

WP3: Overview of iron flux studies

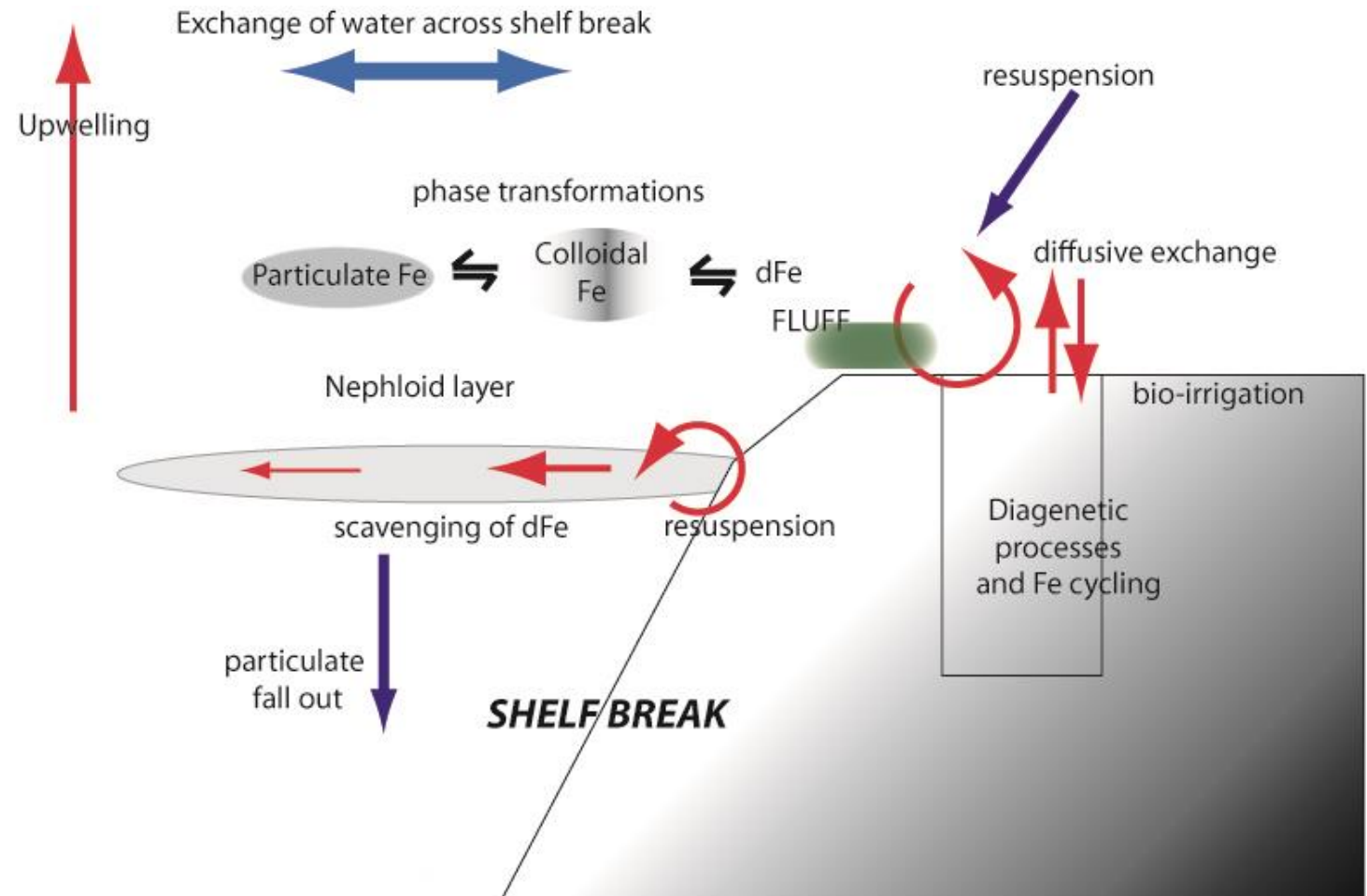
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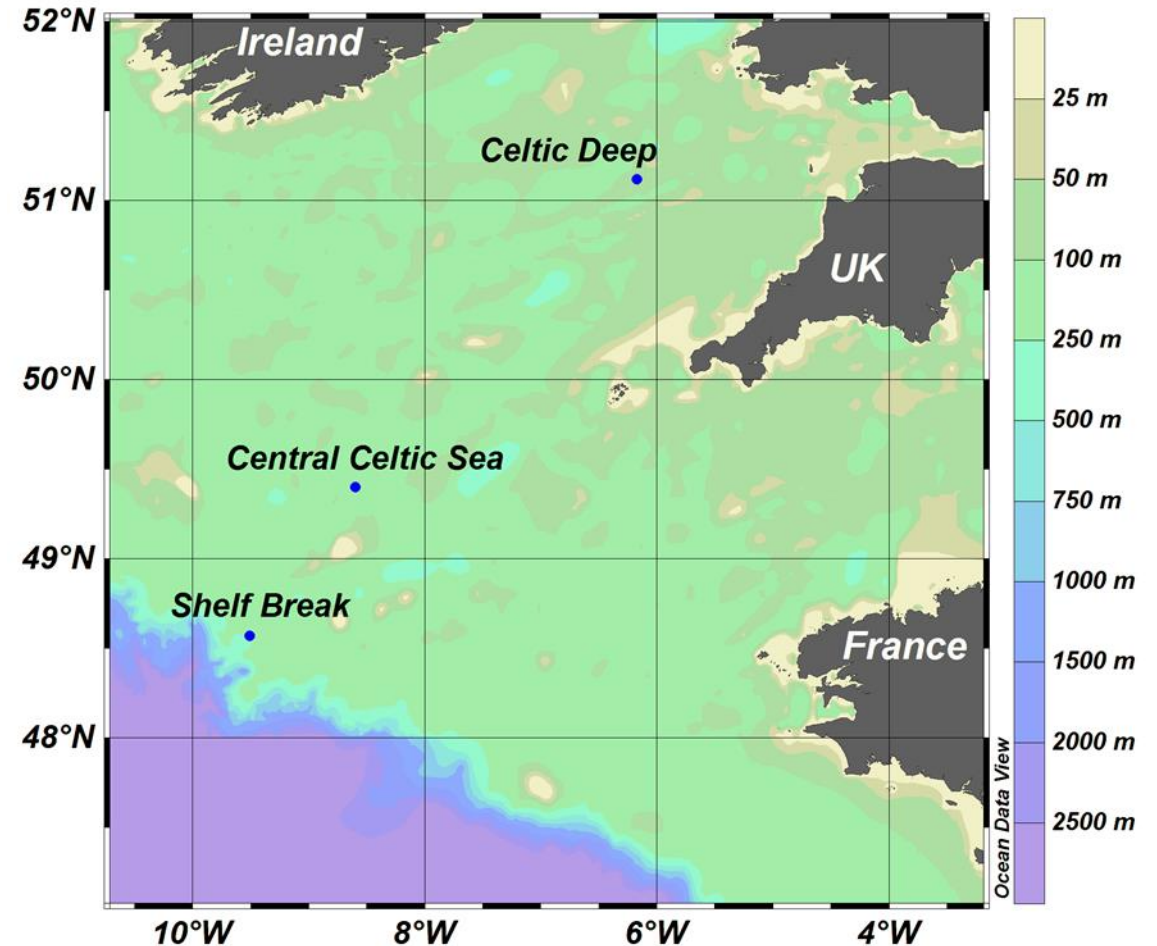
Supply of iron from shelf sediments to the ocean

