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Biological Impacts of Ocean ACIDification

Project 1.2

Effects of ocean acidification on the turnover of organic matter in pelagic ecosystems

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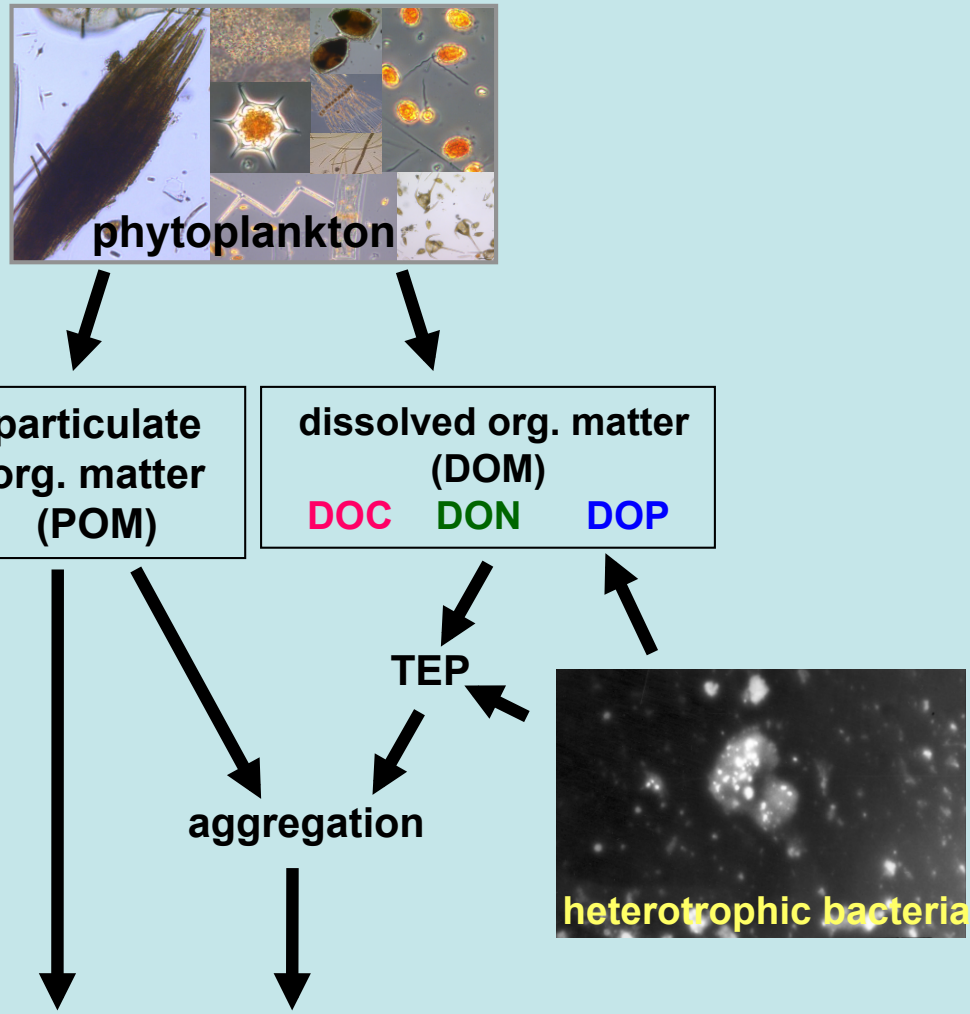

DOM production:

- production by phytoplankton (exudation,viral lysis, release by cell death)
- viral lysis of bacteria
- grazer mediated release & excretion (protozoan and zooplankton)
- bacterial transformation & release
- solubilization of particles (detritus)

DOM sink:

- uptake by bacteria - transport
- mineralization
- UV oxidation
- Sedimentation: sorption onto sinking particles

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Objectives

- Quantification and characterization of the production, exudation and microbial processing of organic matter in response to ocean acidification
- Differentation between functional and structural changes of planktonic communities
- Turnover of biological key elements and resulting changes in the C : N : P stoichiometry
- Changes in remineralisation and final deposition of organic matter

