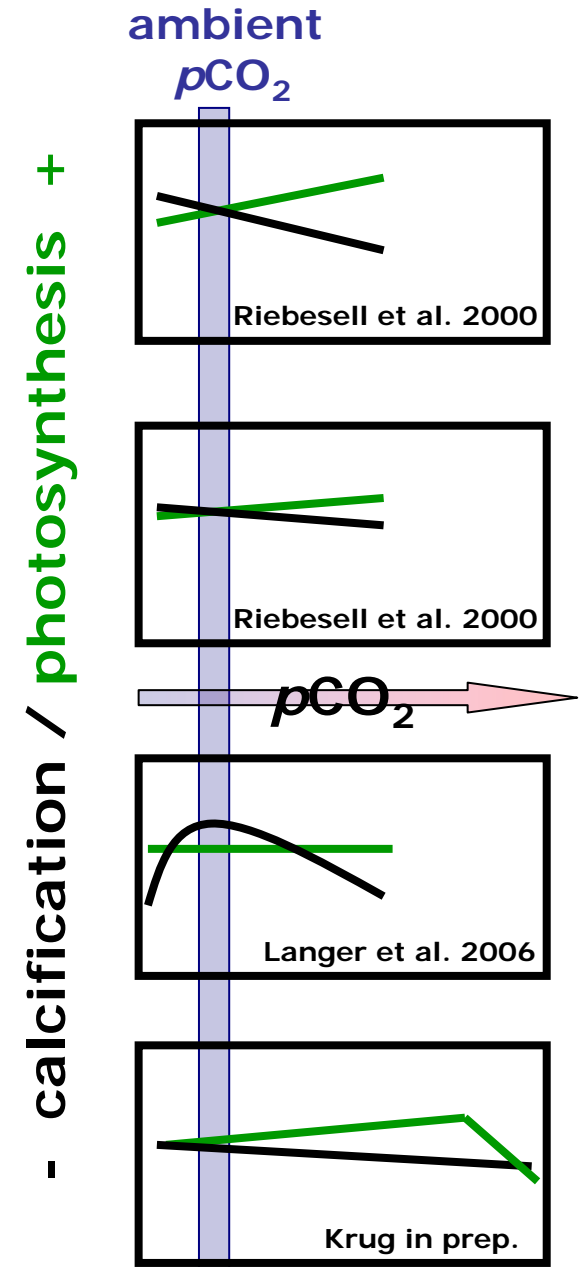


- calcification / photosynthesis +

$p\text{CO}_2$

summary:

- decrease in calcification with species-specific sensitivities
- fertilisation of photosynthesis till a certain threshold
- decrease in PIC:POC
- no detectable changes in cell division rates (excepting 'Krug in prep.')