- Release of dissolved Fe into sediment pore waters & the overlying water column
- Transport & transformation of dissolved Fe in shelf waters & across the shelf break
- Export of Fe to the open ocean

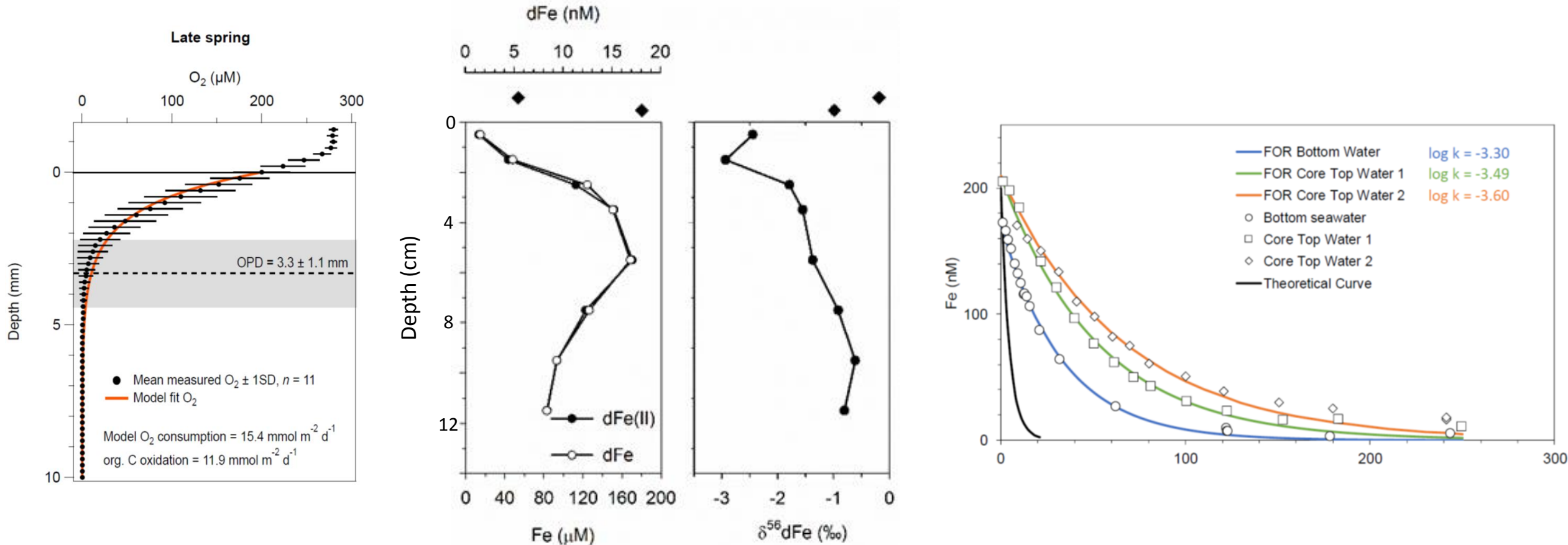


The Celtic Sea

- Seasonally stratified shelf sea
- Along shelf slope surface currents mainly to north west but can reverse in summer
- Mixing can occur at the shelf break
- Slope intersected by submarine canyons that trap particles

