

SSB Pelagic Module 5

Organic matter and remineralisation

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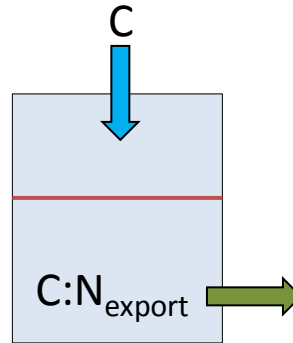
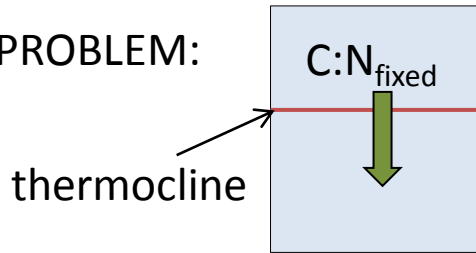
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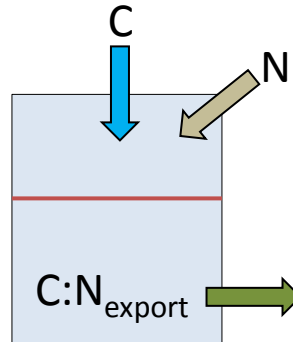
How is carbon export sustained in shelf seas?

THE PROBLEM:



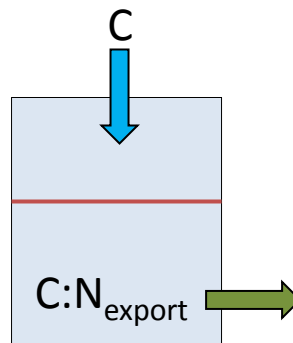
If $C:N_{\text{fixed}} = C:N_{\text{export}}$ then shelf nutrient pools will be diminished

SOLUTION 1:



If C:N is constant, then we need a supply of excess N from elsewhere

SOLUTION 2:



$C:N_{\text{fixed}} < C:N_{\text{export}}$ due to different rates of elemental cycling on shelf (water column and sediments)

Organic matter and remineralisation

Hypothesis: Remineralisation of POM and DOM creates a carbon-rich residual organic matter pool.

DOC:DON:DOP
POC:PON:POP
C:N remineralisation

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C:N remineralisation

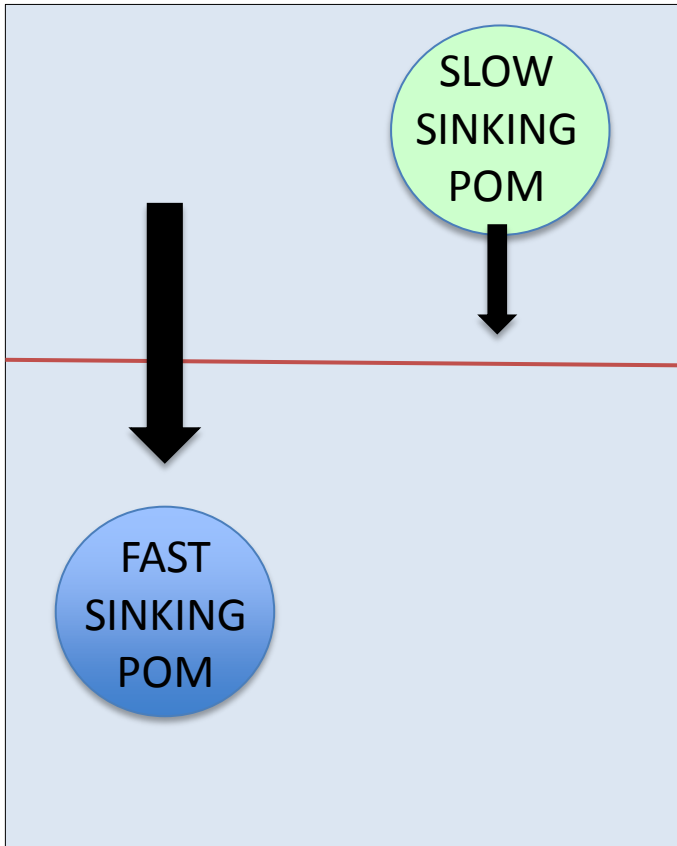
Quantity and stoichiometry of organic matter:

DOC:DON:DOP
POC:PON:POP

Rates and stoichiometry of remineralisation:

- C regeneration via respiration
- N regeneration via ammonium regen./oxid.