Combination of laboratory and field studies

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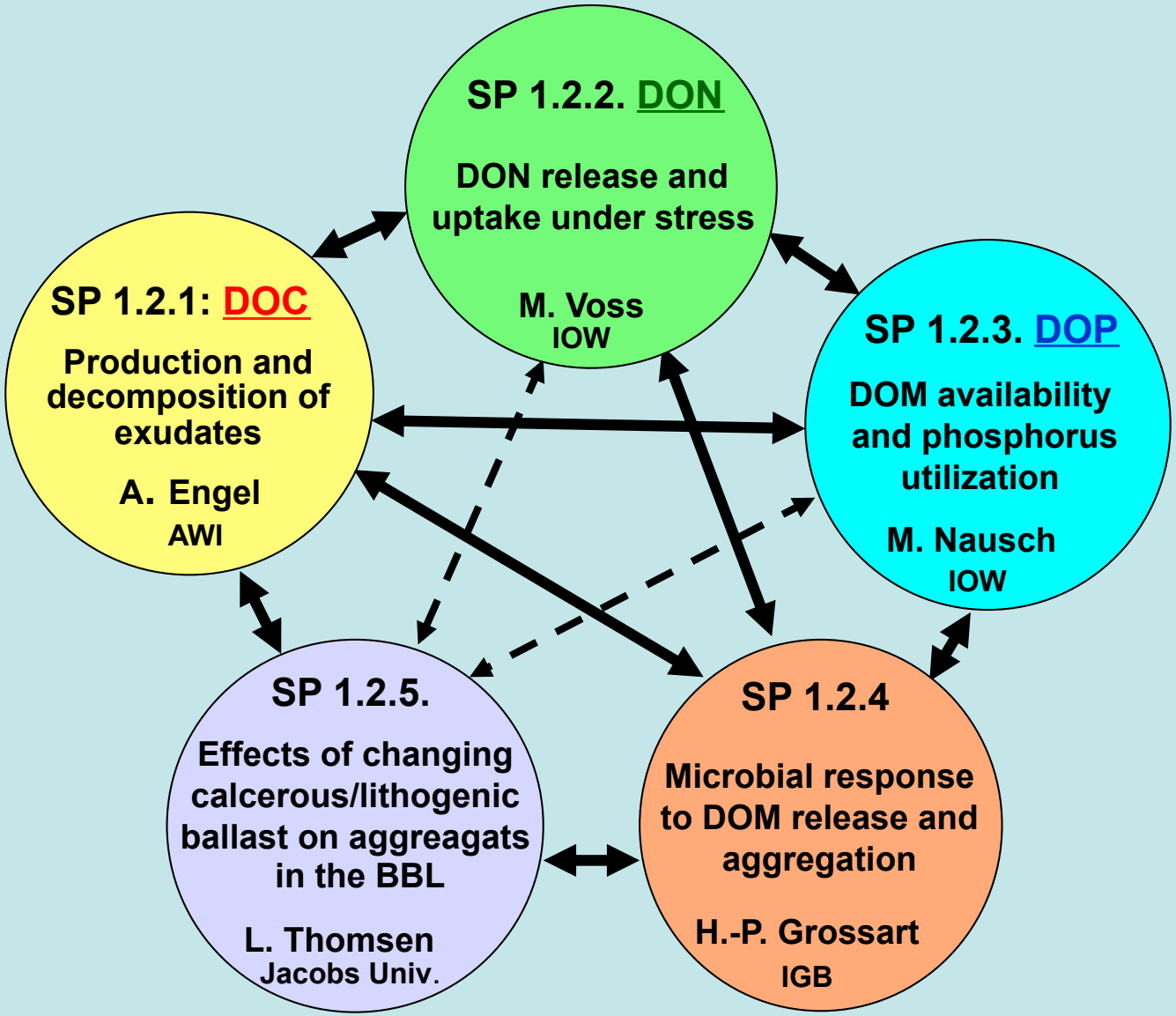

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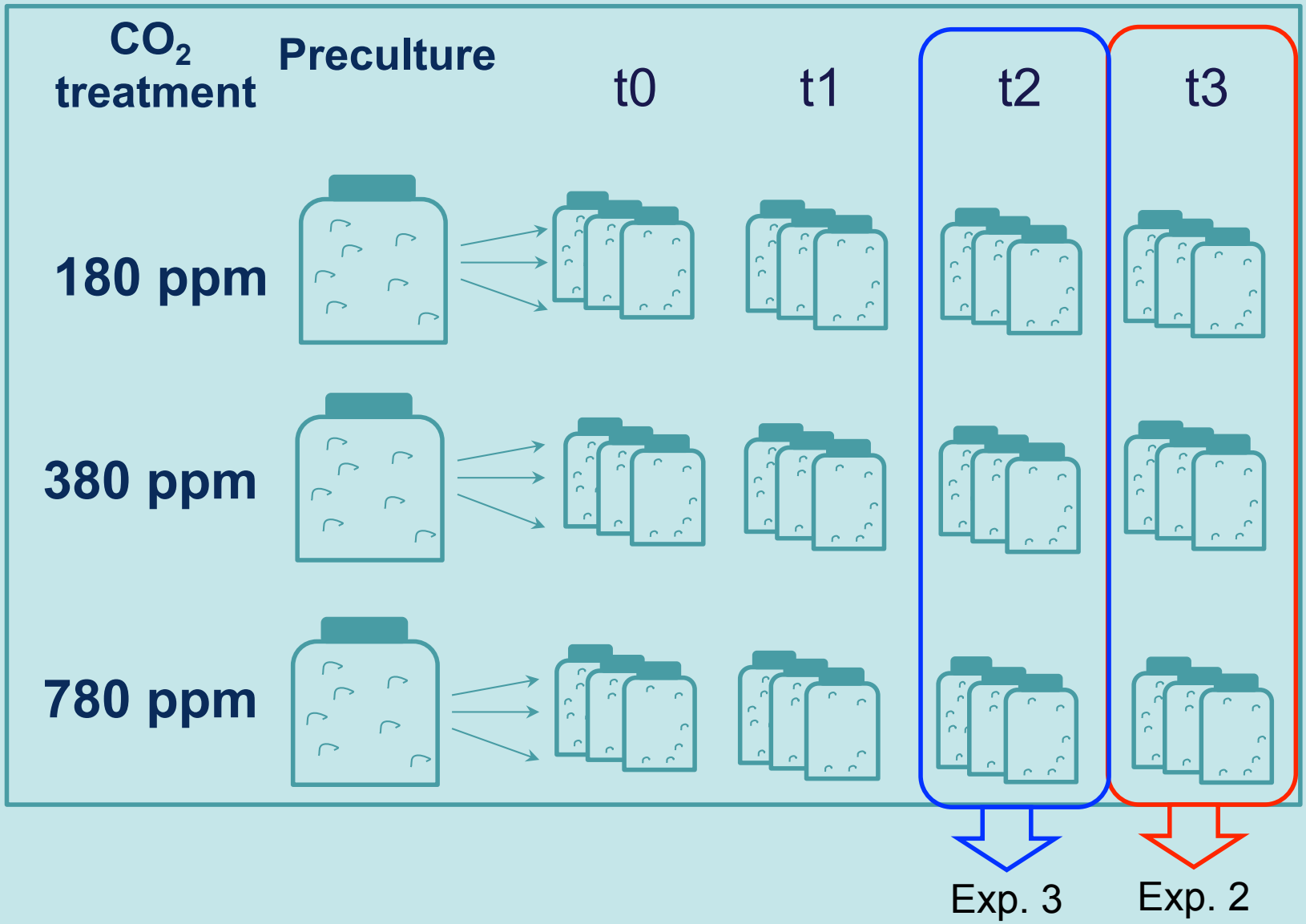
Experimental design