Experimental setup

1 Short-term
no acclimation

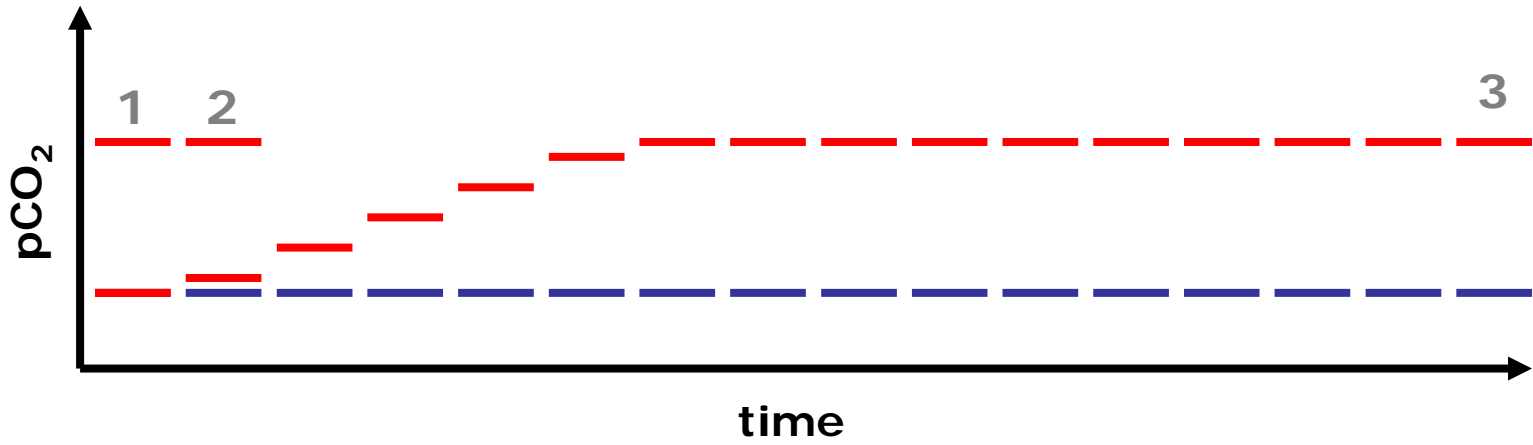
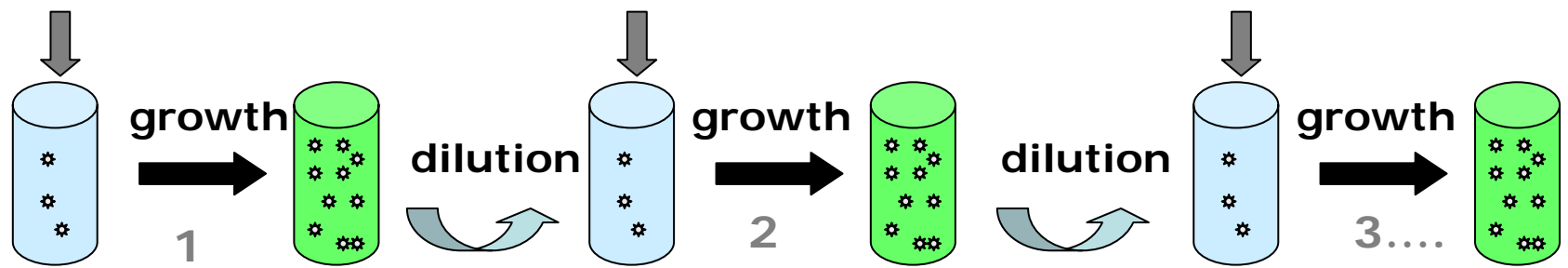
2 Intermediate-term
*acclimation over
7-20 generations*

3 Long-term
*acclimation over
> 20 generations*

System
adjusted at
target $p\text{CO}_2$

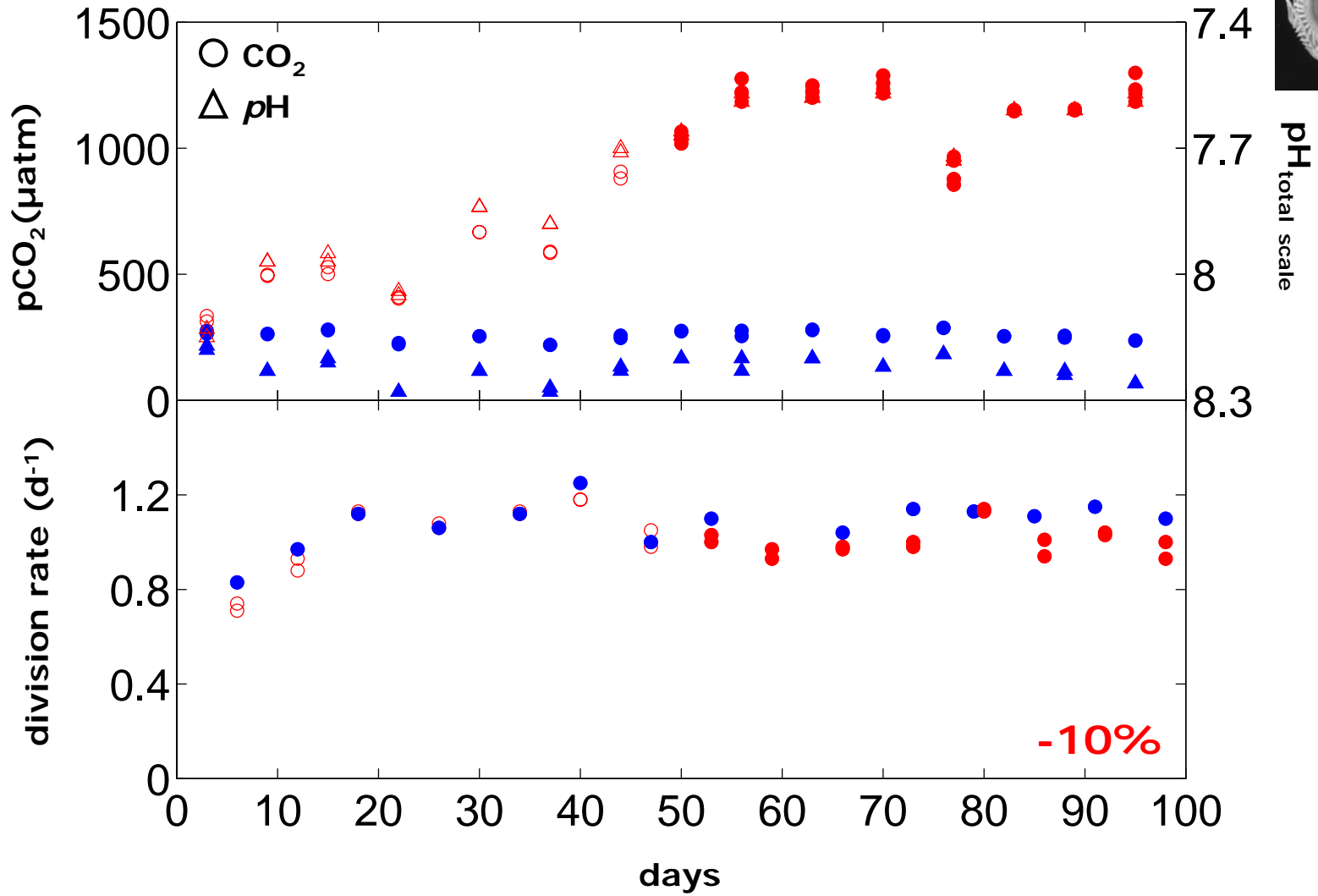
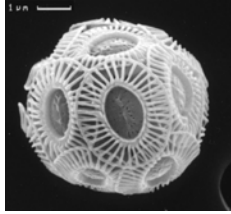
System
adjusted at
target $p\text{CO}_2$

