Iron isotopes track the uptake and exchange of iron across an oxic shelf sea

A J M Lough[1*], J K Klar[2], R H James[1], D P Connelly[3] , W B Homoky[4], J A Milton[1], P J Statham[1]

[1] Ocean and Earth Science, University of Southampton , National Oceanography Centre Southampton, Waterfront Campus, European Way, Southampton, SO14 3ZH, UK (*correspondence: A.J.M.Lough@soton.sc.uk)

[2]LEGOS, Universite de Toulouse, 14 Avenue Edourd Belin, 31400 Toulouse, France

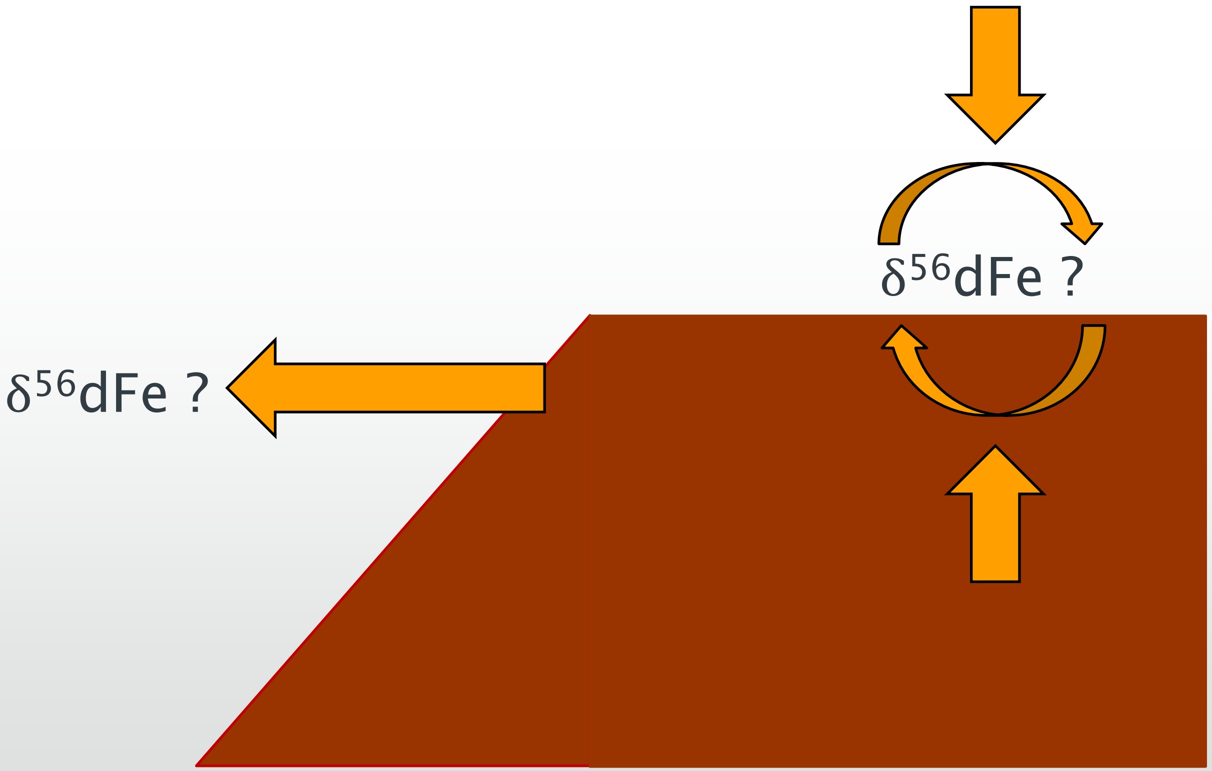
[3] *National Oceanography Centre, European Way, Southampton, SO14 3ZH, UK.*

[4] Department of Earth Sciences, University of Oxford, South Parks Road, Oxford, OX1 3AN, UK

Aims

- To differentiate the (i) source inputs of Fe fluxes (ii) and effects of primary productivity on the shelf seasonally

