Shelf Sea Biogeochemistry

Work Package 3

The supply of iron from shelf sediments to the ocean

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First Science meeting
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Overview

- Brief introduction, and main objectives
- Potential links to other WPs; extending the science outcomes

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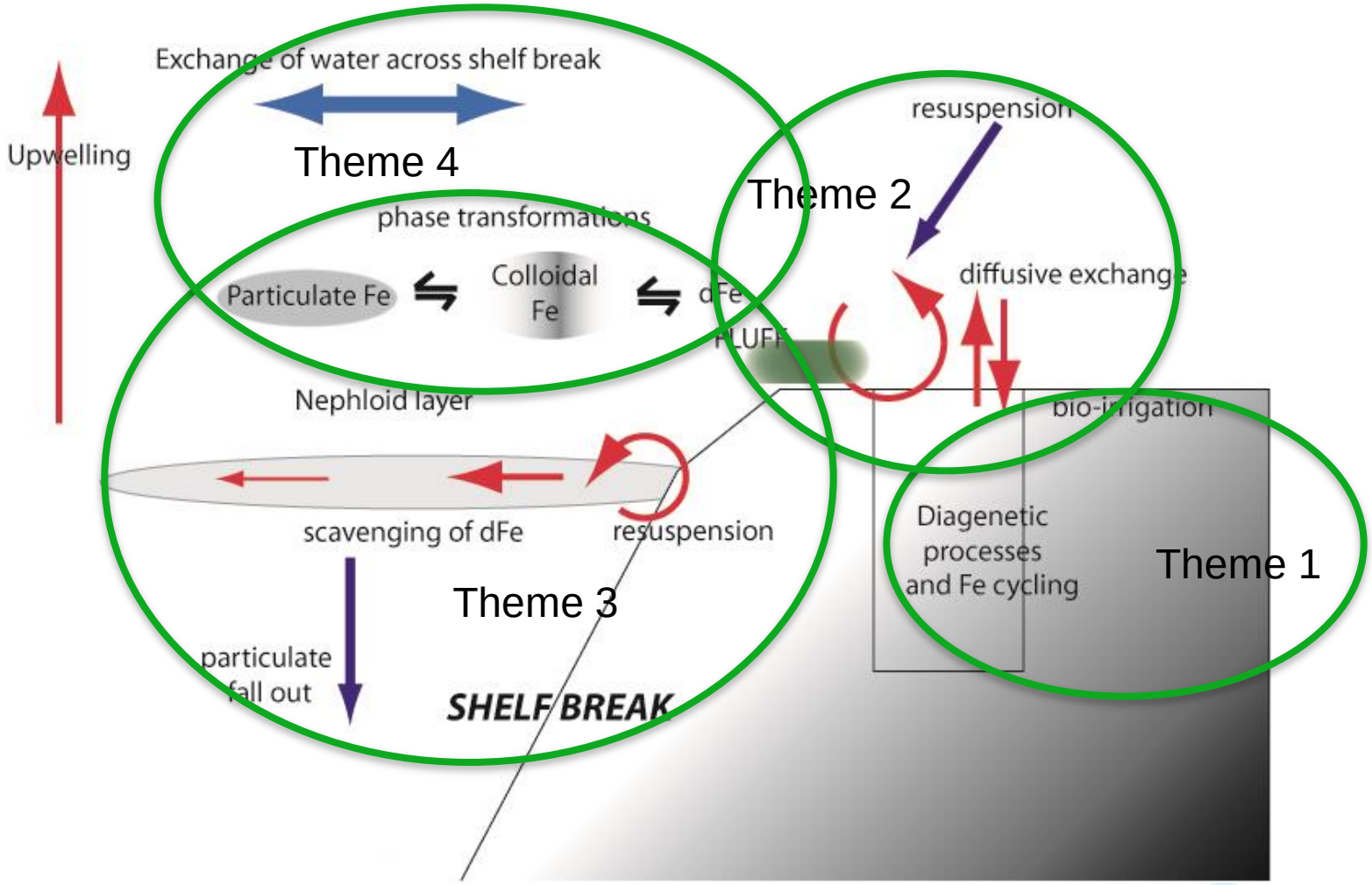
Key process affecting Fe distributions on shelf that relate to proposal hypotheses