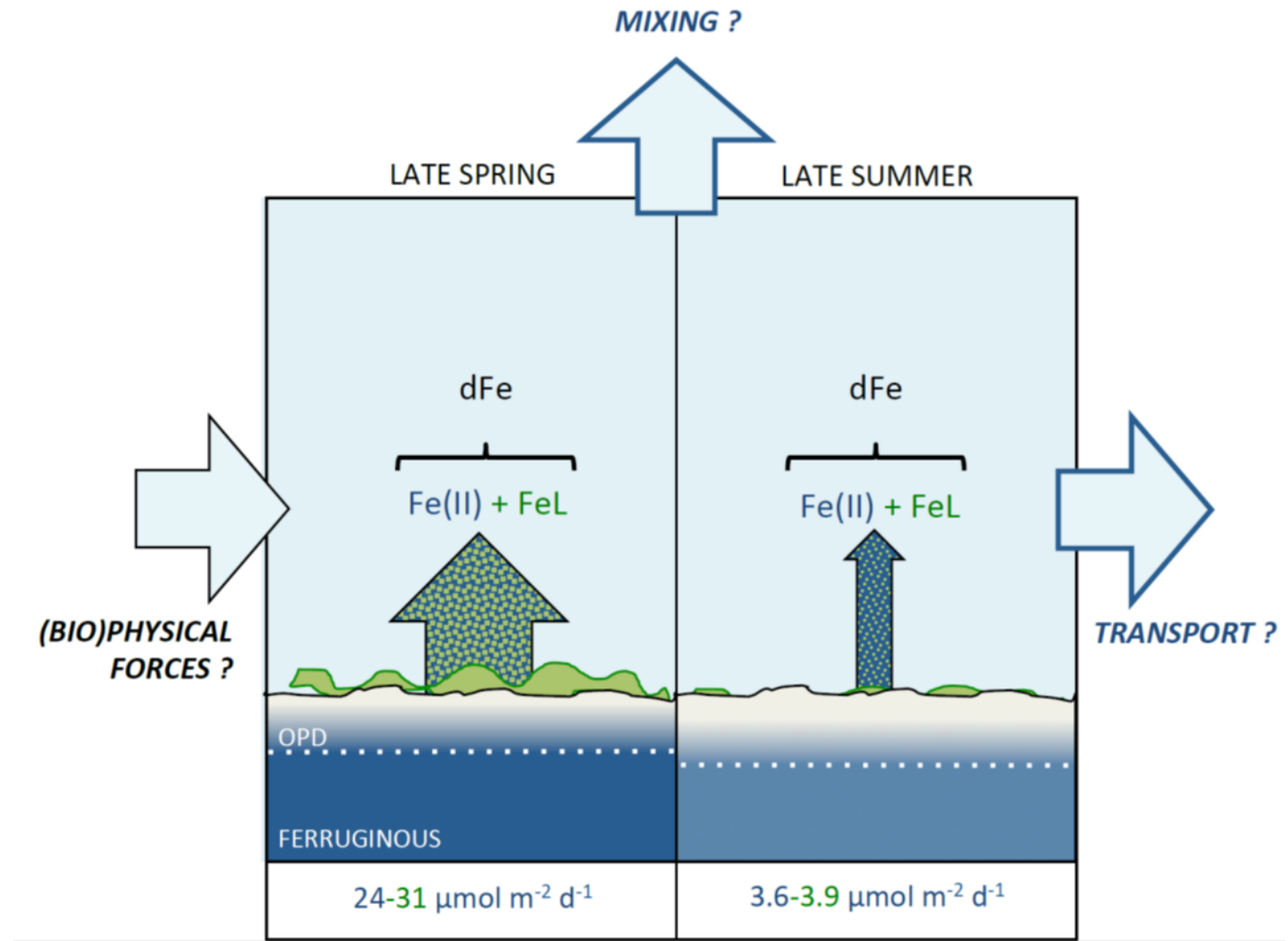


Release of Fe from sediments to an oxic water column



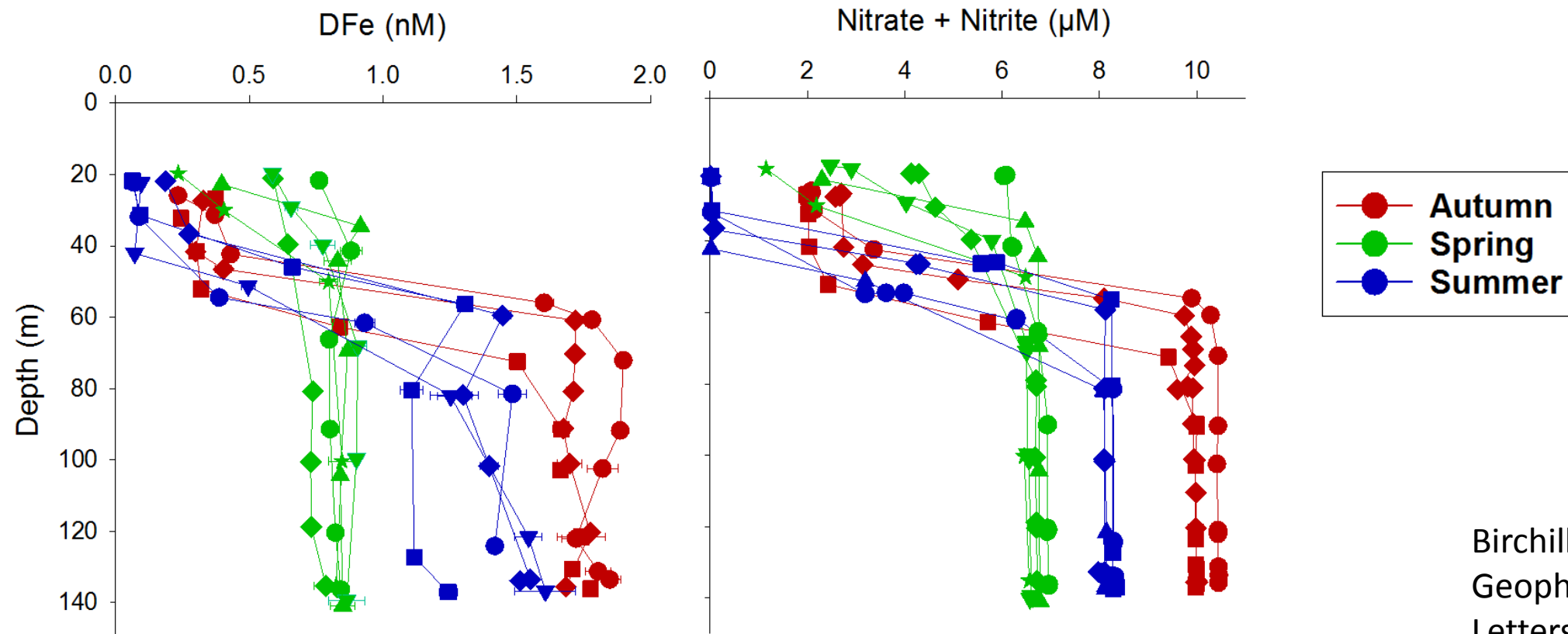
See Klar et al. (2017) Biogeochemistry doi:10.1007/s10533-017-0309-x

- Suboxic shelves Fe flux ~ 10 - $100 \mu\text{mol m}^{-2} \text{d}^{-1}$
- Flux on oxic shelves is seasonally significant
 - Likely to be higher if non-diffusive fluxes considered
 - Likely to be higher for sandy sediments