- Track the transport of sediment-derived dFe off the shelf



Fe isotope biogeochemistry

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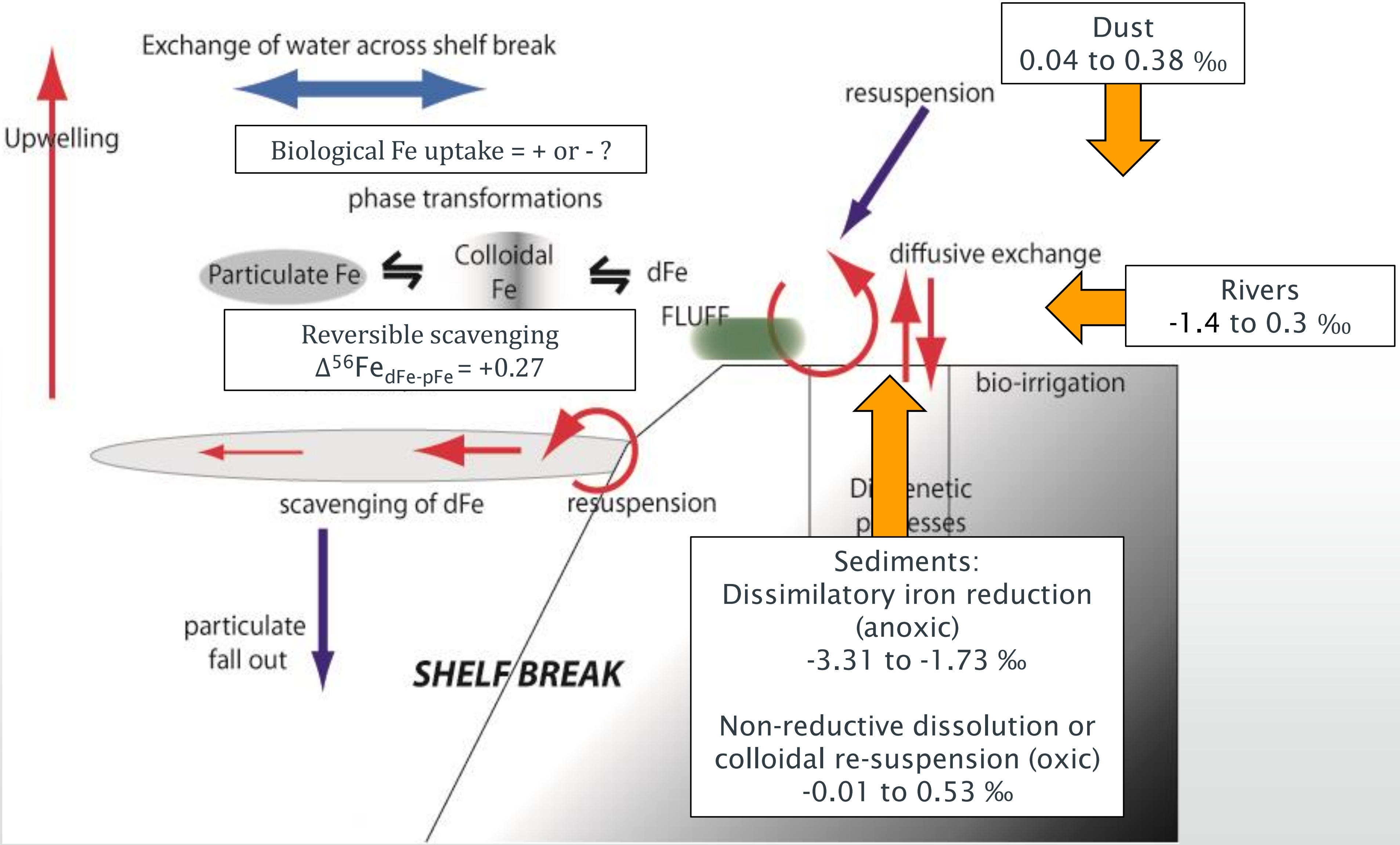
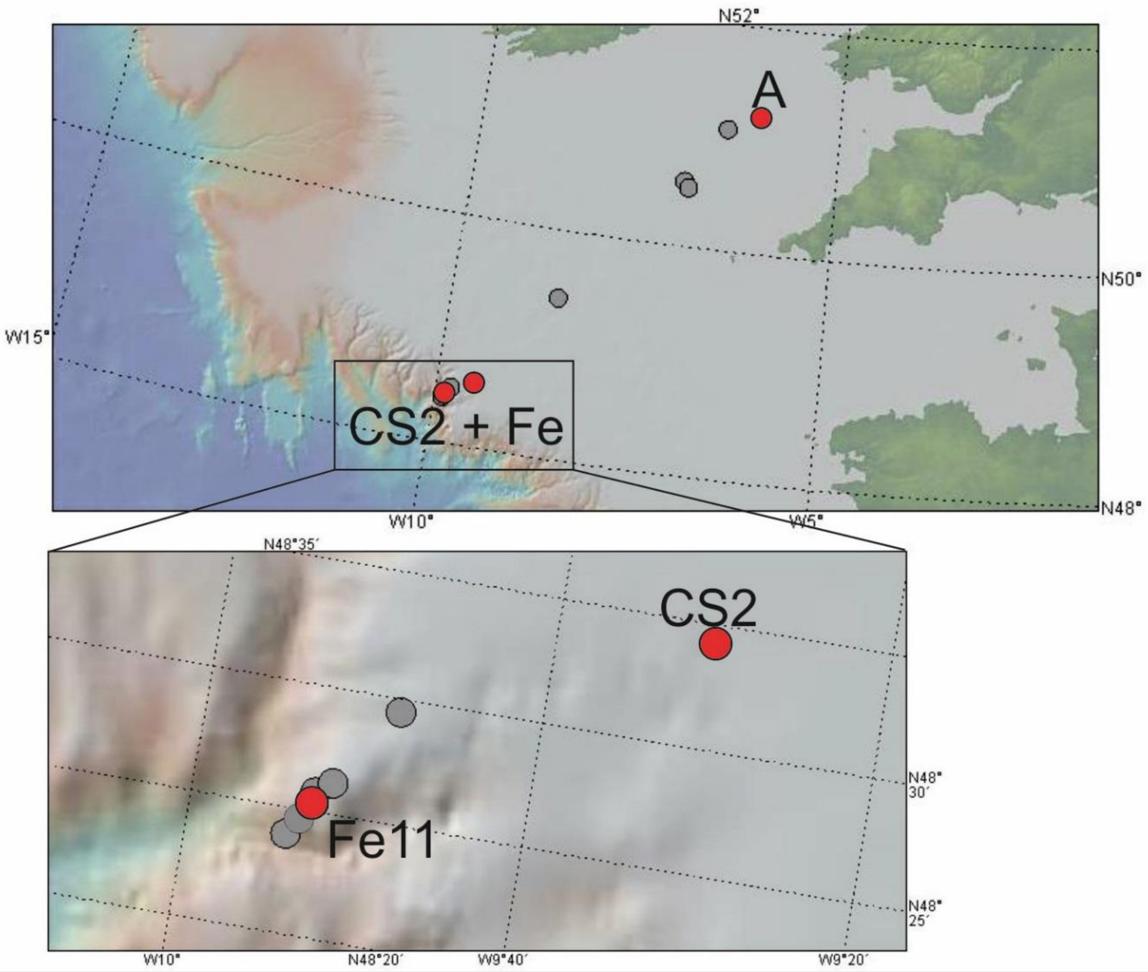


Sampling



Site A

DY021 - March 2015 (pre-bloom)
DY030 - May 2015 (bloom/post bloom)
DY034 - August 2015 (post bloom)