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- **Hypothesis 1. The flux and isotopic signature of iron from shelf sediments is dependent on the physical and chemical characteristics of the sedimentary environment and overlying water column.**

What	How	Requirements
Measure Fe isotopes In sediment porewaters as indicator of DIR	Rhizon samplers at sea; clean up and MC-ICP-MS in shore lab.	Mega cores from consolidated sediments RHJ requires cleanly collected porewaters for Fe isotope measurements
Collect sediment porewaters for Fe speciation (FeII and FeIII FeIII ligands from incubation (MG) ?	Combined with above. Further filtration for size fractionation, plus FeII and total dFe FeII complexation (MG)?	Cold room for sample handling Nutrients (Malcolm W) DO profiles, pH sulfide

Hypothesis 2 Interaction with sediment particles and phytodetritus close to the seafloor will significantly modify fluxes of Fe to the overlying water column.

What	How	Requirements
Consolidated sediment Fe release /uptake	in core tube resuspension experiments at sea Potentially add Fe 57 labeled fluff	Cold room Ideally nutrient release also and oxygen utilization Say 3 experiments In replicate) plus control per cruise. Clean CTD for water samples
Examine organic re-mineralisation and Fe release in un-consolidated sediment	Use Fe-57 labeled organic debris and through flow reactors. Measure release of FeII and total dFe, nutrient release and oxygen usage Solid phase Fe speciation	Box cores/ grabs to obtain un-consolidated sediments Shore lab experiments Cold room for sample handling Nutrients DO profiles Sulfide, pH

Hypothesis 3

- **Fe export from the shelf to the ocean will be determined by the fate of Fe species within the water column during transport.**
- Objectives
- Determine size fractionation and concentrations of dFe (sFe, cFe) and pFe in onshore/offshore transects over the shelf edge.
- Identify and quantify changes in physical form, speciation and isotopic composition of dFe and pFe during off shelf transport. RHJ Fe isotopes - water column samples from sites that show offshore transport of Fe, filtered and preserved as for Fe conc measurements. 1-2 L are required.

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Hypothesis 4

- **Export of Fe to the open ocean is driven by transport and mixing along isopycnals.**
- Objectives:
- Follow changes in Fe concentration and form along off shelf isopycnals (including nepheloid layers).
- Assess the flux of Fe across SW shelf to/from the adjacent Atlantic
- Fe fluxes from concentrations and water mass fluxes from Ra measurements and available models.

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Interaction across WPs and beyond SSB

- Whilst WPs will have key deliverables, intention is to enhance science outcomes where possible through additional interactions
- Some ideas under development, some new

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Benthic WP3

- Combination with C and macro nutrient projects in WP2
- Respiration experiments (Henrick Stahl)
- Resuspension/through flow reactor experiments (Thompson, Fones et al.)
- Re cycling of Fe from biogenic debris together with C and N (Mayor)
- Impact of in fauna on Fe release/removal (Solan et al.)
- Microbial activity in sediments relevant to Fe (e.g. DIR) PML??
- Linking sediment colour redox and geochemistry (CEFAS Parker)