System
adjusted at
target $p\text{CO}_2$



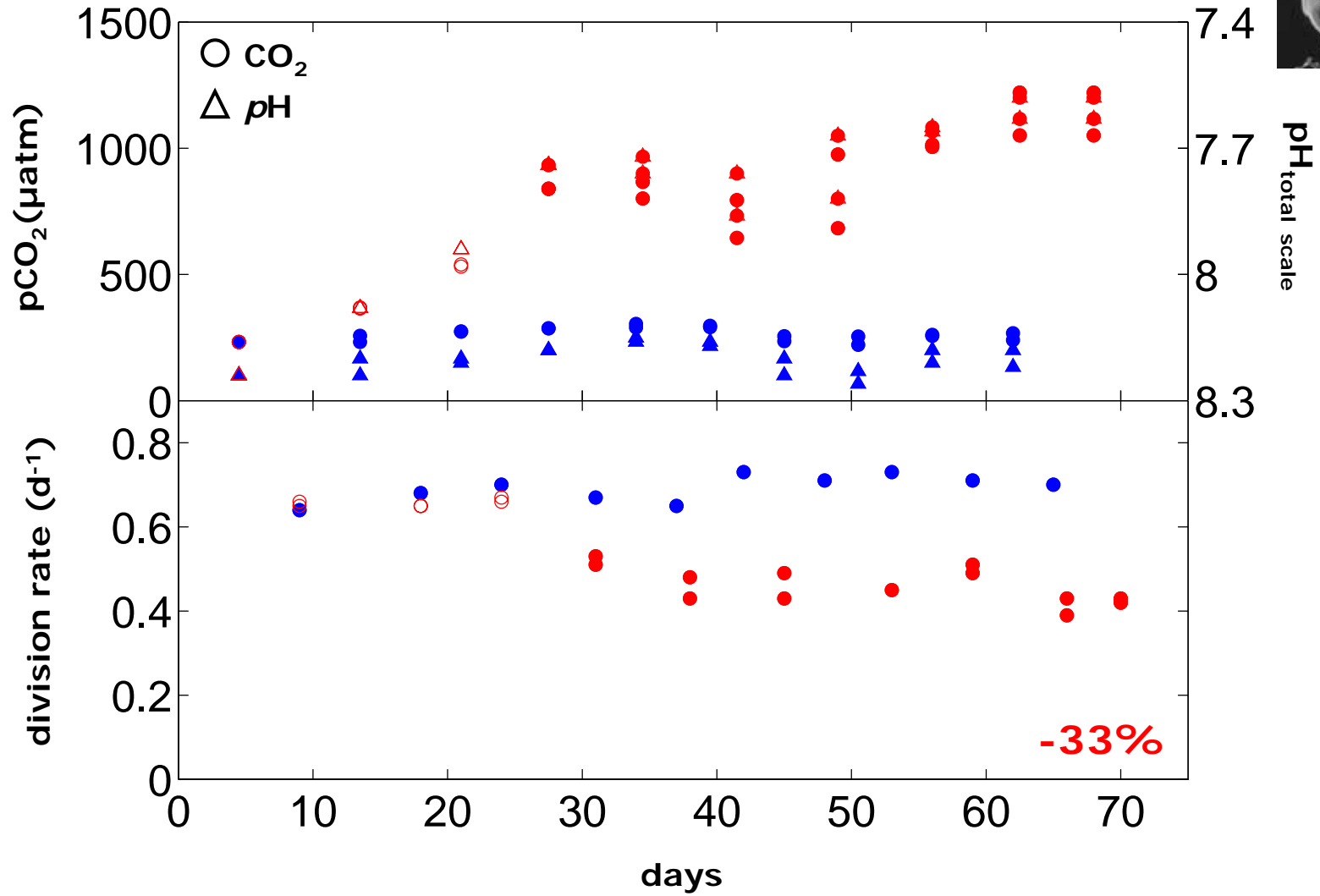
Results