Experiment 1: Production



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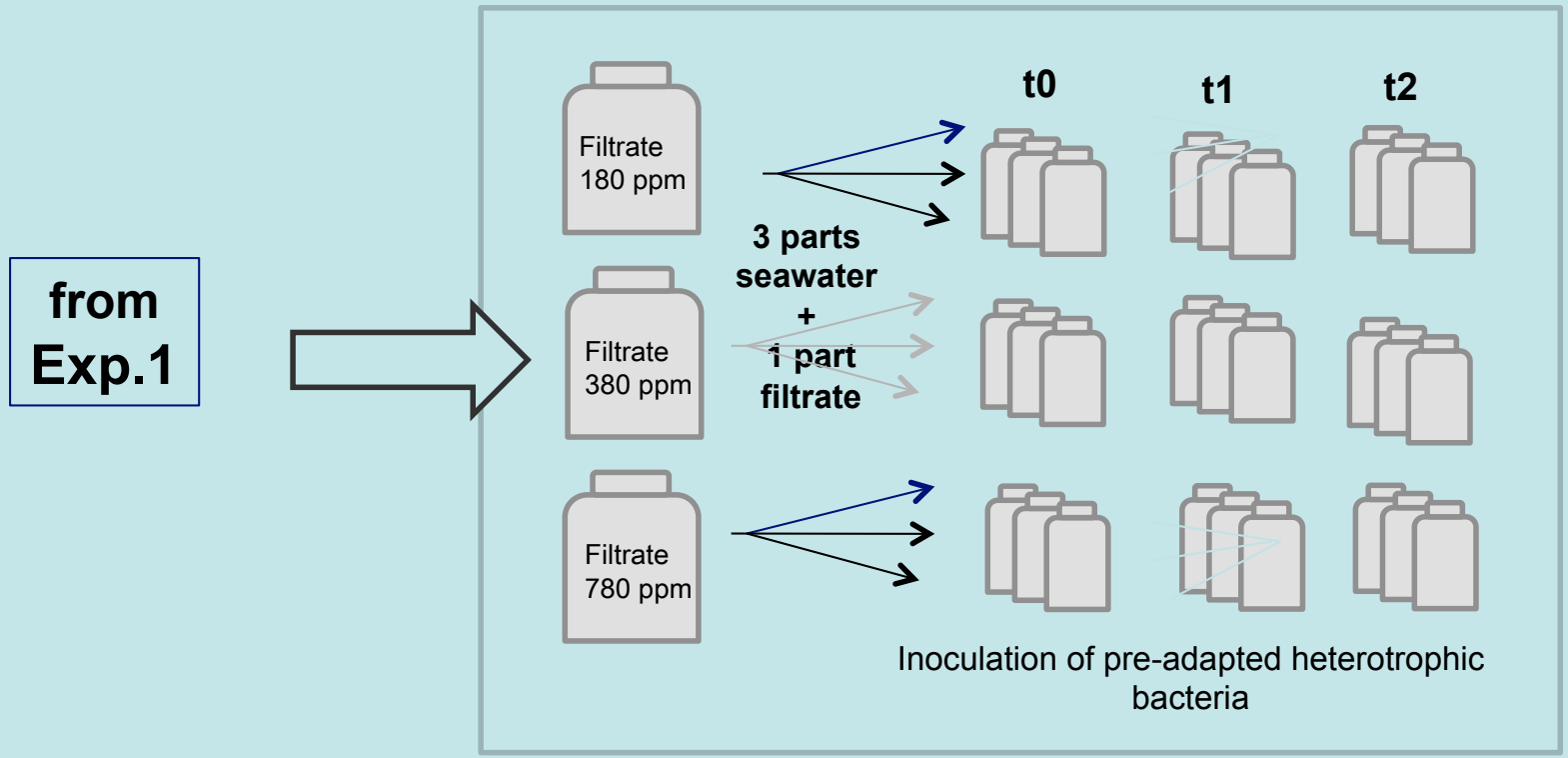
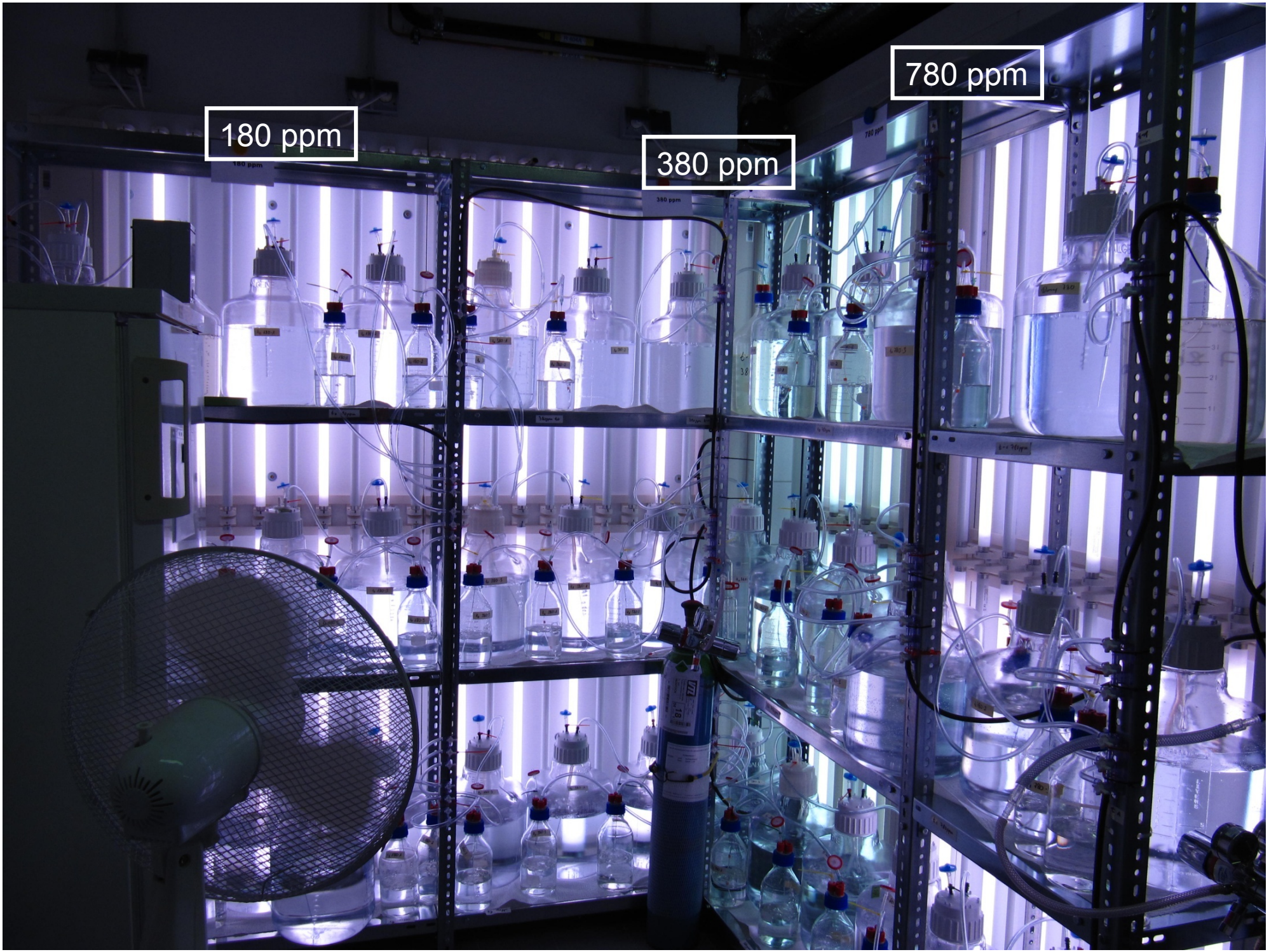
Experimental design