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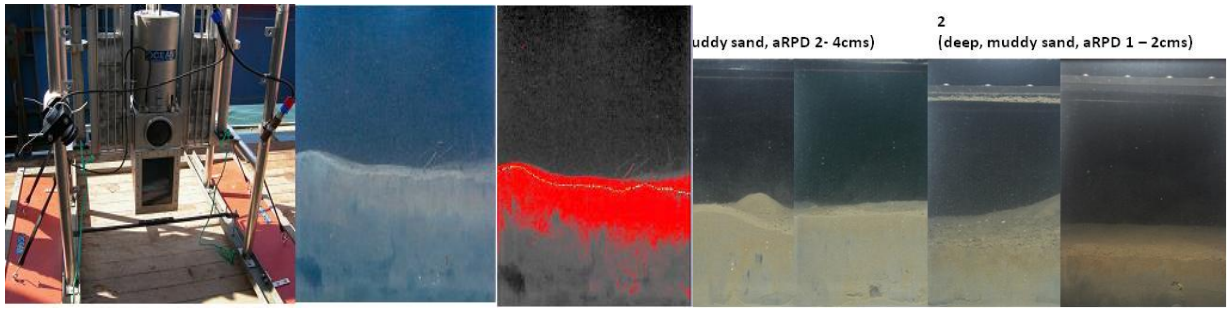
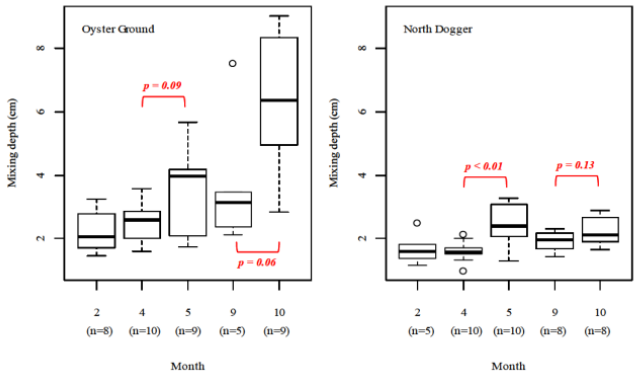
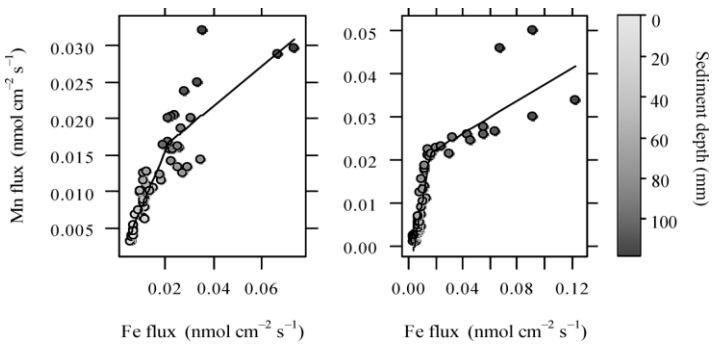
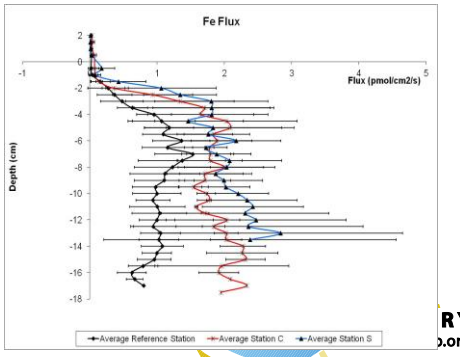
SPI (Sediment Profile Imagery)

- Colour (brown/grey) transition describes Fe reduction boundary, biological mixing
- Spatial and temporal changes – regional shelf scale
- Links to pore-water Fe / P sampling (controlled by DOC, S species)









Teal et al., 2009; 2010;2013; Parker et al., 2013

Pelagic WP3

- Impact of PP on Fe concentrations, and vice versa? (Moore Purdie Robinson et al.)
- Behaviour of other trace metals (PhD Dagmara Rusiecka ; Eric Achterberg supervisor)
- Nepheloid layers as sinks sources of Fe (link to Glider Programme, Matthew Palmer)
- Links to physics (Sharples et al.) and Ra work