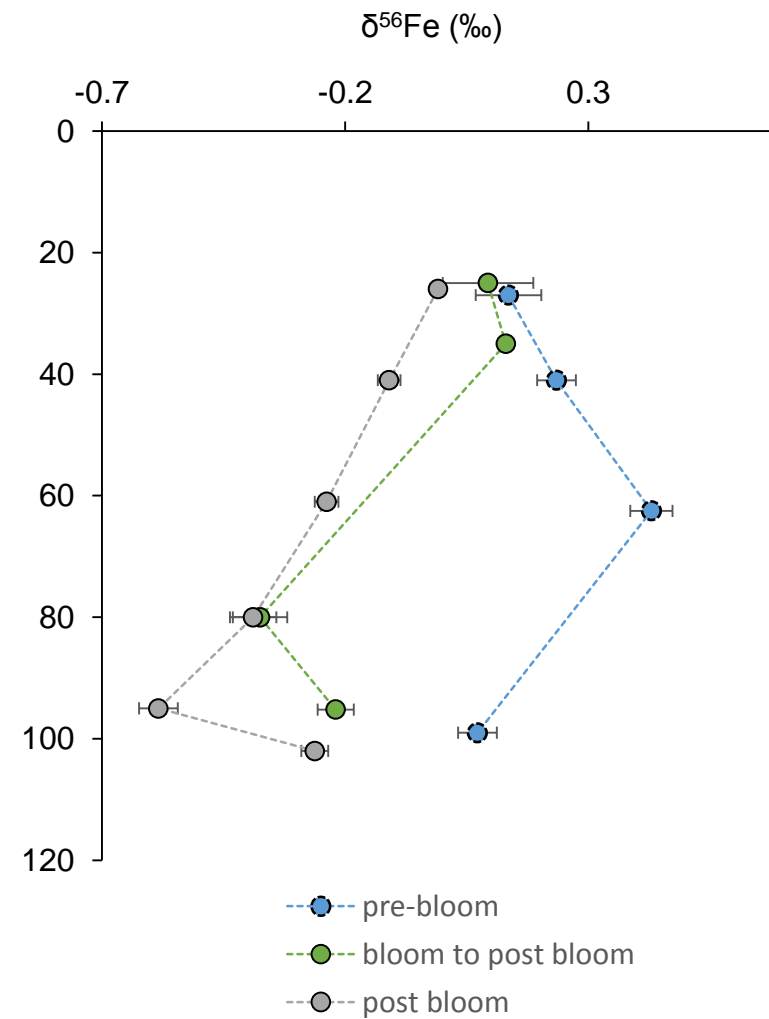
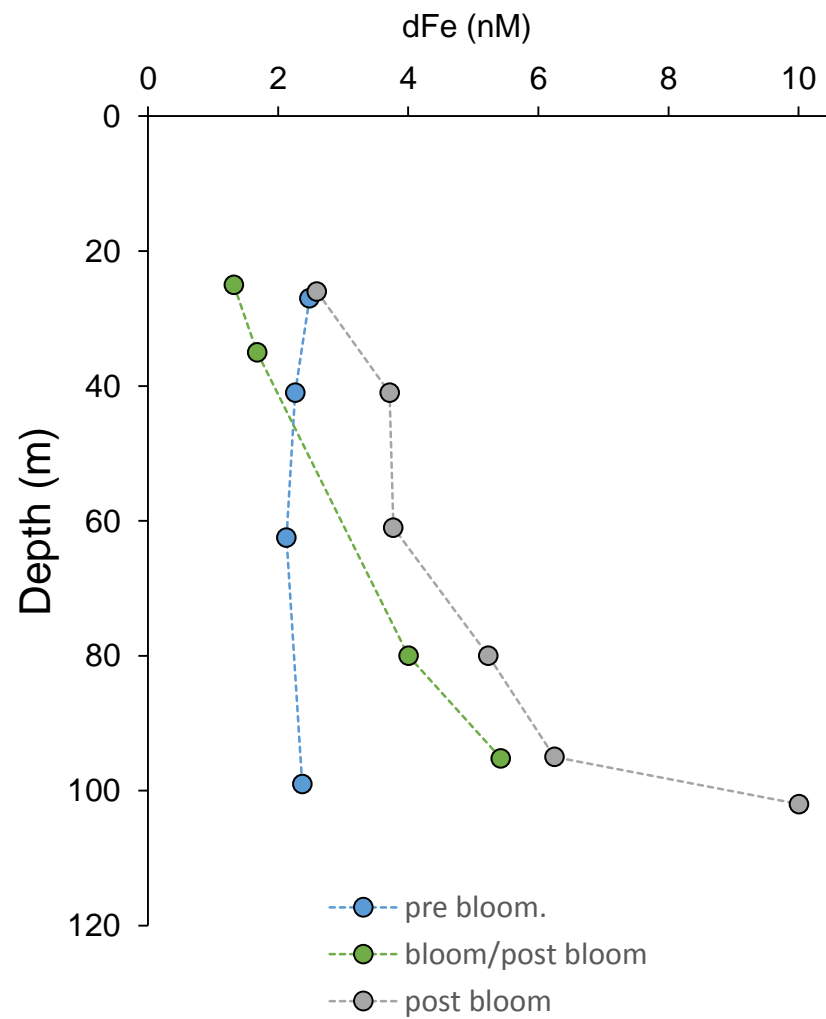