Experiments 2 & 3: Decomposition




180 ppm
380 ppm
780 ppm

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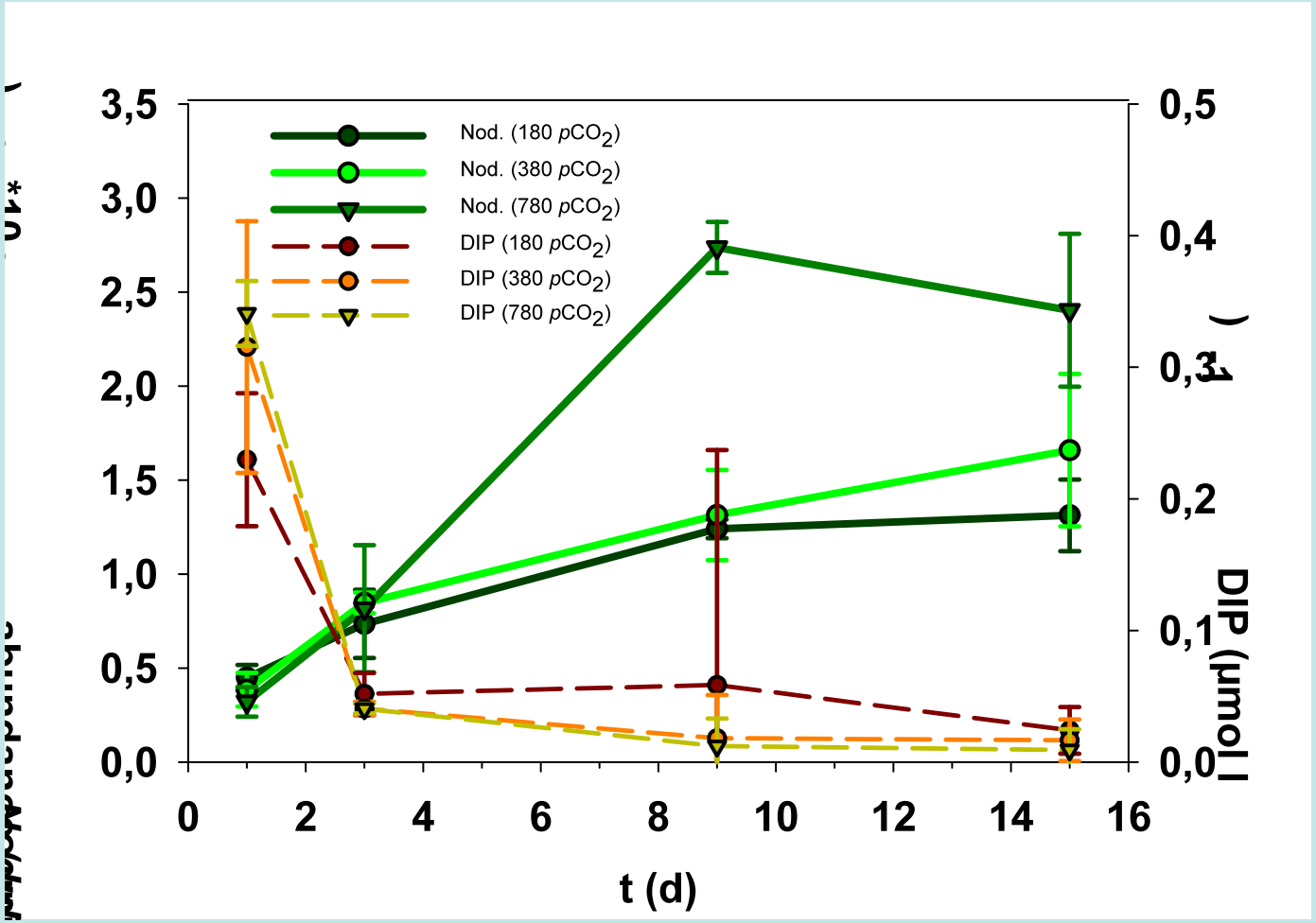
Experiment 1: Production