Emiliana huxleyi



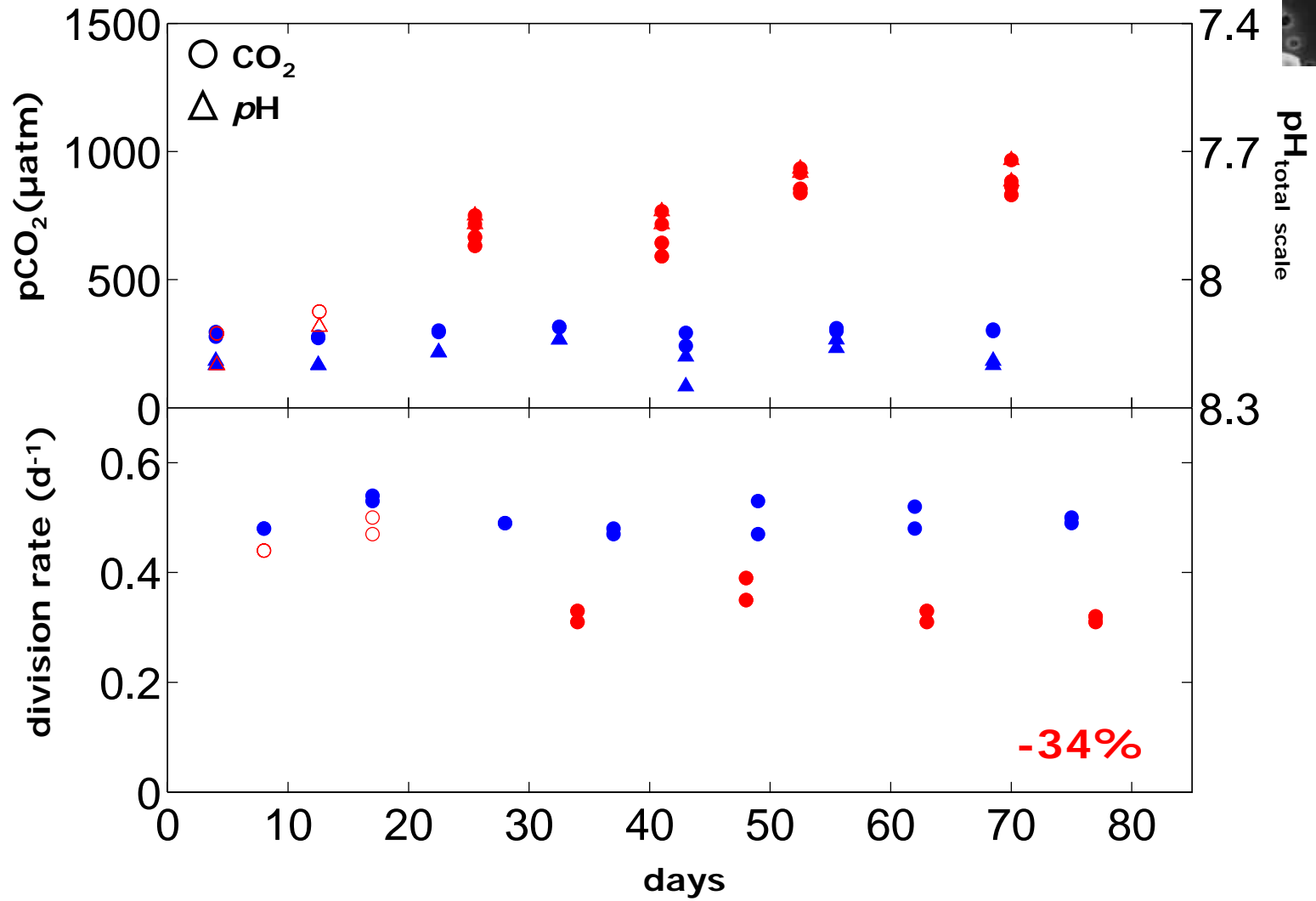
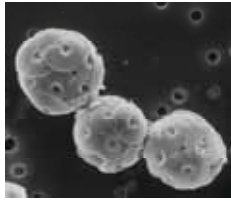
Results