CS2 and Fe11

DY029 - April 2015 - Fe11
DY030 - May 2015 - CS2

Site A – Pre bloom

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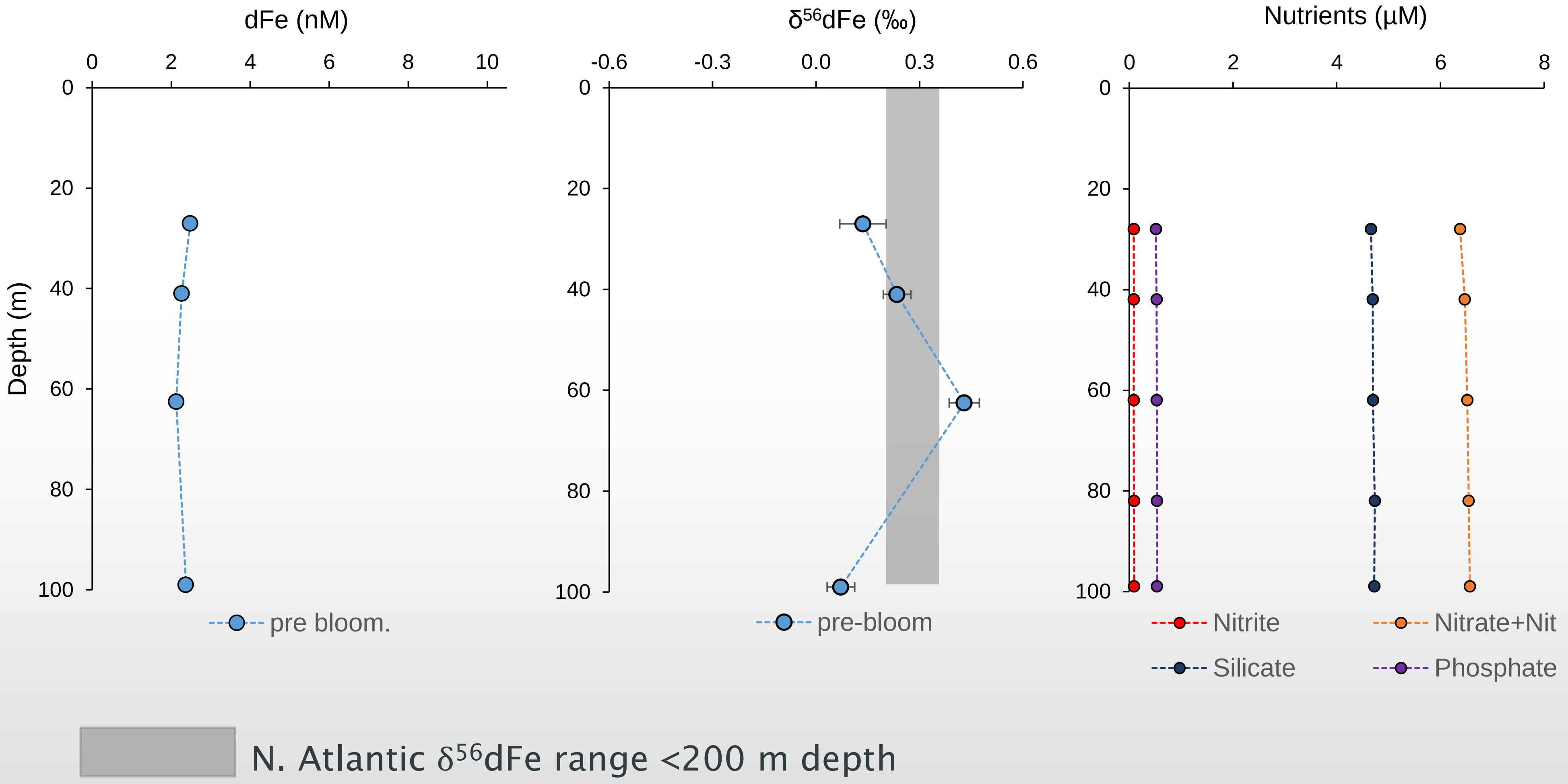
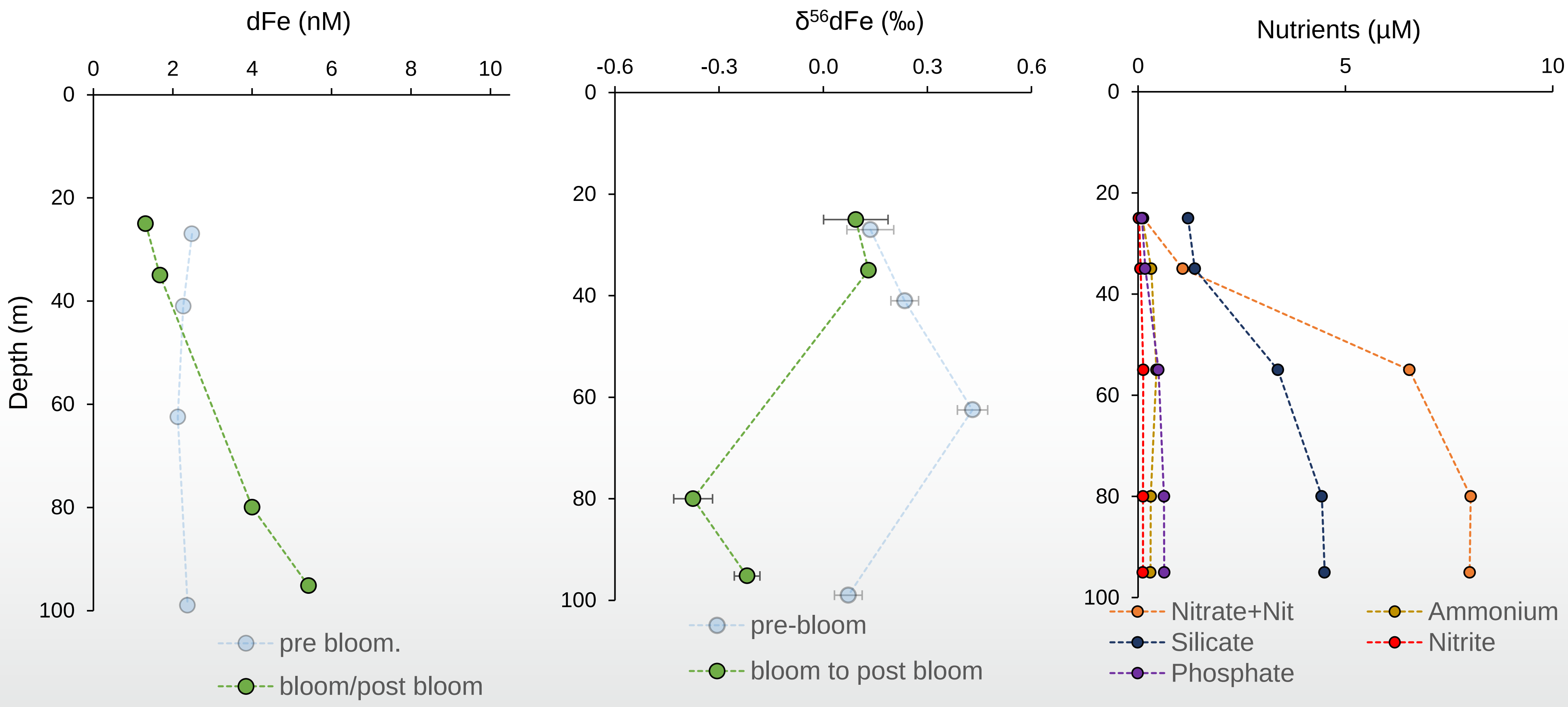
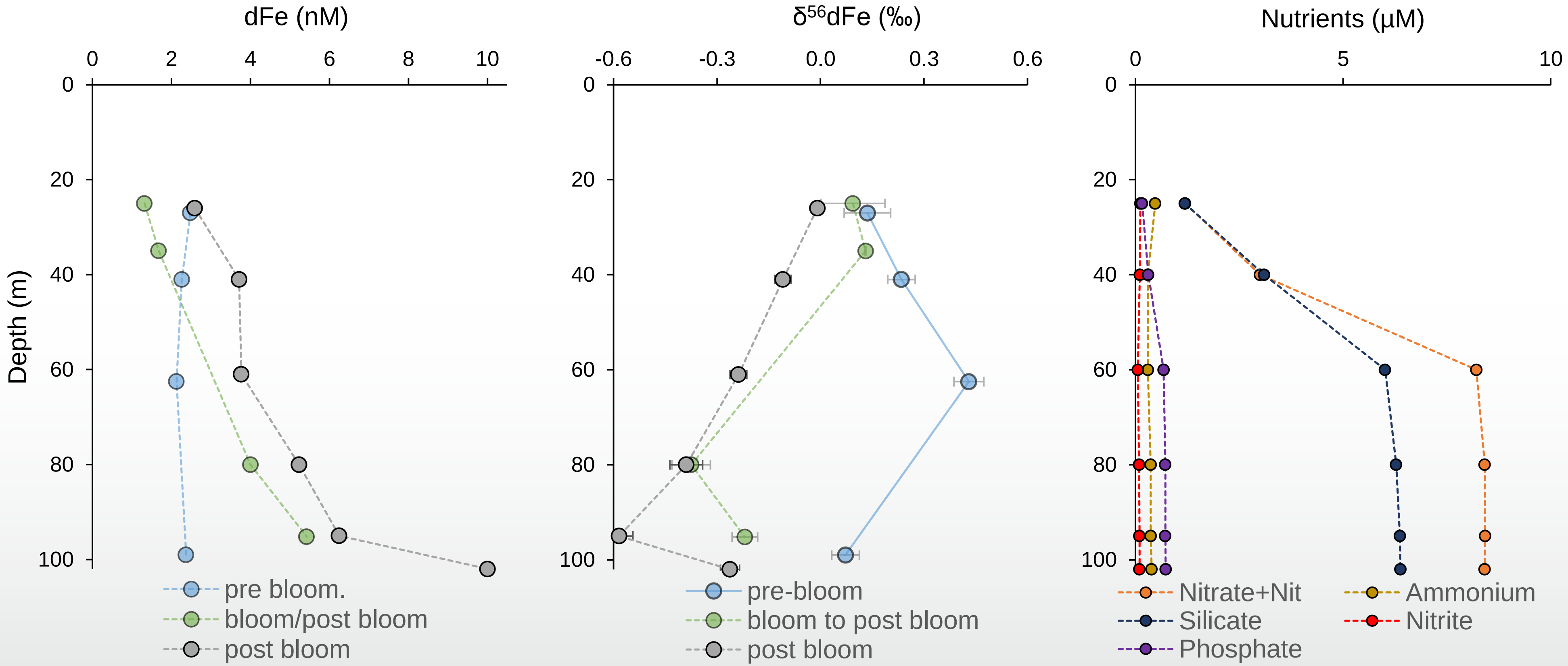