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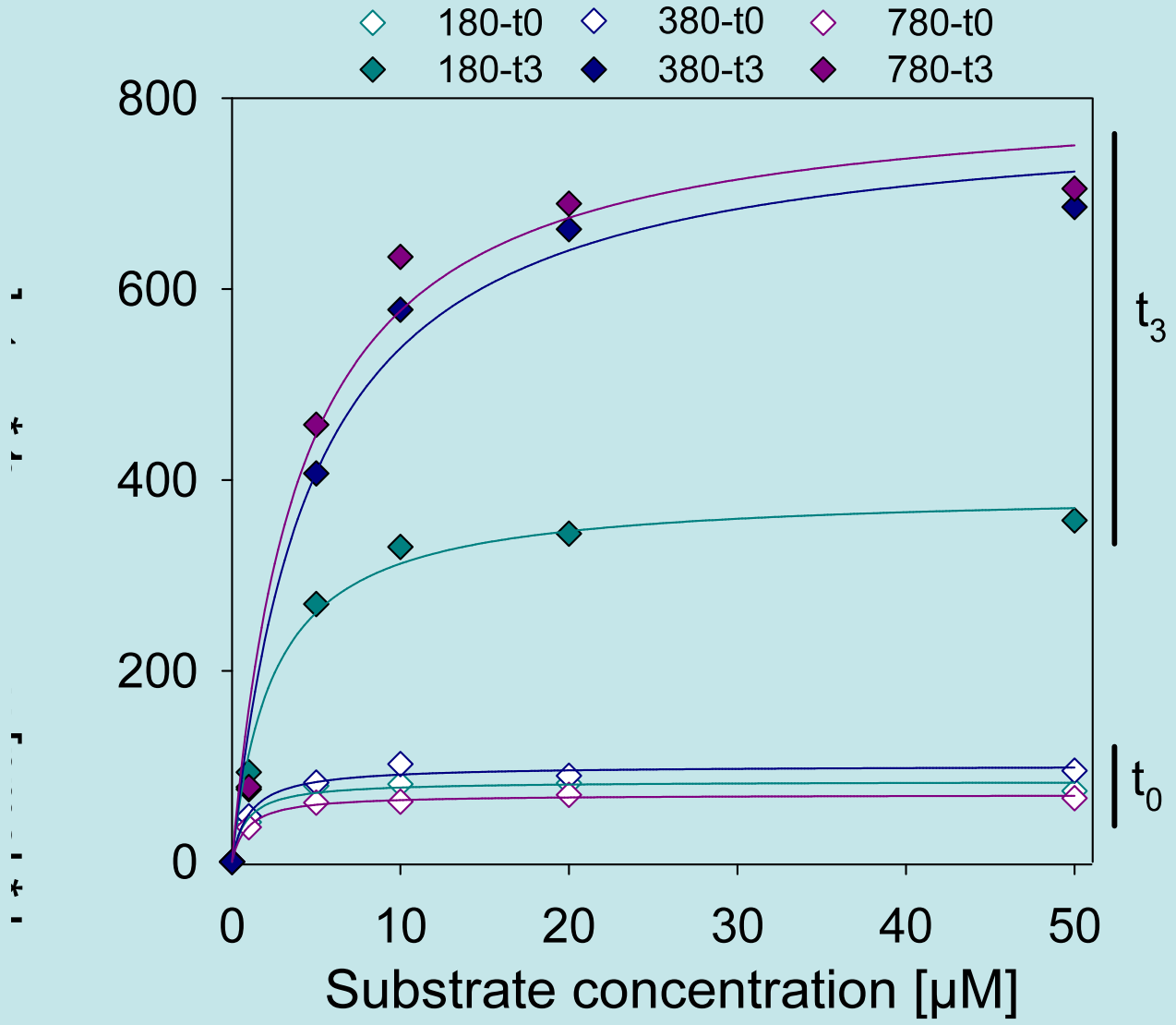
Phosphatase activity at the beginning of the experiment and after DIP depletion (Part I)



