**Fate of copepod faecal pellets during an iron induced phytoplankton bloom (EIFEX) in the Southern Ocean**

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Introduction

In recent years, large scale iron fertilization experiments draw increasing attention. The induction of large phytoplankton blooms and their subsequent, possible export to the deep sea attracted interest as a possibility to reduce CO2 concentration in the atmosphere and thereby slow down global warming. As one of the main consumers of phytoplankton, copepods were in the focus of this study. The aim of our study was to quantify their impact on carbon export via faecal pellets to the deep sea. A combined examination of faecal pellet production in experiments and the analysis of the faecal pellet standing stock within the water column was carried out in the course of the European Iron Fertilization Experiment (EIFEX) in the Southern Ocean (~ 49°S, 02°E).

In response to the iron fertilization a diatom bloom developed with chlorophyll a concentrations up to 3.1 µg Chl a l⁻¹ inside the fertilized patch (Fig. 1). Possible faecal pellet recycling mechanisms:

- coprophagy, coprochaly, coprorhexy (Oithona spp. ?)
- fragmentation of FPs by other copepod species
- microbial degradation

**Theory...**

Importance of copepods in the carbon cycle

- decrease of phytoplankton biomass
- structuring effects on phytoplankton blooms
- production of fast sinking faecal pellets
- vertical distribution and migration

With potential high sinking rates of faecal pellets from larger copepods, it was formerly expected that the contribution of these faecal pellets to the vertical flux is always high. Vertical flux studies of the recent two decades, however, showed that the contribution of faecal pellets to the vertical carbon flux is not always high but highly variable.

**Faecal pellet production experiments**

- Experiments were conducted with a specific number of one copepod species
- 24 hours grazing on the natural phytoplankton community
- Faecal pellet volume (FPV) could be calculated assuming a regular geometrical shape and afterwards converted into faecal pellet carbon (FPC)

Faecal pellet production experiments with the abundant copepods Calanus simillimus, Pleuromamma robusta, Rhincalanus gigas and C. propinquus showed, that faecal pellet volume as well as faecal pellet production rate increased with increasing chlorophyll a values.

**Abundance of calanoid copepodites & adults**

Initial: ~ 1.5 x 10^6 individuals m⁻²
Final: ~ 3.5 x 10^6 individuals m⁻²

Maximum abundance values were nearly reached at the mid of the experiment. With the copepod abundances in the field and the onboard faecal pellet production experiments, it was possible to estimate the expected in situ faecal pellet production of the copepod community, making the rough assumption: FPR for CIIV- adults = 100% (experimental values)
FPR for CI-CIII = 40%

During EIFEX, there seemed to be a high recycling rate of the produced faecal pellets within the mixed layer, with different possible mechanisms. The actual main mechanism triggering the recycling of the faecal pellets during EIFEX can only be speculated and may be a combination of different processes.

**Faecal pellet abundances in the field**

Faecal pellet abundances in the field were determined from concentrated water samples, by concentrating 12 or 24 l of water from a discrete depth over a mesh. Faecal pellets were measured under an inverted microscope and values were converted into faecal pellet carbon.

At the end of EIFEX, maximum FPC values inside the fertilized patch were 13 times higher than in the beginning of the fertilization experiment, while the FPC increase at the out patch stations was only half of this (Fig. 3).

**Faecal pellets in the field**

In depth beneath 150 m, only 1 – 7 % of the maximum FPC could be detected.

**Faecal pellet turnover time:**

Estimated FPC standing stock (µg C m⁻²)

~ 24 hours

**Strong evidences for recycling of faecal pellets, rather than export**

**Possible faecal pellet recycling mechanisms:**

- coprophagy, coprochaly, coprorhexy (Oithona spp. ?)
- fragmentation of FPs by other copepod species
- microbial degradation

**Faecal pellet size measurements:**

Neither length, nor width of the faecal pellet sizes overlapped with regard to the 95 % confidence intervals.