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15. New Production by ^{15}N and Export Production by ^{234}Th

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New Production by ^{15}N

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{ $^{15}\text{NH}_4$.Uptake, $^{15}\text{NO}_2$.Uptake, $^{15}\text{NH}_4$.Mineralisation}

Uptake of ammonium

Sampling and spiking:

4.5 l seawater was sampled in a Nalgene bottle. Spike solution (1.7 ml ^{15}N - NH_4Cl solution: 11.6 mg l^{-1} ; 99% ^{15}N) was added. The bottle was gently shaken and subsampled for the initial ammonium content. The spike addition was calculated to increase an original ammonium content of 1 $\mu\text{mol l}^{-1}$ by about 10%. Since during ANT X/6 natural ammonium concentrations never reached that level, spike additions were generally \gg 10% of the original content.

Incubations: During the transects samples from -10 and -30m were incubated for 24 hours in the on-deck incubator, respectively at 100% and 30% of incoming radiation using a neutral density screen.

During the drift station (from October 22 to 24), day incubations (06.00 to 18.00) and night incubations (18.00 to 06.00) were done. Day incubations concerned samples from -7, -20, -40, -60 and -80 m depth. The first day of the drift station experiment these samples were set out *in-situ*. On day 2 and day 3 the samples were incubated in the on-deck incubator, respectively at 100%, 66%, 30%, 13% and 1% of incoming light, using neutral density screens.

Night incubations were done on samples from -10 and -60m. These samples were incubated in the dark in the cold room at 1 °C or in the on-deck incubator.

At the end of the incubation period, subsamples were taken for determination of the final ammonium content. Another subsample is taken for assessment of the ammonium mineralisation rate (see point 2 below).

For cases where Chl-a content $\geq 0.3 \mu\text{g l}^{-1}$, one fraction of the seawater sample was passed over a 20 μm screen to assess ammonium uptake by the $\leq 20 \mu\text{m}$ sized phytoplankton. The other fraction was directly filtered (approx. 0.2 bar underpressure) on precombusted (450 °C) Whatman GF/F filters to assess ammonium uptake by the total phytoplankton population.

For situations with low Chl-a content ($< 0.3 \mu\text{g l}^{-1}$) no size fractionation was performed.

GF/F filters are oven dried (50 °C) and sealed in plastic petri dishes for later analysis in the home laboratory.

Mineralisation of ammonium

Mineralisation of ammonium is assessed during the same experiment as ammonium uptake. After the incubation and before the filtration (see point 1 above), 10 ml of the sample are transferred to a serum vial, and spiked with 500 μ l of an unlabeled ammonium carrier solution (NH_4Cl : 54.15 mg l^{-1}) for the entrainment of ^{15}N -ammonium. Ammonium from this solution is extracted by adding 500 μ l of strong base (KOH: 50%) and the produced ammonia is captured on aluminium oxide beads coated with sulphuric acid (0.25 M) and suspended in a tin cup above the solution. After ≥ 48 hours the tin cup is retrieved and sealed in a plastic envelope for later analysis in the home laboratory.

Uptake of nitrite

Sampling and spiking:

Sampling of the seawater from -10 m, in a 4.5 l Nalgene bottle. Addition of 2 ml spike solution (^{15}N - KNO_2 : 4.8 mg l^{-1} ; 99% ^{15}N). The bottle is gently shaken and subsampled for the initial nitrite concentration.

Incubation:

The sample is incubated for 24 hours in the on-deck incubator at 100% of incoming light. After the incubation a subsample is taken for the determination of the final nitrite concentration. The remaining solution is filtered on precombusted Whatman GF/F and oven dried at 50 $^\circ\text{C}$. Samples are sealed in plastic petri dishes for later analysis in the home laboratory.

Determination of ^{15}N abundancy (home laboratory)

The ^{15}N abundancy is determined by emission spectrometry (JASCO NIA- ^{15}N analyzer) after conversion of particulate nitrogen and extracted ammonia into dinitrogen by means of an oxidation with CuO. This conversion is performed in quartz discharge tubes at 750 $^\circ\text{C}$. Specific and absolute uptake rates are computed using mathematical expressions based on the isotope dilution law and on a constant transport model (the latter assumes no significant biomass build up during the incubation)