Site A – Bloom/post bloom



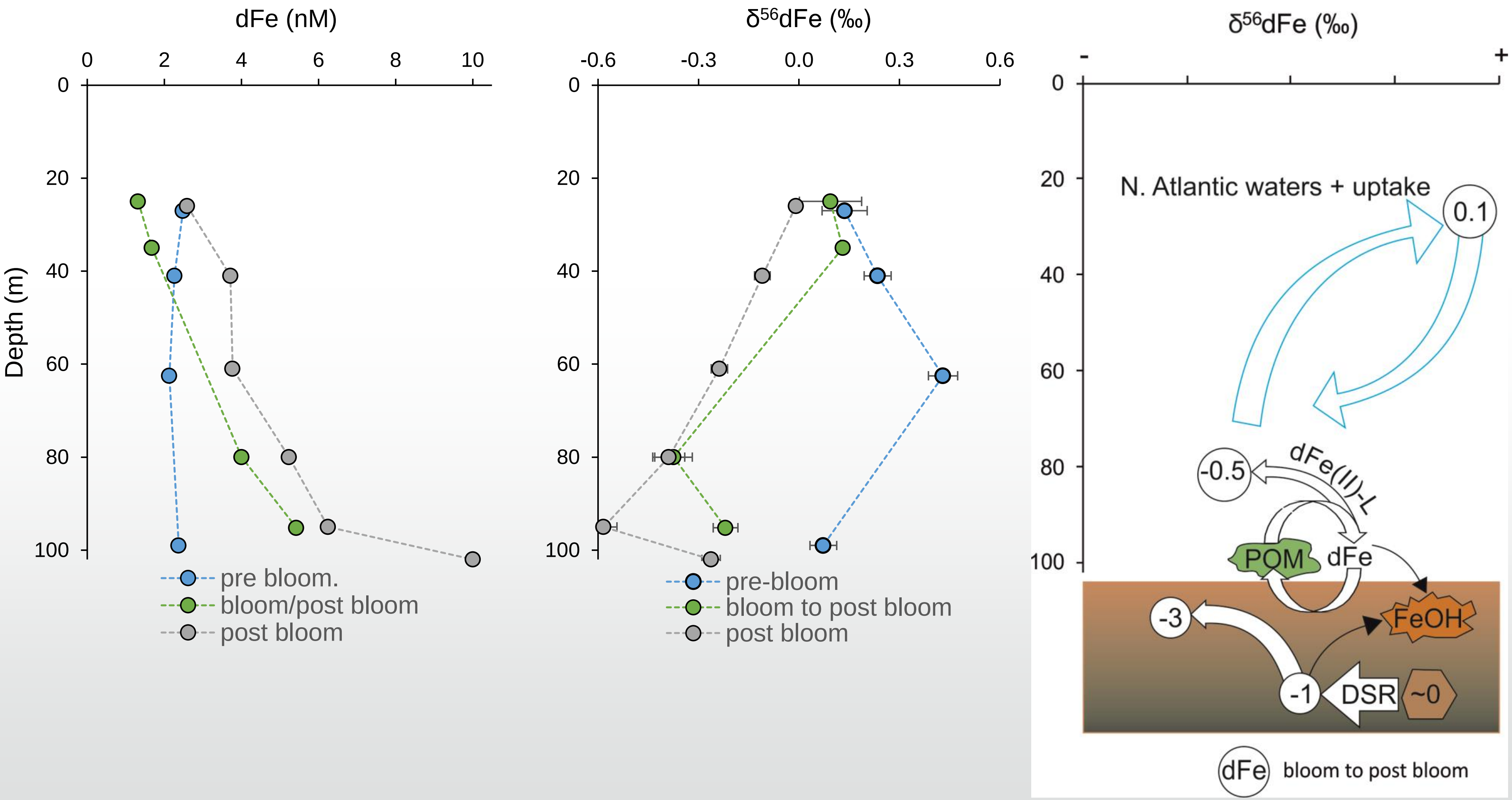
- Pore water δ^{56}dFe ranges from -3 to -0.6 ‰ >85 % is soluble Fe (II)
- Bottom waters 72 % colloidal Fe δ^{56}dFe ranges from -0.5 to -0.2 ‰

Site A – Post Bloom

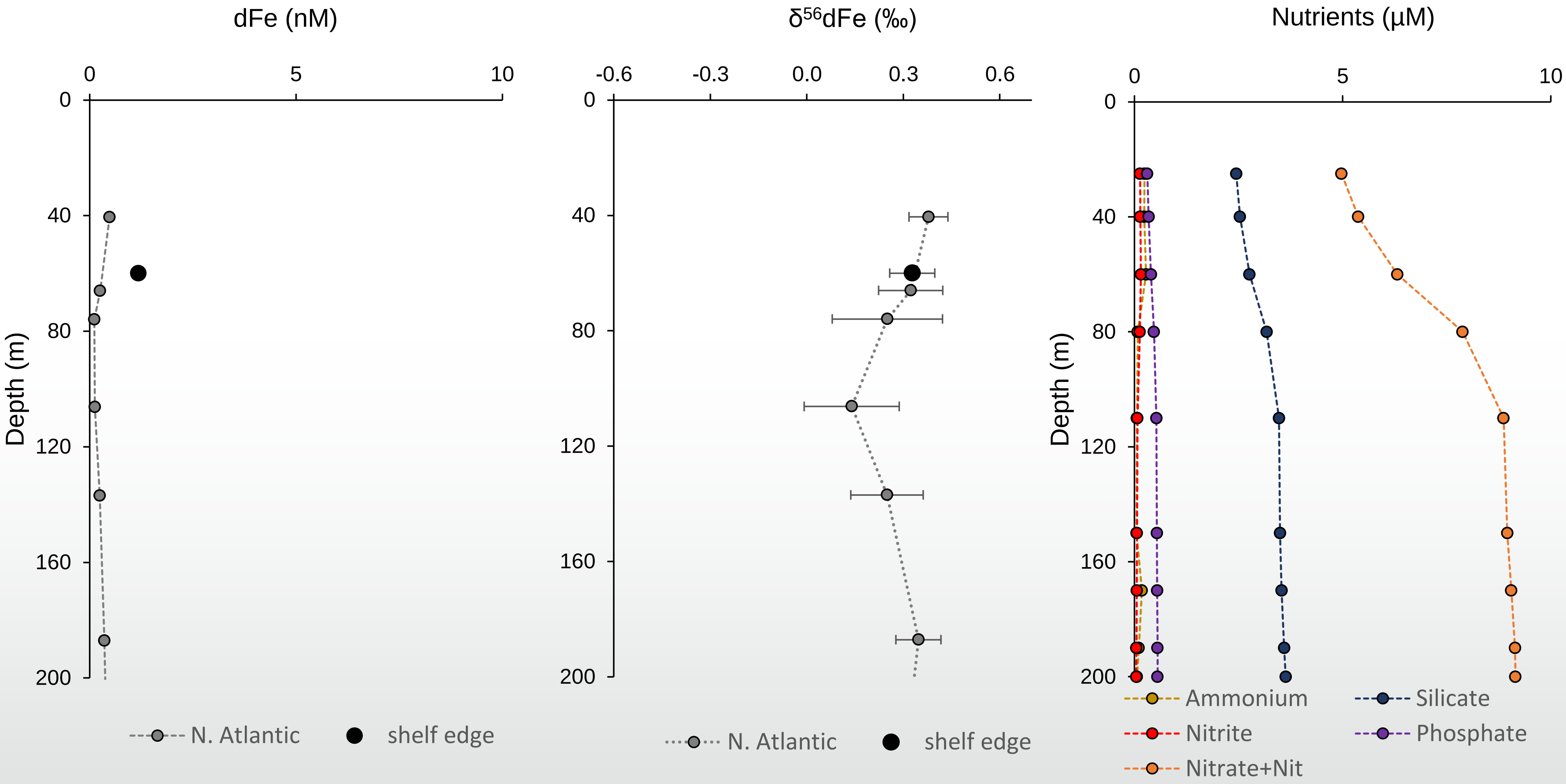


- Pore water δ^{56}dFe ranges from -3 to -0.6 ‰ >85 % is soluble Fe (II)
- Bottom waters 72 % colloidal δ^{56}dFe ranges from -0.6 to -0.3 ‰