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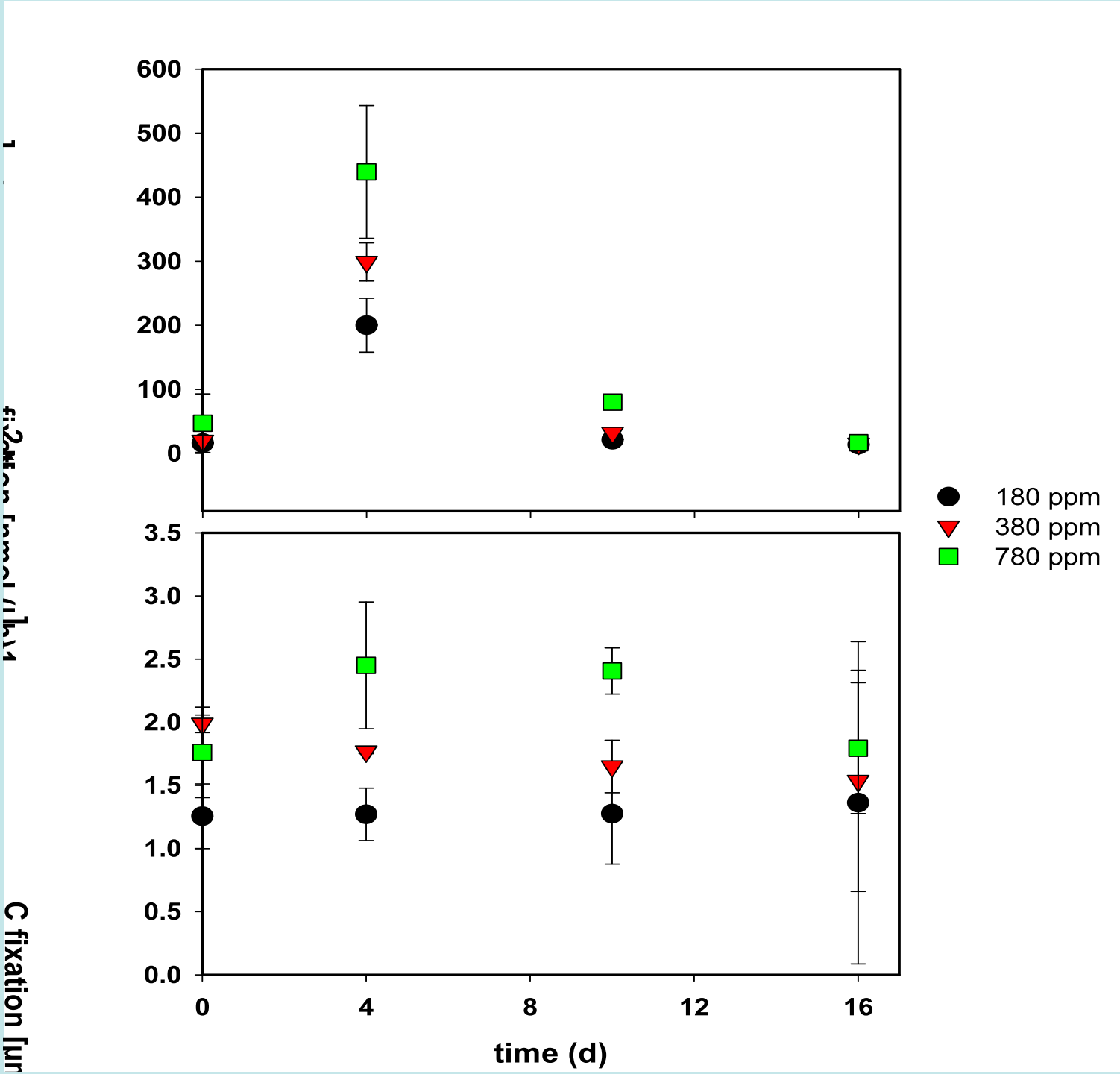

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Summary 1

Experiment 1: Production

- Significant stimulation of growth of *Nodularia* (abundances and Chl a) at 780 ppm compared to present and glacial pCO_2 (380 and 180 ppm) suggesting a possible CO_2 limitation of nitrogen fixers
- Total TEP production was significantly enhanced at 780 ppm, but cell growth was more stimulated than TEP production
- Phosphate is the preferred P source until it is exhausted after 3 days
- Thereafter DOP utilization increased with highest rate at 780 ppm confirmed by highest phosphatase activity
- Significant increase of N_2 and C fixation under higher pCO_2, additionally stimulated by P addition