Coccolithus braarudii



Introduction

Calcidiscus quadriperforatus



Response of coccolithophores to high CO₂

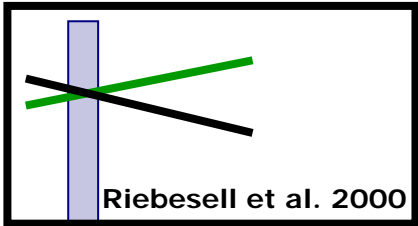
Short-term
no acclimation

Intermediate-term
acclimation over 7-20 generations

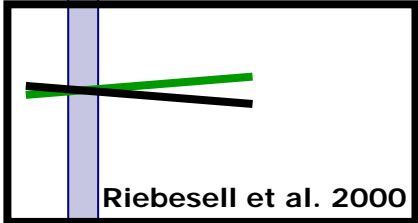
Long-term
acclimation over
> 20 generations

+ photosynthesis
- calcification

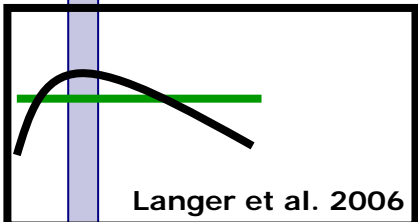
G. oceanica



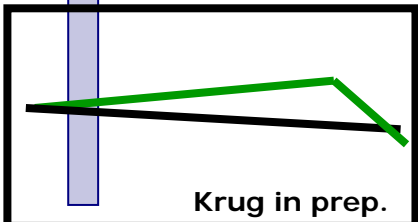
E. huxleyi



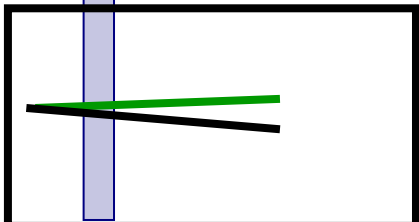
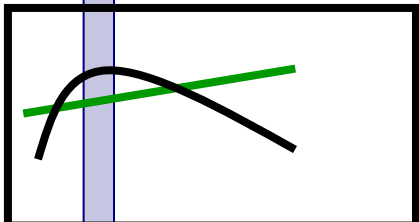
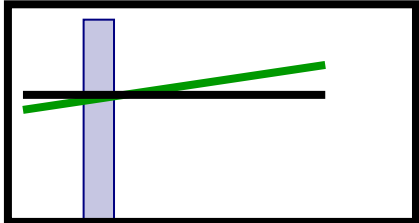
C. quadriperforatus



C. braarudii



All studied species:
Decrease in
cellular division by
10 to 34 %



pCO₂ →

Take home message

- consistent trends in short-, intermediate- and long-term experiments
- from ambient $p\text{CO}_2$ to $\sim 1000 \mu\text{atm}$:
 - decrease in calcification*
 - increase in photosynthesis*
 - reduction in PIC:POC*
- new concerns on cell division rate
- no visible/detectable adaptation in mono-clonal cultures (low genetic pool)