Site A – Summary

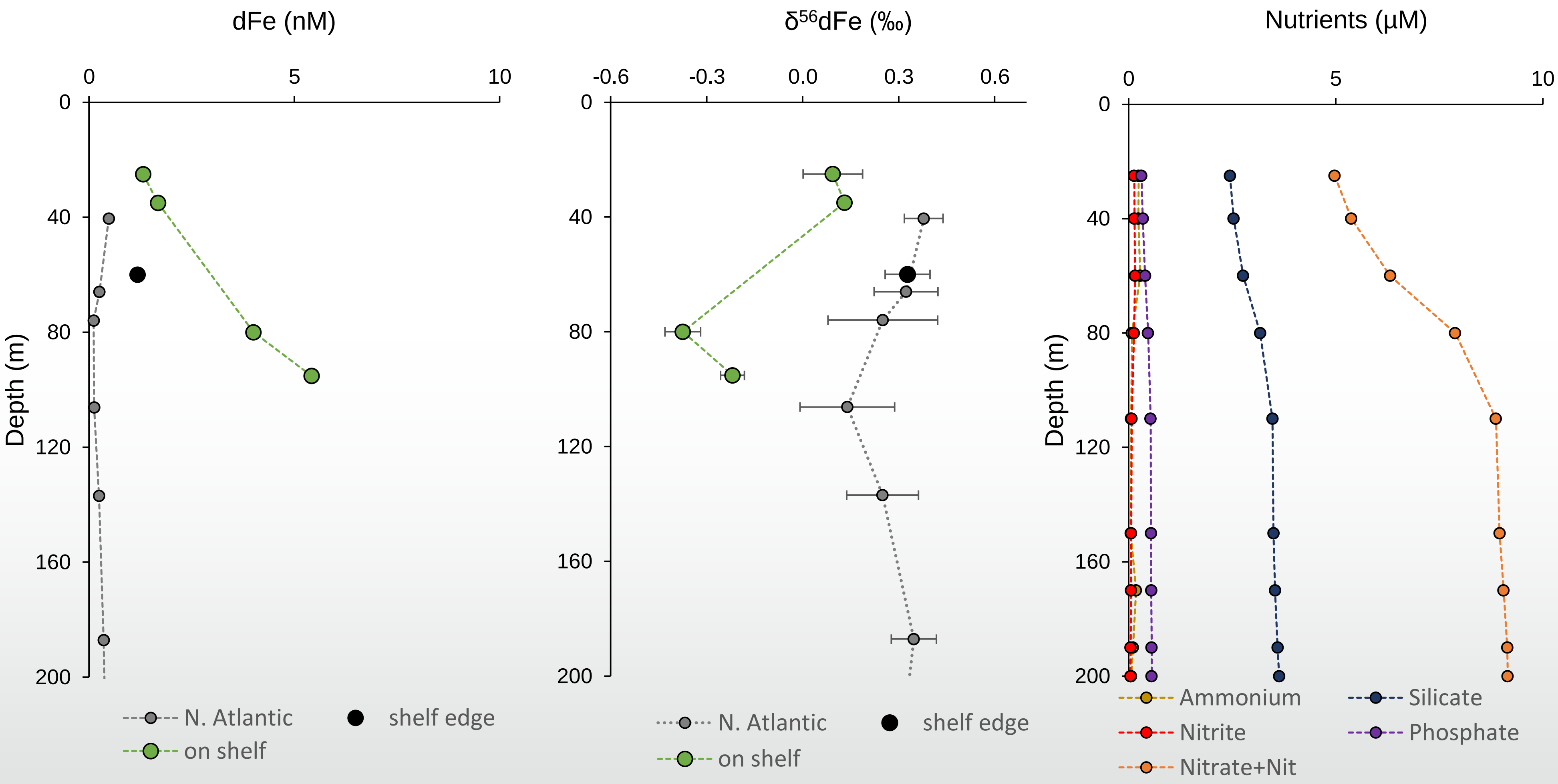


Shelf edge



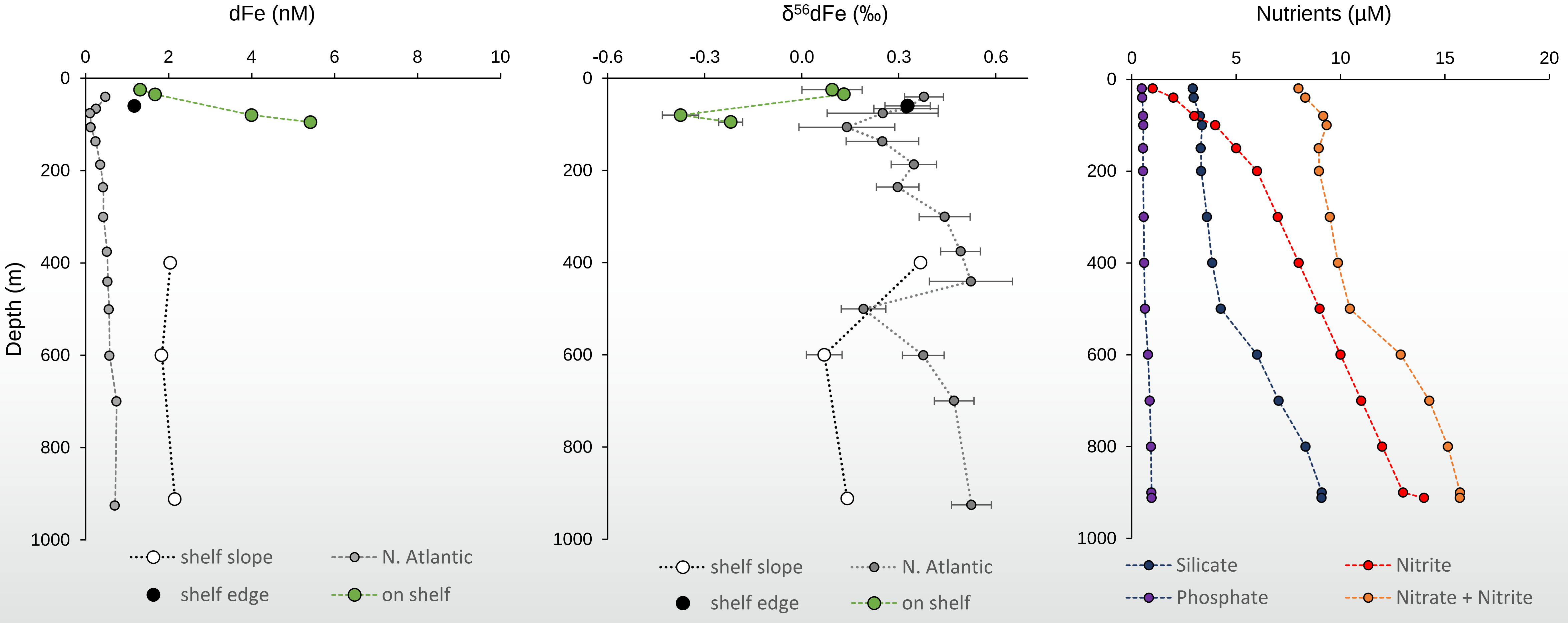
- N. Atlantic data (grey) 35° W, 22° N, Conway & John (2014)