Particulate organic matter

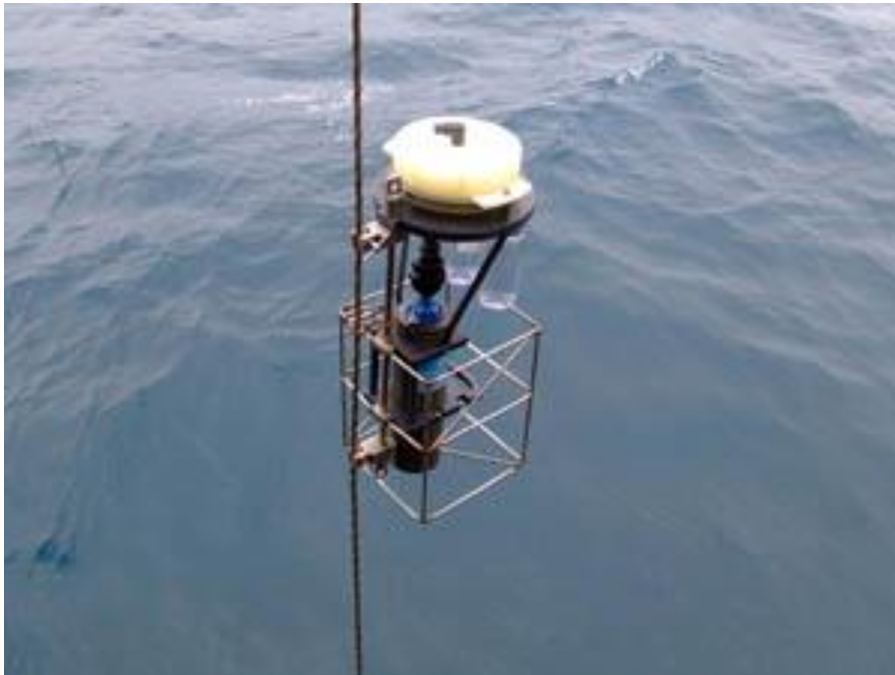


- Sinking characteristics of particles dictates where POM is remineralised in the water column
- Quality of organic matter in fast and slow sinking particles is different

Particle collection

Marine Snow Catcher
Mega-MSC ~ 350 L

Stand alone pumping system (SAPS)



Particulate organic matter

Slow and fast sinking particles separated through settling (MSC) or filtration (< and > 53 μm) and particle fractions split



Quantity, quality and source (MSC and SAPS):

- POC:PON:POP:PSi:PIC
- Microscopy: faecal pellets and aggregates
- Lipid analysis

Rates and C:N of remineralisation (MSC only):

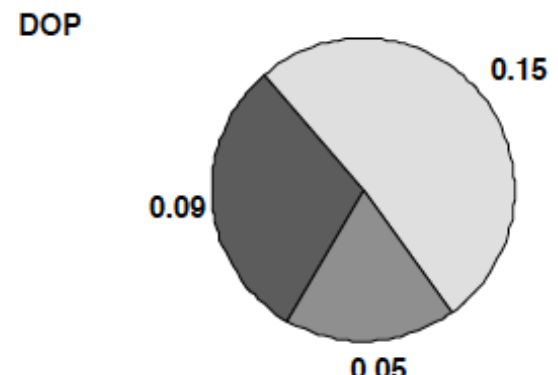
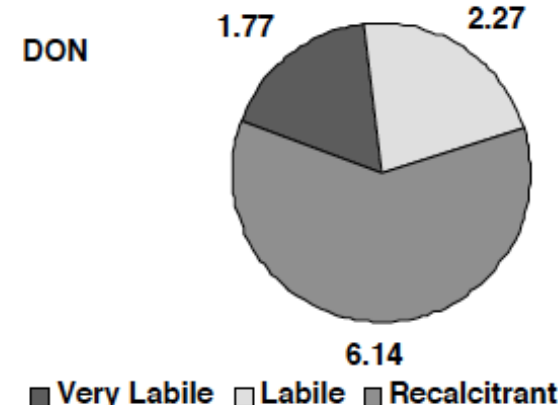
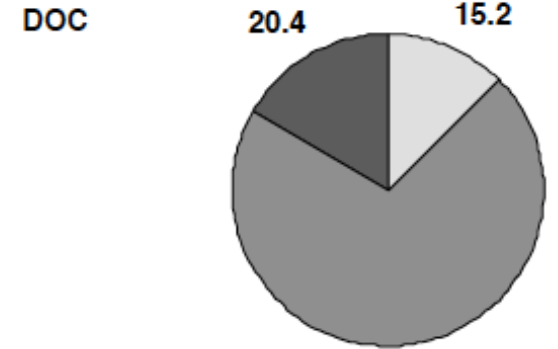
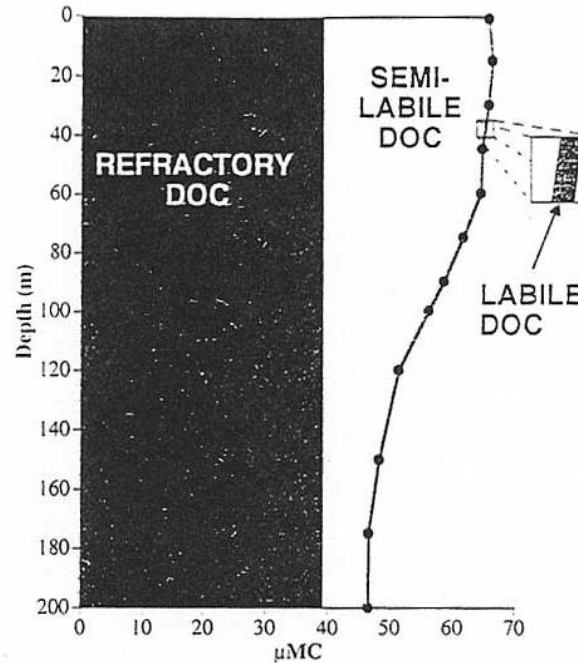
- C-regeneration via respiration
- N-regeneration via ammonium regeneration/oxidation