Fe in the water column

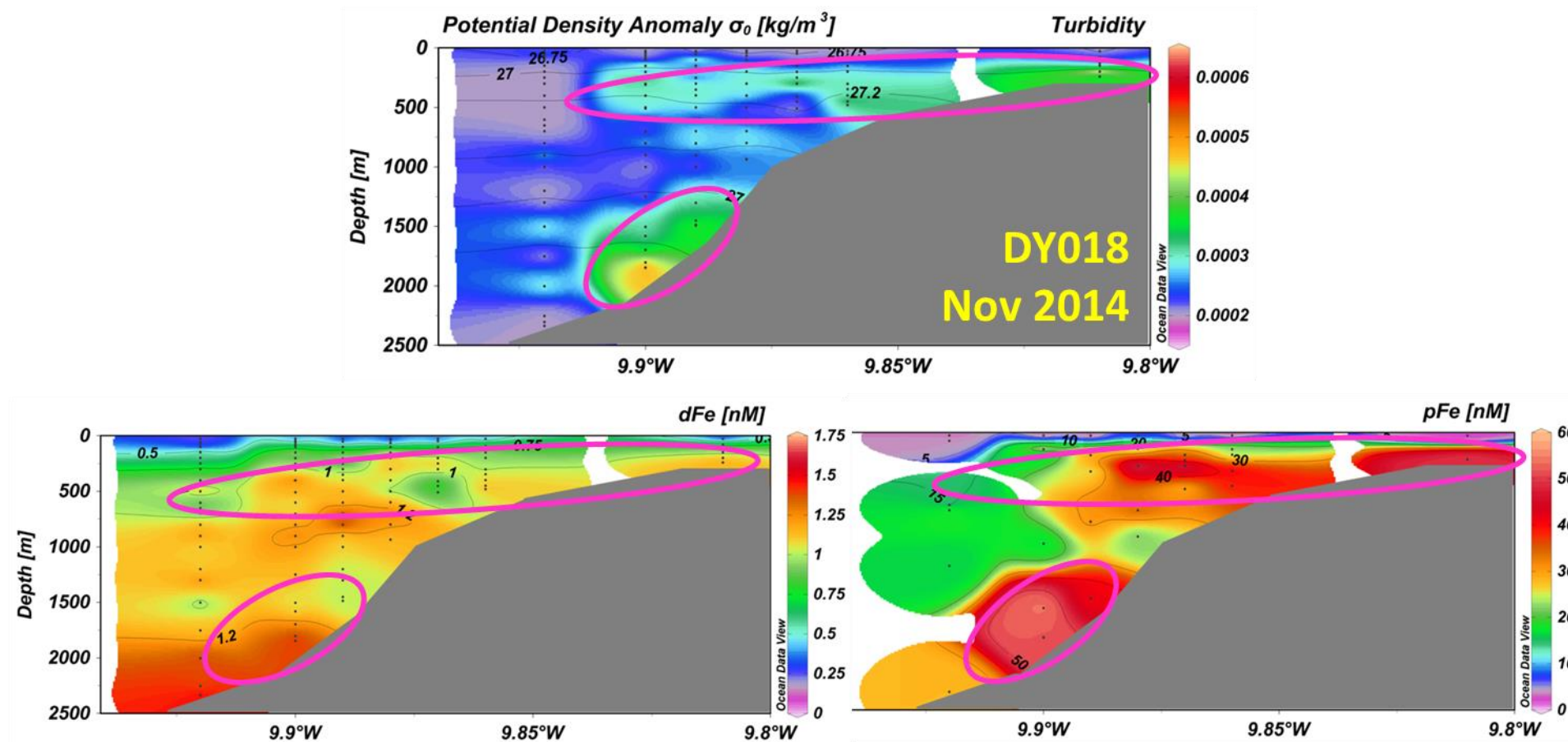
- Distribution of dFe similar to nitrate
- Bioavailable Fe depleted in surface mixed layer when waters are stratified