Shelf edge



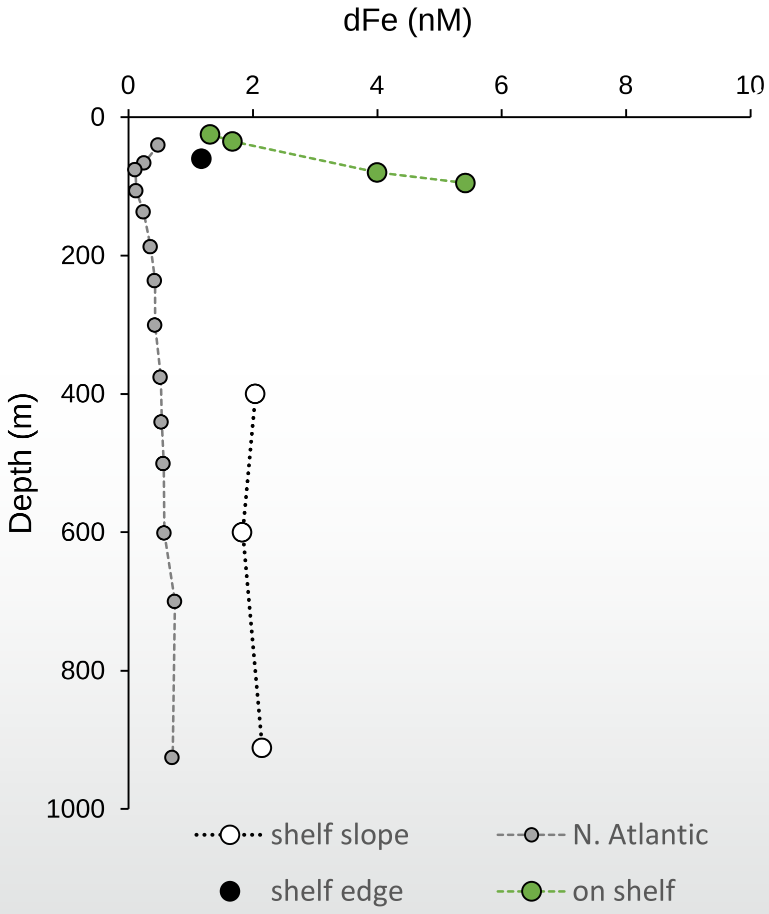
- N. Atlantic data (grey) 35° W, 22° N, Conway & John (2014)

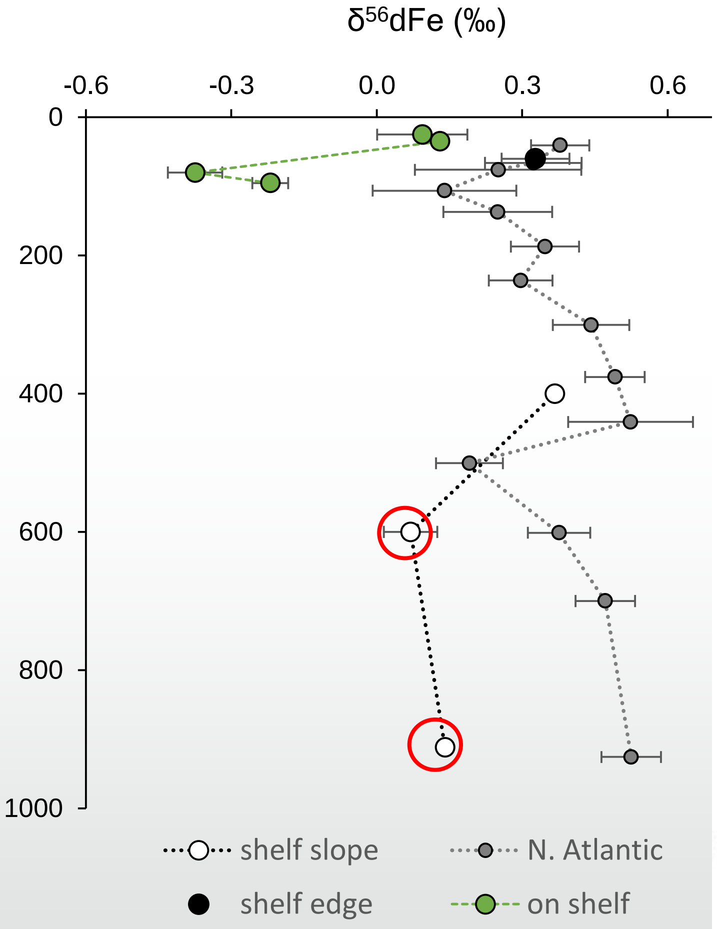
Shelf slope

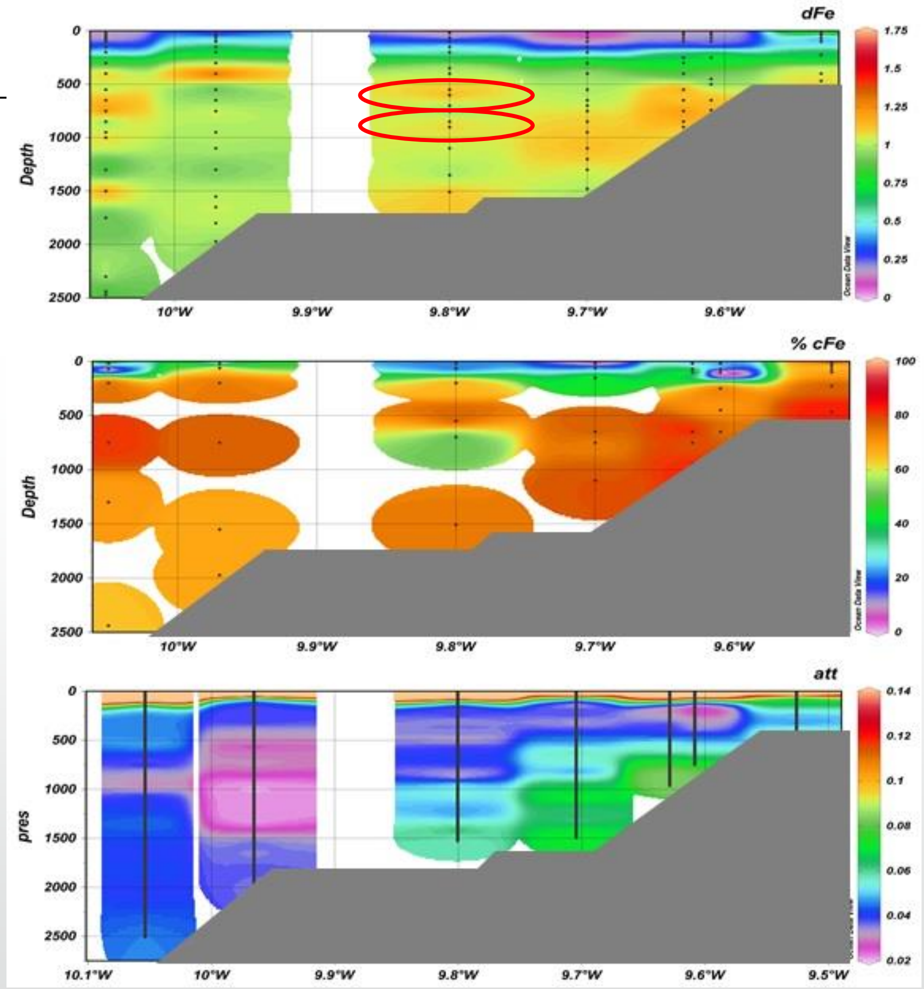


- N. Atlantic data (grey) 35° W, 22° N, Conway & John (2014)