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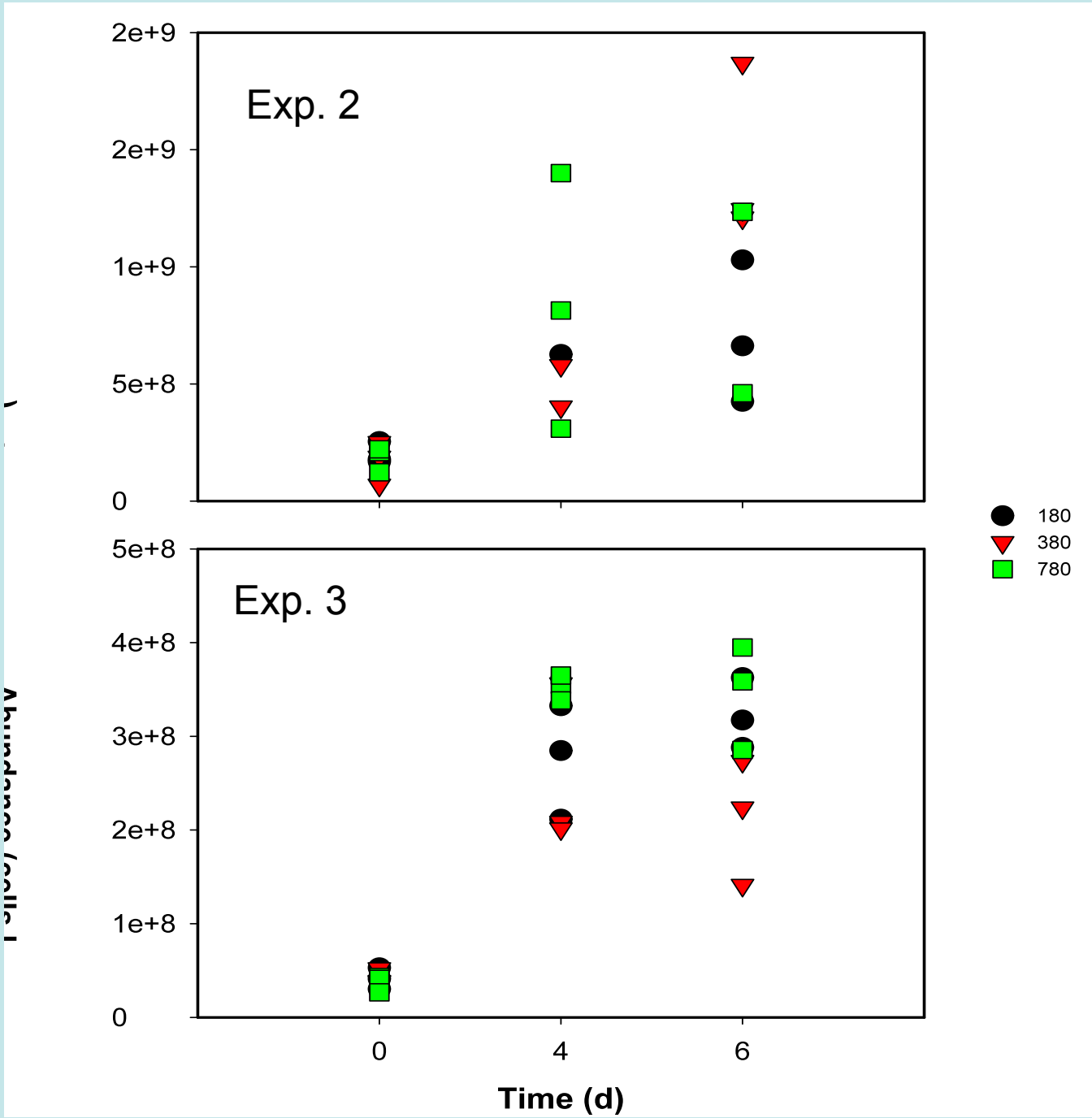

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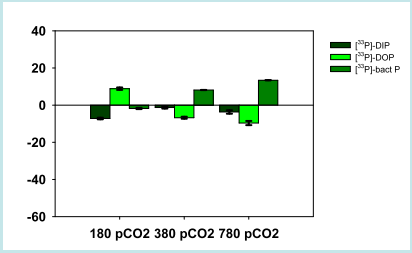
Radiotracer –Experiments