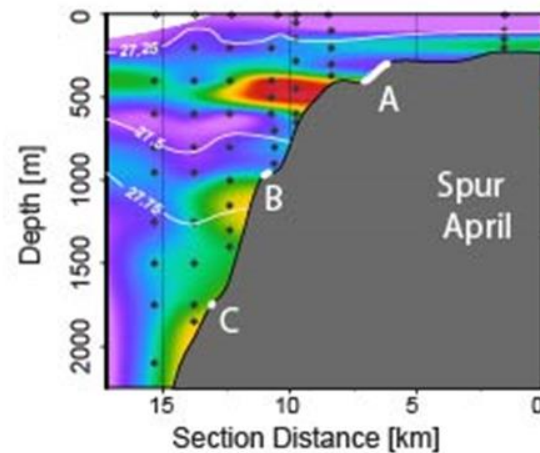
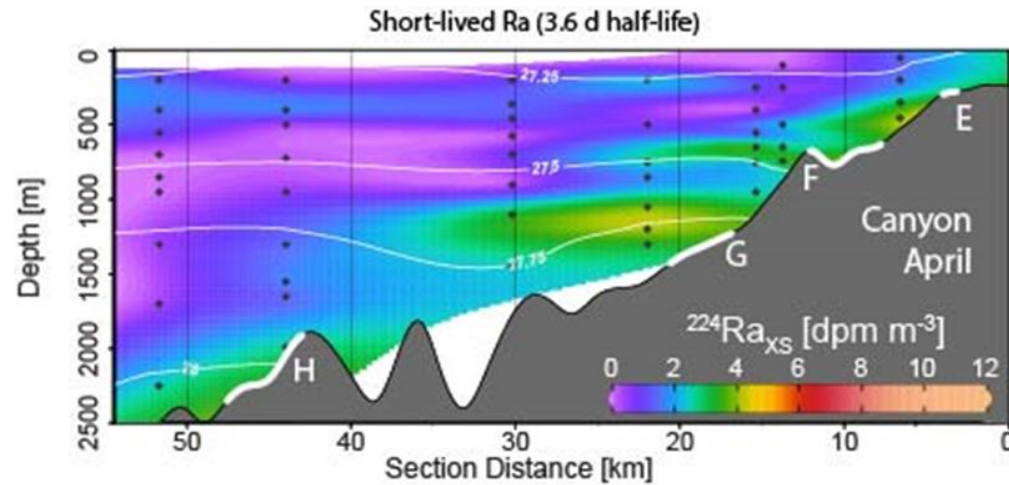
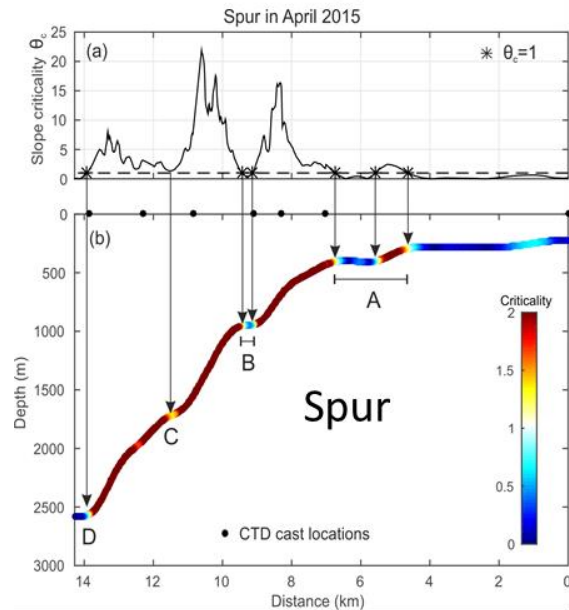
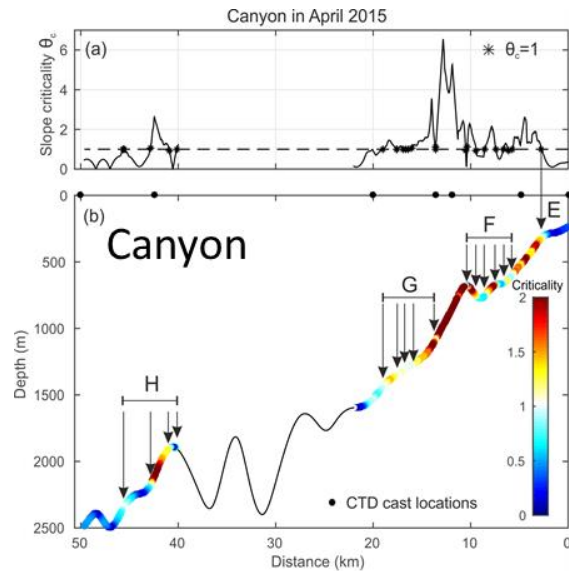
Birchill et al., in review,
Geophysical Research