Shelf slope







- N. Atlantic data (grey) 35° W, 22° N, Conway & John (2014) shelf slope profile A. Birchill (2016)

Conclusions & Future work

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- Bottom water Fe isotope signatures on the shelf are indicative of ligand stabilised pore water flux of Fe post bloom.

- Shift to isotopically lighter Fe throughout water column as bloom progresses and Fe flux increases.

- Shelf edge isotope compositions similar to N. Atlantic waters (so far), lighter isotope composition on shelf slope associated with (re-suspended) colloidal Fe mixed into overlying waters.

- Analysis of more shelf slope and shelf edge samples (incl. nepheloid layers) to complete depth profiles.

Acknowledgements:

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- Many thanks to:
- Antony Birchill – initial Fe data and plots for DY029 T1
- Malcolm Woodward – Nutrient data

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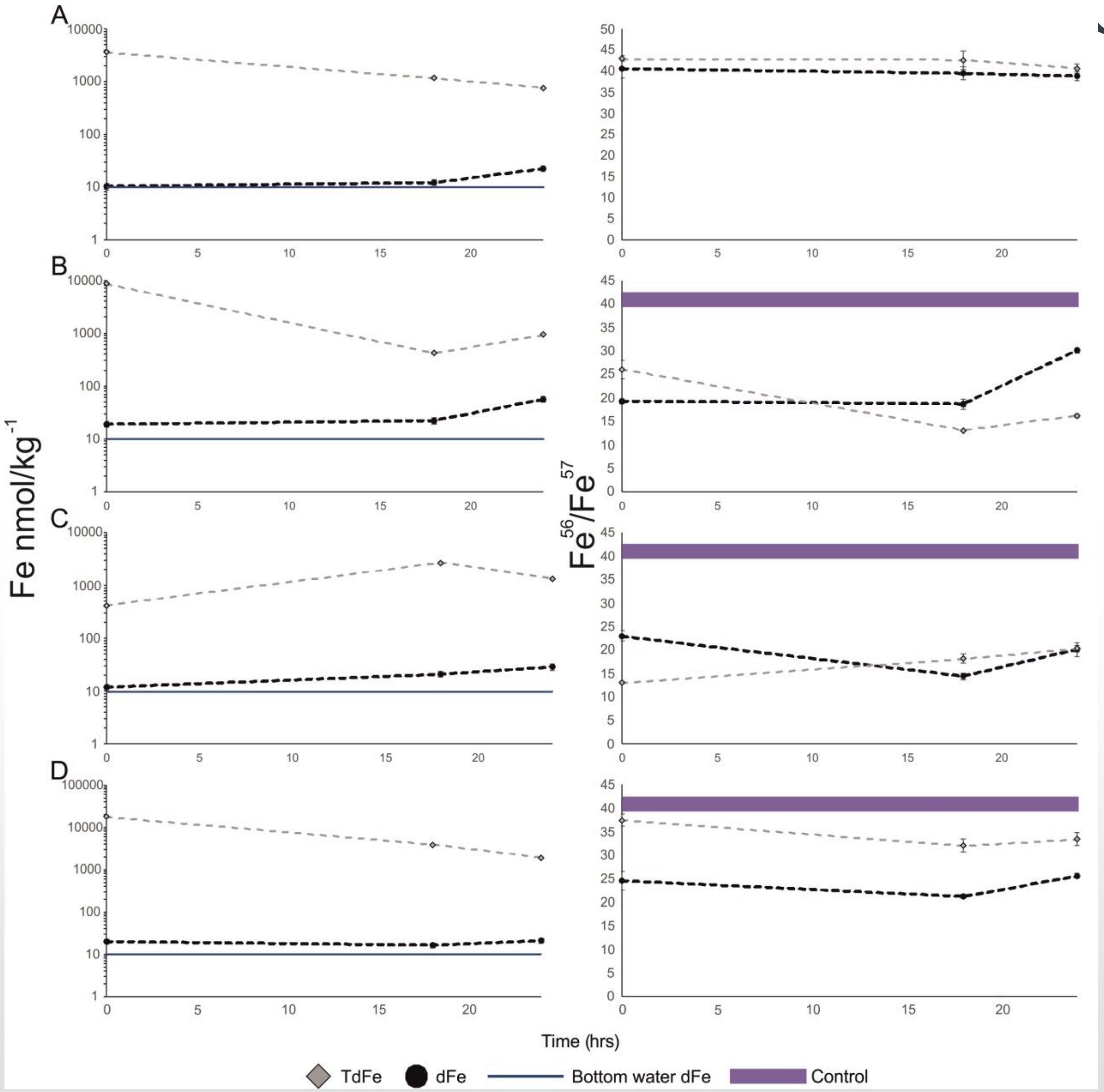
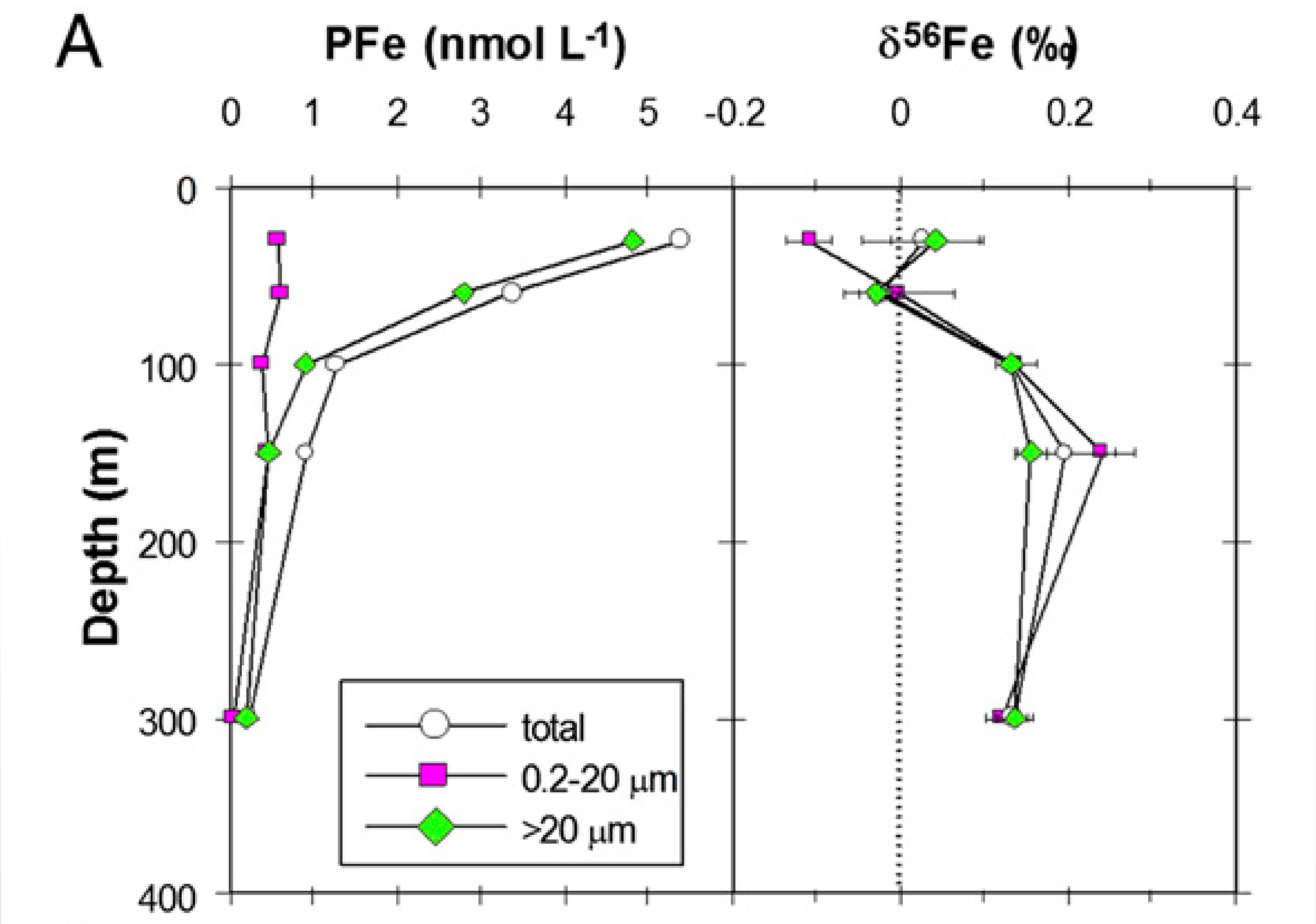
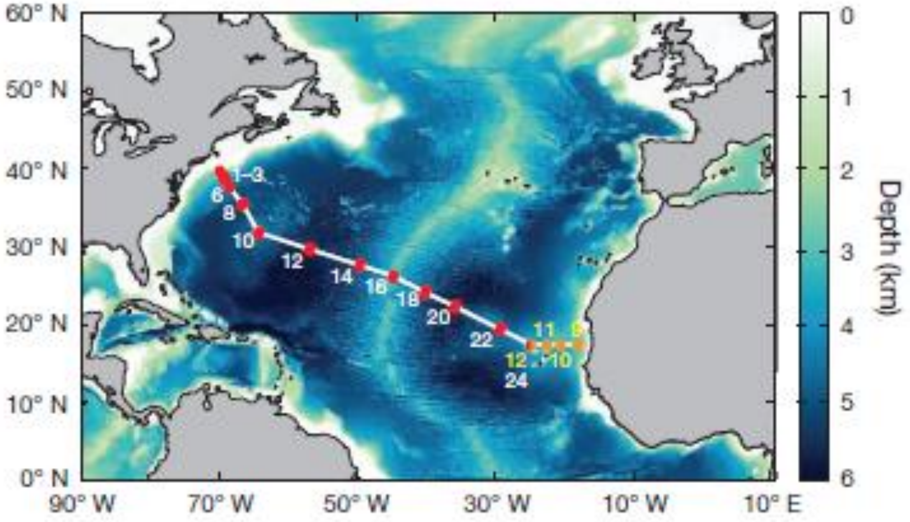
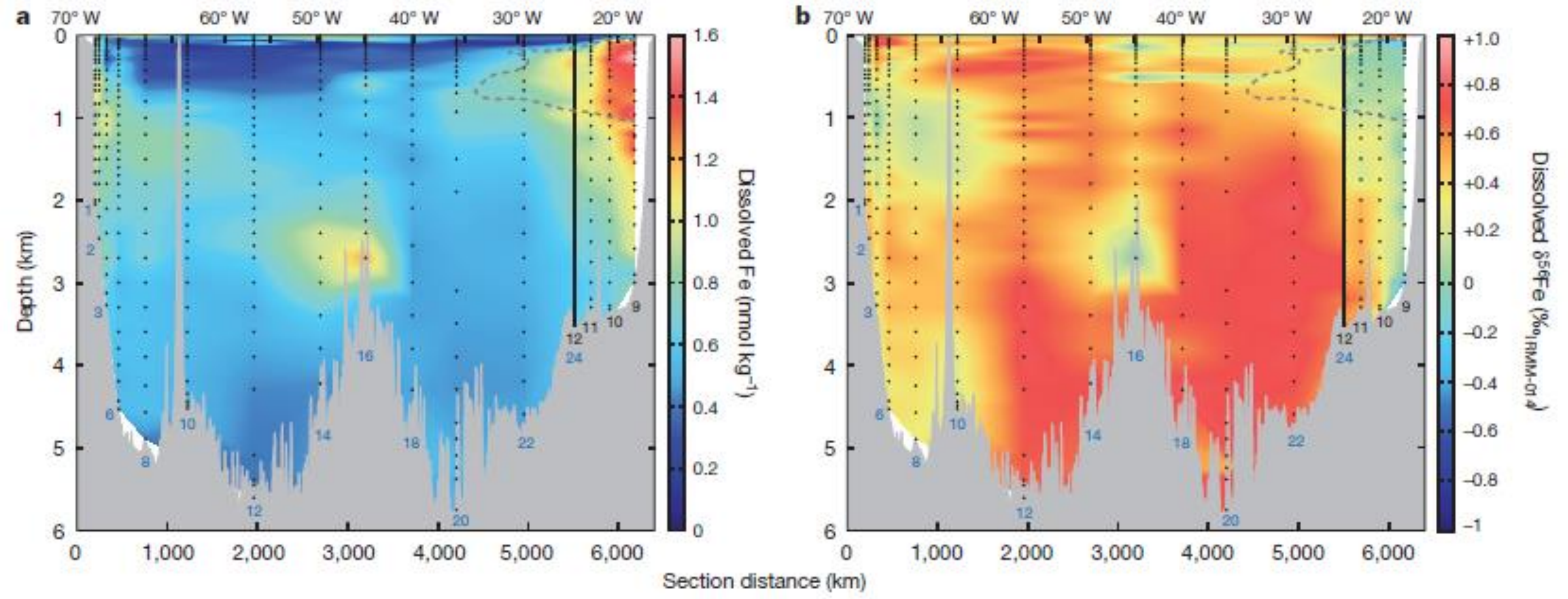



A
PFe (nmol L-1)
δ56Fe (‰)
0
1
2
3
4
5
-0.2
0
0.2
0.4
Depth (m)
0
100
200
300
400
total
0.2-20 μm
>20 μm



60° N
50° N
40° N
30° N
20° N
10° N
0° N
90° W
70° W
50° W
30° W
10° W
10° E
Depth (km)
1–3
6
8
10
12
14
16
18
20
22
24
11
9
12
10



a
b
70° W
60° W
50° W
40° W
30° W
20° W
Depth (km)
Dissolved Fe (nmol kg^{-1})
Dissolved δ^{56}Fe (‰$_{IRMM-014}$)
Section distance (km)
0
1,000
2,000
3,000
4,000
5,000
6,000