Understand how particle characteristics influence remineralisation and stoichiometry of residual organic matter

Dissolved organic matter

- DOC:DON:DOP
~ 300:22:1

- 25 to 75 % of DOM is refractory



- Refractory C:N:P ~ 3511:202:1

- Semi-labile C:N:P ~ 199:20:1

- Composition will differ in above and below the thermocline

DOM experiment

Filtered seawater inoculated with extant bacteria and incubated in the dark using water above and below the thermocline

Quantity, quality and source:

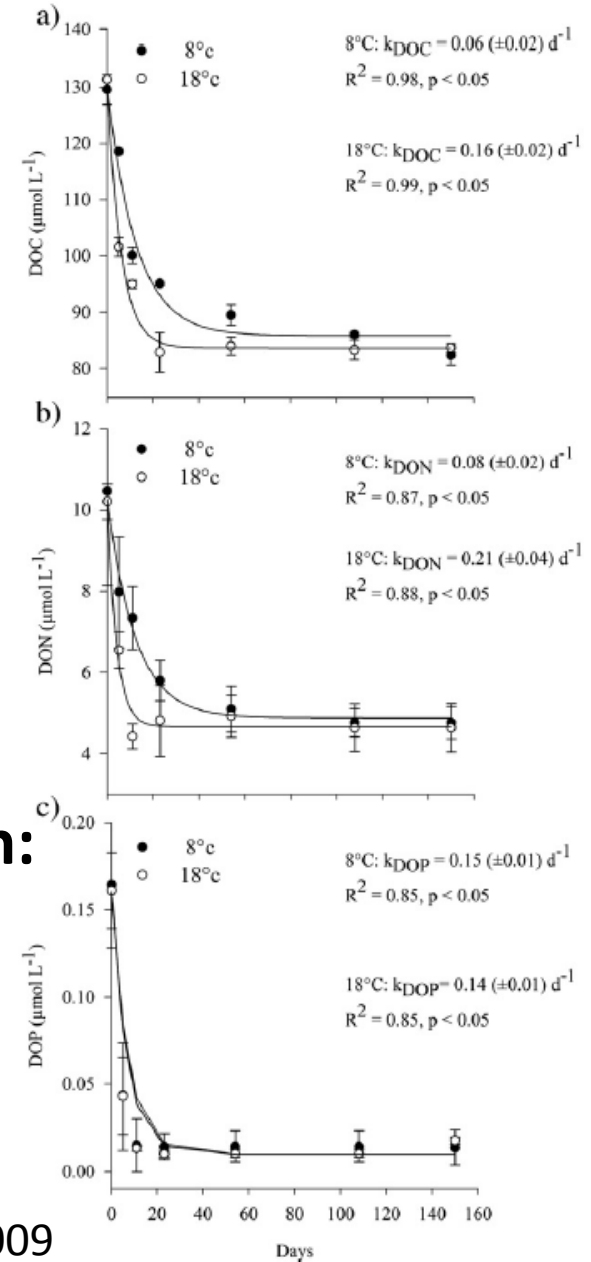
- DOC:DON:DOP
- DFAA/THAA, d/l ratios
- EEM/PARAFAC

Rates and stoichiometry of remineralisation:

- Estimated from decay curves generated through experiments

Understand how remineralisation varies with DOM quantity and quality

Lonberg et al 2009



Links to other WPs

Sediments

- Sinking POM: how much POM reaches the seafloor and what is its C:N:P ratio?
- Sediment resuspension: how much does resuspension contribute to particles we are capturing in the bottom mixed layer?

Iron

- Request for $> 53\mu\text{m}$ size fraction for particulate iron
- Estimates of humic substances