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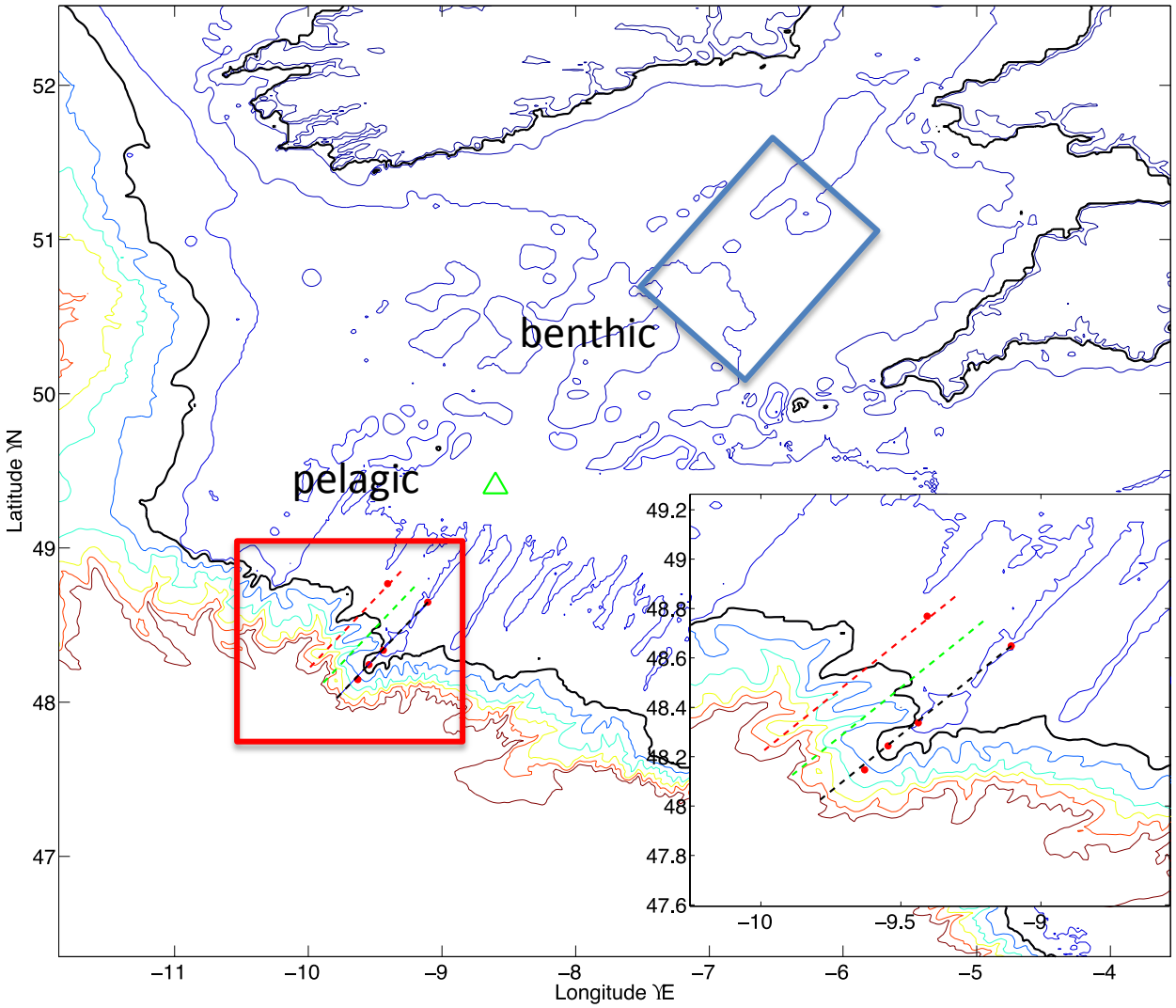
Modelling WP4

- Modelling of benthic sources of Fe
- Modelling of off-shelf Fe transport (Ra work, Geibert)

Glider programme

- Tracking of nepheloid layers (NLs) to allow sampling
- Temporal and spatial variability of NLs
- NLs as off shelf Fe, C and macronutrient vectors (link to WP5??)
- Additional data for PP and water column studies

Main working areas



Key Points

- Above selection not exhaustive
- This meeting is the time to discuss above plus any new ideas!
- Not all will be possible
- Recently announced supplementary SSB funds may help make new ideas happen
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