Letters



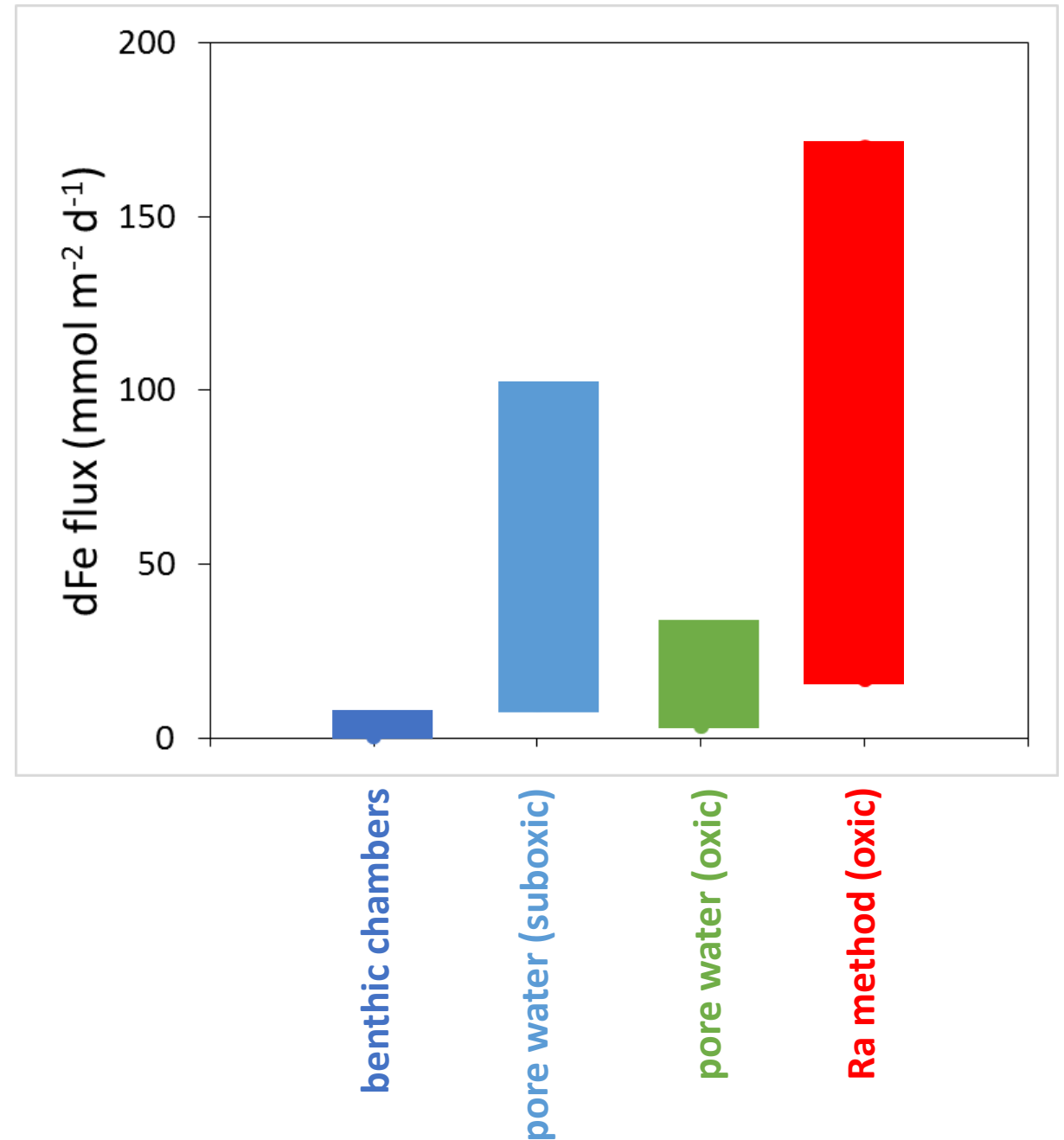
- High concentrations of dFe and pFe associated with nepheloid layers at intermediate depths
- These layers are persistent and occur throughout the year