$[^{33}P]$ –PO_4

Exp. 2

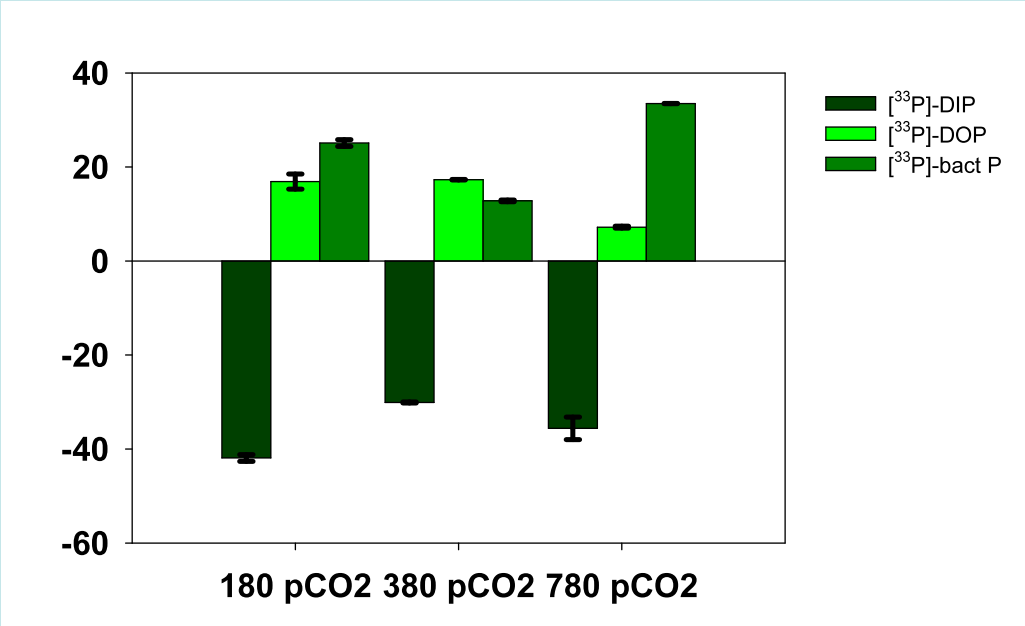


Filtrate from Exp. 1

55 - 75% $[^{33}P]$-DIP

25 -45% $[^{33}P]$-DOP

Exp. 3



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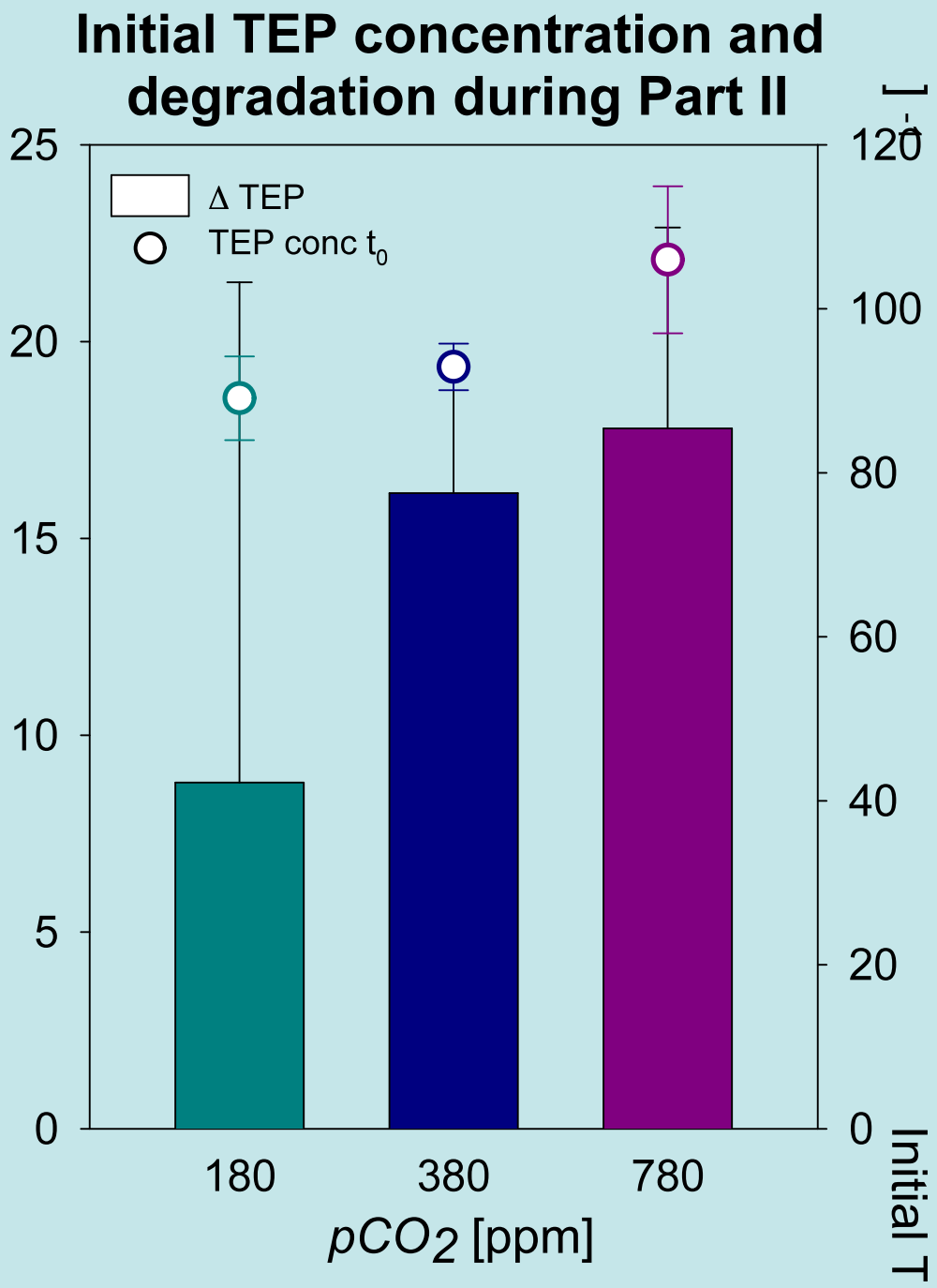
Initial TEP concentration and degradation during Part II
Δ TEP
TEP conc t_0
25
20
15
10
5
0
120
100
80
60
40
20
0
180
380
780
pCO_2 [ppm]
Initial T

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Summary 2

Experiment 2: Decomposition

- Bacterial protein production is significantly elevated at higher pCO_2 whereas respiration decreased. Bacteria growth was higher at 780 ppm but without any significance

- Degradation of TEP was low in all treatments but with highest decline at 780 ppm

- More phosphorus is incorporated into bacterial biomass at 780 ppm. This is seen more clearly in radiotracer experiments than in P pool changes. Bacteria transfer DIP to DOP if DIP is utilized in a high proportion. If low amounts of DIP are used, bacterial P originates predominantely from DOP

Preliminary conclusion

Ocean acidification may increase phosphorus recycling and therewith support algal growth

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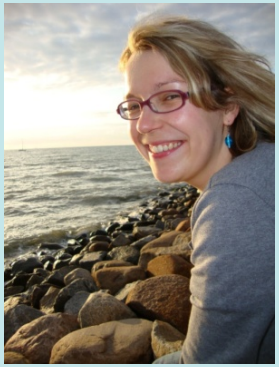
Poster presentations

Wannicke et al. (1)
Growth and production by *Nodularia* under different CO_2 concentrations – first results from a joint laboratory study

Wannicke et al. (2) How DOM derived from Nodularia spumigena grown at different pCO_2 level modify bacterial growth and activity – first results from a joint laboratory study



Unger et al.
Phosphorus transformation by *Nodularia spumigena* and by heterotrophic bacteria under different pCO_2 levels – first results

Endres et al.
Effect of ocean acidification in production and decomposition of exudates – first results from a joint batch experiment


Thank you for your attention