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Bioavailability of autochthonous dissolved organic nitrogen in marine plankton communities

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Aim

We measured the bioavailability and net mineralization of dissolved organic nitrogen (DON) produced during a phytoplankton bloom. The aim was to

- **quantify the remineralization of the added dissolved inorganic nitrogen (DIN) - how much DIN ends in a refractory DON pool?**
- **determine how fast the added DIN was recycled**

Hypotheses

- The mineralization of DON produced during a phytoplankton bloom was expected to be high
- Only a small fraction of the added DIN was expected to end in a refractory DON pool
- The recycling of DIN was expected to be rapid

Results

- On average only 11 % and maximum 33 % of the added DIN was remineralized with large variation during the different growth phases.
- Natural samples from Roskilde Fjord had a lower variation

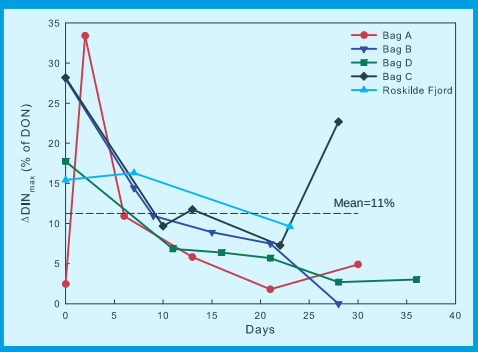


Figure 1

The maximum net mineralization of the labile pool of DON measured as the increase in DIN (ΔDIN) (% of DON) in the four batch growth experiments and the natural samples prior, during and after the spring bloom in Roskilde Fjord. Dashed line indicate overall mean.

- In this study a C:N ratio < 17 in DOM was essential to observe a positive net mineralization of DON

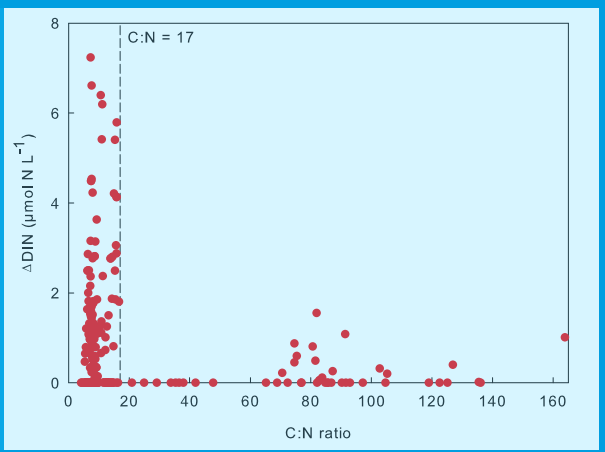


Figure 2

Concentration of ΔDIN (μmol N L^{-1}) as a function of the C:N ratio in DOM in the degradation experiments.

Conclusions

- **Only a minor fraction of the added DIN (mean=11 % of DON) was remineralized**
- **This study emphasizes the importance of distinguishing between bioavailability and net mineralization**
- **A positive net mineralization was only observed if $C:N_{DOM} < C:N_{Bac}$ i.e. if bacterial growth was carbon limited**
- **The N-pool in autochthonous produced DON was retained in the bacterial biomass for a period of time instead of being rapidly recycled to DIN**
- **Collapse of a phytoplankton bloom may be possible even without presence of larger grazers or sedimentation**

Perspective: **This study revealed the importance to implement the DON pool into models and not just assume a rapid recycling of DIN since only a minor remineralization occurred**

- The added DIN was rapidly incorporated into particles and later DON
- DIN was not recycled in the 30 days the growth experiments in this study lasted

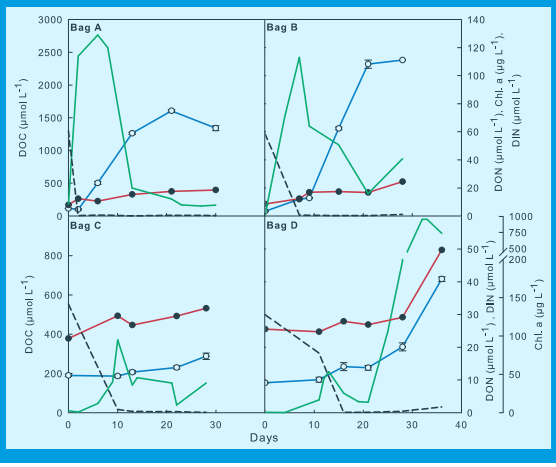
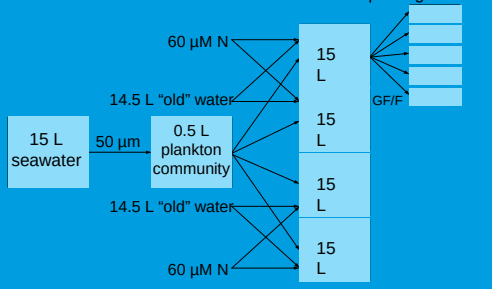


Figure 3 *The measured parameters during the four batch growth experiments.*

Methods

- Experiments were conducted as batch growth experiments where DIN was added to a natural plankton community in polyethylene bags at 15 °C
  - Growth experiments ran approximately 30 days
- Natural plankton communities < 50 μm from Roskilde Fjord, Denmark were used in the growth experiments
- Nitrogen was the growth limiting factor
- Degradation kinetics of the produced DON were measured 5-6 times during each phytoplankton batch growth experiment
  - Degradation experiments ran 60-80 days



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