Influence of slope on formation of nepheloid layers

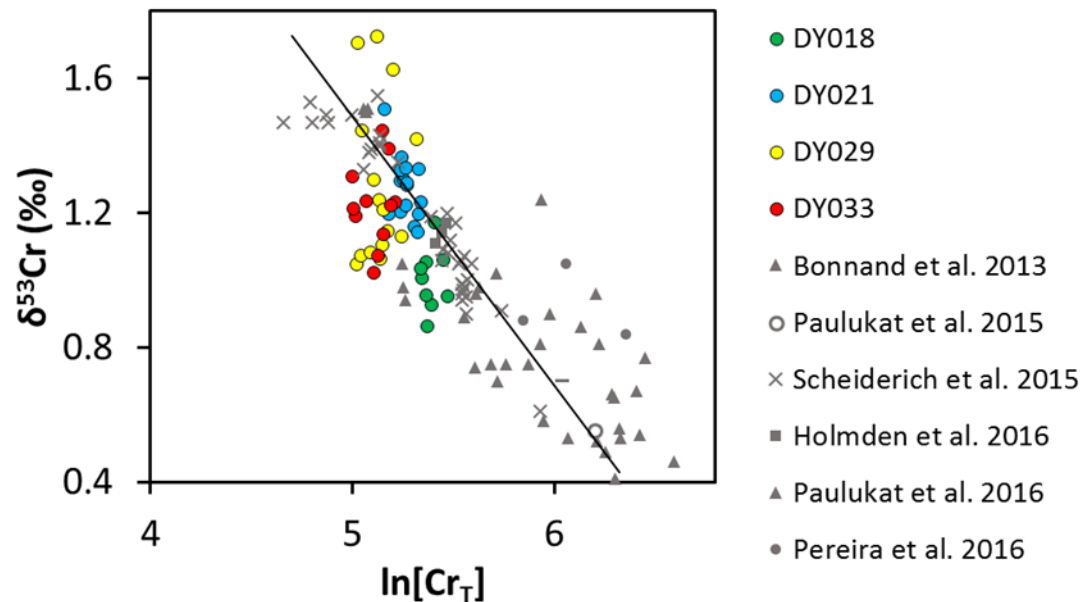


- Radium-derived fluxes are higher than those predicted from analyses of pore waters (inc. this study) and benthic chamber experiments
 - Fits with idea that pore water estimates are minima
 - Ra method reflects energetic suspension processes that cannot be captured by other methods
 - Sediment resuspension is a very effective way of mobilising iron from sediments into the water column



Value-added studies

- [Cr] and $\delta^{53}\text{Cr}$ are decoupled in the Celtic Sea
 - Shelf waters relatively high [Cr] and high $\delta^{53}\text{Cr}$
 - Offshore waters $\delta^{53}\text{Cr}$ notably higher in autumn



- Dissolved Cd, Zn, Ni & Cu correlate with macronutrients (not influenced by proximity to shelf)
- Dissolved Mn, Co & Pb influenced by source inputs (sediments & proximity to shelf)

